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Vytautas Žukauskas

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ISM UNIVERSITY OF MANAGEMENT AND ECONOMICS  
UNIVERSITY OF ANGERS

Vytautas Žukauskas

THE IMPLICATIONS OF MONETARY POLICY FOR THE VALUE  
AND PRICES OF FINANCIAL ASSETS

Doctoral Dissertation

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# The Implications of Monetary Policy for the Value and Prices of Financial Assets

Les implications de la politique monétaire sur la valeur et les prix des actifs  
financiers

## JURY

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## Glossary

<b>Term</b>	<b>Definition</b>
<b>Composite indicator</b>	A synthetic index <i>“formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured”</i> (Nardo et al., 2005, p. 8)
<b>Exchange demand</b>	Quantities of a good that market participants want to purchase at various prices.
<b>Financial repression</b>	<i>“government’s strategy – supported by monetary and financial policies – to gain privileged access to capital markets at preferential credit conditions and divert resources to the state with the aim to secure and, if necessary, enforce public debt sustainability”</i> Riet (2018, p. 14).
<b>Monetary policy transmission mechanisms or channels</b>	Causal links through which changes in the parameters of instruments of monetary policy affect the behavior of other economic variables (e.g. prices and output).
<b>Properties of economic goods</b>	Qualities that can be attributed to economic goods. Dimensions of the goods to which individuals subjectively attach value.
<b>Quality of money</b>	<i>“the capacity of money, as perceived by actors, to fulfil all its main functions, namely to serve as a medium of exchange, as a store of wealth, and as an accounting unit”</i> (Bagus, 2009, pp. 22-23).
<b>Reservation demand</b>	Quantities of a good that its current owners want to hold or reserve for themselves (as opposed to supplying it to the market) at various prices. It is the demand that the current owners of the good have for the units that they already own.
<b>Subjective value</b> (subjective theory of value)	A theory of value which claims that the value of goods is determined by the importance that acting individuals place on the goods for the achievement of their goals. Value is not determined by any inherent properties of the goods.
<b>Total demand</b>	A sum of the exchange and reservation demands for a good at various prices.

## Abbreviations

ABSPP – asset-backed securities purchase program

APP – asset purchase program

APT – arbitrage pricing model

CAPM – capital asset pricing model

CBPP – covered bond purchase program

CSPP – corporate sector purchase program

D – factor of decrease

ECB – European Central Bank

FA or f.a. – financial assets

FTO – fine-tuning operations

GDI – gross domestic product

HICO – harmonized index of consumer prices

I – factor of increase

IMF – International Monetary Fund

LTRO – longer-term refinancing operations

LTRO – longer-term refinancing operations

MRO – main refinancing operations

M1 or M3 – monetary aggregates M1 or M3

OMT – outright monetary transactions

PEPP – pandemic emergency purchase program

PSPP – public sector purchase program

SMP - securities markets program

SO – structural operations

TLTRO – targeted longer-term refinancing operations

US or U.S. – the United States

## Introduction

In the times of economic slowdown related to the COVID-19 pandemic, the behavior of stock markets may be puzzling. First, the stock indices have plummeted after economies have shuttered due to the spread of the disease. Then they have recovered much of their ground, arguably, after massive fiscal and monetary interventions by governments and central banks all around the world. However, the third phase, in which major stock indices (e.g. S&P 500) have rallied, some to all-time heights, “*has puzzled analysts and veteran investors alike*” (Economist, 2020). Economists claim that the fiscal and monetary stimulus helped to cushion the blow. Despite these policies, such rally of the financial markets is quite puzzling given the economic conditions and high uncertainty stemming from the further spread of the virus. If the aim of economic stimulus was to recover some of the lost ground, it is unlikely that it could have lifted an economy higher than it was *before* the crisis. Moreover, this digression of stock markets from the fundamentals is not necessarily seen as a temporary bubble which will need to correct itself. According to *The Economist*, many of those who sounded cautious on the way up are now recommending stocks for those who “*missed out*” on the recovery, suggesting that if “*remorseful investors now pile in too, the stock market’s gains may continue*”.

The explanation of the drivers behind the dynamics of financial markets is a difficult and a complex task. However, economists usually claim that economic and financial theory have the major factors pinned down. The question is how to interpret them in given economic circumstances. Especially when, in some respects, the current economic world – with unprecedented monetary stimulus and negative interest rates – is as novel as the virus itself. Current circumstances give us reason to think that maybe we do know the major factors influencing the dynamics of financial markets, but not quite all the ways they manifest. Maybe the unprecedented world of monetary policy today can offer us new insight about how some of the factors really work. And maybe it is not a coincidence that financial markets rally, despite the fundamentals, when money seems abundant and some creditors pay interest, as opposed to receiving it, while lending money.

The topic of this dissertation is the connection between monetary policy and the prices of financial assets. Monetary policy together, with fiscal policy, are the two most

important tools used by governments to try to steer an economy. Financial markets and financial assets are a crucial component in our current understanding of how monetary policy influences the economy, it is a vehicle of impact.

This work suggests that the current mainstream understanding of the connection between monetary policy and prices of financial assets is incomplete, which obscures a full understanding of the consequences of monetary policies. What this work will try to reason is that monetary policy influences the prices of financial assets by changing both the properties of financial assets, and the properties of money, which in turn shifts the subjective value of financial assets against money for current and potential owners.

The relevance of this dissertation comes from some of the empirical regularities in financial markets which show our current incomplete understanding of the connection between monetary policy and prices of financial assets. First, it is a well-known empirical fact that the prices of financial assets in developed economies grow at a faster rate than other prices (e.g. Žukauskas and Hülsmann (2019)). During the past 70 years, share prices in the US have grown faster than consumer prices. According to Žukauskas and Hülsmann (2019, p. 131), “[...]standard theories of the transmission mechanisms of monetary policy lead to the conclusion that monetary policy is not a possible origin of the observed increase of prices in the financial sector relative to prices in the non-financial sector of the economy. In the standard view, monetary policy may influence financial-asset prices in various ways, but it does not all by itself entail any tendency for financial-asset prices to rise faster than the prices of non-financial assets”.

Second, the real link between monetary policy and financial markets may be stronger than commonly recognized. Financial markets are characterized as very volatile and containing considerable amounts of irrationality, a place where prices are often driven by the exuberance of animal spirits<sup>1</sup>. Monetary policy theorists claim that the link between monetary policy and prices of financial assets is not very strong, that prices are mainly driven by either fundamentals or animal spirits. However, announcements

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<sup>1</sup> E.g. Mishkin (2001, p. 16):

The linkage between monetary policy and stock prices, although an important part of the transmission mechanism, is still nevertheless, a weak one. Most fluctuations in stock prices occur for reasons unrelated to monetary policy, either reflecting real fundamentals or animal spirits. The loose link between monetary policy and stock prices therefore means that the ability of the central bank to control stock prices is very limited.

of the central banks often have a huge impact on the prices of financial assets and volatility in the financial markets. The reactions of the financial markets are studied and identified as a beacon through which market evaluates the decisions of monetary policy. Theory on the transmission channels of monetary policy does not allow us to forecast these reactions, the same decision of the central bank (e.g. lowering of the base interest rate) can have different reactions depending on other circumstances. Maybe the conclusion that should be drawn from this perceived volatility – detached from fundamentals – is not that it is too often driven by animal spirits, but that the link between monetary policy and financial markets is stronger than we think. If so, our understanding is incomplete.

Third, the traditional view of how monetary policy influences the economy (as well as financial asset prices) is shifting. Traditionally interest rates, demand for financial assets by the central bank, and the supply of money were the main channels of monetary policy. In an era of unconventional monetary policy, central banks rely on new instruments, which naturally broadens our view on how central banks influence the financial markets and the economy. Importantly, some of the unconventional instruments work through sending signals into the market, which are not necessarily quantitative in nature (e.g. forward guidance and commitment to particular monetary policy in the future). Inevitably, the impact of these measures is not simply quantitative in nature, that is, they work through changing the *perceptions* of market participants. Here the question of subjectivity becomes important – if we are to understand the impact of monetary policy on financial asset prices, particularly the impact of instruments that work through changing of market sentiment, we need to broaden our analysis of asset pricing, by incorporating subjective perceptions of market participants beyond the traditional analysis of a rational market agent. Allowing for more subjectivity in financial asset pricing may reveal more channels of impact of monetary policy.

All the points discussed above, namely: the discrepancy in the movements of prices in the financial assets vs prices in the real economy, interconnectedness of the financial markets and monetary policy, the new channels of impact of unconventional monetary policy illustrate the relevance of this dissertation.

The impact of monetary policy on prices of financial assets has been investigated in several *contexts*. Firstly, financial markets and assets play an important role in the

transmission mechanism of monetary policy. The discussion is about the different channels of central bank's impact on the economy. Mishkin (1995) outlined the basic channels of traditional transmission mechanism of monetary policy. Some of these mechanisms work through changes of the prices of financial assets (e.g. interest rate, credit, household wealth and liquidity). Such changes may in turn affect the investment and consumption decisions of firms and households.

There is a great deal of empirical research which investigates the efficiency with which central banks move the interest rates and correspondingly the prices of related financial assets in the desired direction. The problems with the empirical investigation of this question include reciprocal dependency (asset prices depend on policy rates, but policy rates may also respond to changes in asset prices), and mutual dependency on other factors (policy rates and asset prices may depend on macroeconomic variables) (Duran, Özcan, Özlü, & Ünalımsı, 2012, p. 1). Central bank communication and its effects on financial markets and asset prices also receive a lot of attention from the theoretical and empirical point of view (e.g. Woodford (2005), Ehrmann and Fratzscher (2007a), Ehrmann and Fratzscher (2007b), Gerlach (2007), D.-J. Jansen and De Haan (2005), D. J. Jansen and De Haan (2006), D.-J. Jansen and de Haan (2007a), D.-J. Jansen and De Haan (2007b), Kohn and Sack (2003), Rosa (2007), Rosa and Verga (2008)). The most common method to overcome abovementioned problems in empirical research is the event study approach (e.g. used by Kuttner (2001) and Gürkaynak, Sack, and Swanson (2005)). Empirical work on the impact of central bank communication utilizes high-frequency data (e.g. Brand, Buncic, and Turunen (2010)) as well as analysis of central banks' press conferences (e.g. Ehrmann and Fratzscher (2009)). Communication is becoming an increasingly important tool of monetary policy and hence its impact on financial markets is increasing. E.g. Rosa and Verga (2008, p. 210) find that the significance of ECB press conferences for asset prices has increased over time. The ability of the central bank *"to move asset prices by simply using words seems to indicate that financial markets believe that the European Central Bank does what it says it will do."*

A more recent debate in the field of connection between monetary policy and financial assets is about the channels of what is still considered unconventional monetary policy, when traditional instruments are exhausted and central banks engage in quantitative easing, large scale asset purchases, forward guidance and other actions,



which fall outside of the traditional basket of instruments of central banks (e.g. Bernanke and Reinhart (2004), Joyce, Miles, Scott, and Vayanos (2012), Kuttner (2018)). Other channels of transmission mechanism are emphasized when analyzing the impact of unconventional monetary policy. Portfolio balance and signaling effects work through financial markets and financial assets (e.g. Gagnon, Raskin, Remache, and Sack (2011a), Campbell et al. (2012), Bordo and Landon-Lane (2013), Bauer and Rudebusch (2013)). There is a lot of empirical work, which tries to capture the workings of unconventional monetary policy. E.g. Gagnon et al. (2011a) estimates the importance of portfolio balance and forward guidance effects. This stream of literature directly addresses the issue of the connection between monetary policy and prices of financial assets. In it, financial assets are an instrument in the ultimate goals of monetary policy.

Secondly, the connection between monetary policy and the prices of financial assets was discussed in the context of to what extent prices of financial assets should be a target (as opposed to just a vehicle) of the monetary policy. Should monetary policy makers incorporate movements of asset prices into their decisions? To the extent monetary policy is a contributing factor to asset booms, should central banks use their tools to counteract the booms before they become busts? The traditional view is that monetary policy should react to asset prices only if they provide information about future inflation (Schwartz (1995), Bordo, Dueker, and Wheelock (2002), Bordo, Dueker, and Wheelock (2003)). According to this view, any financial imbalances should be dealt with separately by other policies, such as regulation or lending of last resort (Bernanke and Gertler (1999, 2001); Schwartz (2003)). After the Great Recession many policy makers decided that financial stability should be a priority of the central banks. Thus the new view argued that central banks should be monitoring asset prices and the overall state of the financial system more closely and in case there is a need, they should use monetary policy to diminish the imbalances (Kashyap, Rajan, & Stein, 2008). This case for macro-prudential regulation proposed the use of new policy tools such as countercyclical capital requirements and liquidity ratios. The macro prudential monetary policy made asset prices an even more important part of the monetary policy (e.g. Bordo and Landon-Lane (2013), Galí and Gambletti (2013)).

Thirdly, another important question which receives a lot of attention in the literature is the connection between the economy and financial assets, both in theory and

empirically. In the discussion of the literature before, financial assets were treated as either the transmission, or the possible target of monetary policy. However, the impact of monetary policy on the financial markets may also be indirect – changes in the economy may influence prices of financial assets, and central banks aim to and do influence economy. Early on Fama and Schwert (1977) and Fama (1981) investigated empirical connections between macroeconomic variables (output, inflation, money supply, and others) and stock returns, providing a theoretical reasoning behind these connections. Current studies look for empirical relationships between economic variables and prices of financial assets in different contexts (e.g. Maio and Philip (2015), Menike, Dunusinghe, Ranasinghe, and Accounting (2015), Barakat, Elgazzar, and Hanafy (2016), Peiró (2016), Claessens and Kose (2017)).

The interrelation between monetary policy, economy and financial assets is also important in the context of asset pricing and valuation. Capital asset pricing model (CAPM) does not directly incorporate macroeconomic variables, except for the interest rate. However, more flexible asset pricing models do. Arbitrage pricing theory which was formulated by Ross (1976) was presented as an alternative to the capital asset pricing model. Arbitrage pricing theory and empirical multifactor asset pricing models (e.g. Mateev and Videv (2008)) allows to incorporate not only company specific, but also macroeconomic variables while pricing assets.

If the impact of monetary policy on the prices of financial assets in the first stream of literature was through the transmission mechanism and direct impact, the third stream of literature suggests that the impact is potentially a lot broader. Any impact central banks have on an economy may in turn influence financial assets. In this context, the discussion on what is the actual impact of central banks on the overall economy – theoretically and empirically – is crucial and relevant for the topic of this work.

The *problem* of this dissertation is: what are the theoretical links between monetary policy and prices of financial assets, and how can these links be captured empirically?

The *aim* is, after having reviewed different approaches analyzing the impact of monetary policy on the prices of financial assets, to create a new theoretical framework based on the theory of subjective value encompassing different channels through which monetary policy influences prices of financial assets, and then test it empirically.

The aim of the dissertation is achieved through the following *objectives*:

1. To analyze the literature on the transmission of monetary policy to capture the standard view of the link between monetary policy and value and prices of financial assets;
2. To review and systematize instruments of conventional and unconventional monetary policy to the extent that they are relevant for the value and prices of financial assets;
3. To theoretically analyze the price formation of financial assets using the principles of subjective value theory, and derive price determinants of financial assets;
4. To develop a comprehensive theoretical framework which would better explain different channels through which monetary policy influences the prices of financial assets;
5. To apply the theoretical framework to empirically investigate the link between monetary policy and prices of financial assets through one of the newly identified channels (which is not prevalent in the scientific literature).

The *scientific novelty* and *significance* of this work comes from introducing multidimensionality and relying on the principles of subjective value theory in the analysis of pricing financial assets, which allows for the creation of a more comprehensive understanding on how monetary policy influences prices of financial assets.

The interconnectedness of monetary policy and financial assets poses a serious problem for the asset pricing models. The most prominent model of financial asset pricing, namely, capital asset pricing model, is one-dimensional. According to this model, the returns of a diversified portfolio depend on the systematic risk. Individual stocks have higher expected returns if they have higher betas. Beta is a measure of systematic risk, a volatility of a price of particular stock relative to the market. However, there are examples where the price of a particular financial asset or group of them is impacted by the decisions of central banks, which do not necessarily work through changing the volatility or beta coefficients of these assets. Central banks can increase the liquidity of a financial asset by choosing it to be the object of open market

operations, or by allowing it to be used as a collateral for the loans from the central bank. Central banks through monetary policy can influence different dimensions of financial assets which are outside of the usual risk and return model of financial asset pricing, but which are important for values and prices of financial assets.

Another *theoretical gap* is the question of the subjective value theory in the price theory of financial assets. The foundations of modern finance are being challenged by the most recent findings of behavioral finance. The main theoretical constructs of modern finance – modern portfolio theory, efficient market hypothesis, capital asset pricing – are attacked not only on the basis of their unrealistic assumptions (e.g. complete knowledge, rational choice in terms of risk and return), but also on the basis of them not being able to explain the developments in the financial markets (e.g. asset bubbles, big fluctuations of asset prices in times of turmoil). One of the main criticisms stems from the psychological biases of human decision-making in the financial markets identified by the behavioral finance, which appears to suggest that people's financial behavior in fact systematically contradicts the behavior described by the models of modern finance (e.g. Shiller (2003) and Curtis (2004)).

This clash between modern financial theory and behavioral finance raises very important theoretical and empirical questions. The criticism of behavioral finance of the rational agent having perfect information and perfect cognitive abilities rests on a simple, yet powerful, insight – that this is not a realistic representation of people acting and ultimately determining the developments of the financial markets. Behavioral biases highlighted by behavioral finance are often identified as psychological or emotional biases, which utilizes quite a popular distinction between cognitive rationality and emotional behavior (Agrawal, 2012). However, this distinction between rational behavior described by modern finance and psychological behavior, identified by behavioral finance does not have to be a fatal blow for the modern finance. The challenge of incorporating the psychological intricacies of human behavior into modern finance may also be based on the economic science and described in economic reasoning.

A fitting example of this is related to information, which in the actual market is never perfect and symmetric. Information gathering is in itself an economic activity, which has marginal costs and marginal benefits. Assuming perfect information is assuming

the problem away, which undermines the ability of the model to explain reality. This is an economic argument, not a psychological one. A similar argument can be posed with respect to the cognitive abilities of interpreting the information by market participants.

Moreover, how should we think about the rationality of market participants? What functions are market participants maximizing? Cognitive biases and bounded rationality in behavioral finance is behavior, which systematically diverges from the models of the rational agent, with full information and unlimited abilities searching for the best tradeoff between risk and return. But this divergence is not necessarily caused by a psychological bias, which unintentionally leads market participants to behave against their own interests. There might be many other completely rational dimensions in investment and saving decisions, which fall outside of the modern portfolio selection, efficient market hypothesis or capital asset pricing model. In positive, or descriptive analysis, acting individuals may not always perceive return in only financial terms, and risk only in terms of volatility.

So the call of behavioral finance to confront the assumed rational agent in these models with the real behavior of market participants can be interpreted, in the broader sense, as the call to incorporate more realism and subjectivity in describing individual behavior in financial markets. The reaction of market participants to new information is never mechanical – it depends on their subjective preferences, on their cognitive abilities, on the availability of information and on how they interpret this information. Market participants may have very different manifestations of these dimensions, so their reactions will be different. Finance theory lacks a framework that would incorporate multidimensional and subjective aspects of human behavior in financial markets.

This task is challenging, since more dimensions in the framework means more complexity and more variables. The acceptance of subjectivity creates a complication in the absence of a representative agent who is always acting the same way given the same circumstances. Therefore, any framework, which incorporates these dimensions, would have to be more flexible and less specific in terms of its ability to predict exact movements in financial markets. However, it would be more realistic in terms of causal connections. So the question is, given all the subjective factors that determine actions and choices of financial market participants, how far can the

subjective approach go in explaining prices of financial assets? And can this approach be useful in explaining the links between monetary policy and prices of financial assets in a more realistic and comprehensive way?

The dissertation utilized mixed *research methods*. In the analysis of the literature on the transmission mechanism of monetary policy (1<sup>st</sup> objective), and the review of tools of monetary policy (2<sup>nd</sup> objective) – literature review, deduction, generalization, comparative analysis and typologization were applied. To theoretically analyze the price formation of financial assets (3<sup>rd</sup> objective) – the principles of the theory of subjective value were applied to the value and prices of financial assets and money. Moreover, for the analysis of the price formation, a particular analytic tool of total demand-stock was used to complement the regular demand and supply analysis. The creation of a theoretical framework (4<sup>th</sup> objective) used deductive reasoning and the principles of economic modelling – defining relationships between different economic variables in the theoretical construct (framework) of pricing of financial assets. Empirical analysis (5<sup>th</sup> objective) applied the methods of composite indicators and regression analysis.

The dissertation is organized in *five parts*. The first part discusses the standard transmission mechanism of monetary policy, which reflects the traditional way of understanding of how monetary policy influences the prices of financial assets. Moreover, the first part of the dissertation discusses the instruments of monetary policy, which are related to financial markets and financial assets. The discussion separates conventional and unconventional monetary policy, and then focuses on the instruments of monetary policy at the European central bank (ECB) and their evolution over time.

The second part develops the framework of the value and prices of financial assets, which is based on the subjective value theory and which is presented as an alternative to the standard analysis. Using the total demand approach, the second part proposes an alternative way to analyze the connection between monetary policy and financial assets, which is based on the idea that monetary policy transforms properties of financial assets and of money.

The third part outlines the methodology of the empirical research. It explains the link between the theoretical and empirical model, the choice and parametrization of

variables. The empirical framework focuses on the channels of influence, which were identified in the theoretical framework, namely, the quality of money channel.

The fourth part empirically investigates how monetary policy influences prices of financial assets through one of the identified channels (quality of money channel) in the context of Eurozone. This part presents an index, which quantifies the quality of money. Then it looks at the statistical significance of this measure in the multifactor stock pricing model based on macroeconomic variables applied to the Eurozone and ten Eurozone countries' stock indices.

Finally, the fifth part discusses the results of the theoretical framework and the empirical analysis, explains their importance and limitations.

The biggest limitation of the dissertation is that it did not provide for a full and thorough discussion of all the channels of the impact of the monetary policy on the prices of financial assets which were identified in the theoretical framework. Moreover, the empirical research was focused on one of the channels and did not test other channels. This limitation is due to the aim of the dissertation to create a broad framework based on the subjective value theory, which explains the value and price formation of financial assets and consequently the impact of monetary policy on them. The lengthy development of this framework and the broadness of it do not allow for an in depth theoretical discussion or empirical investigation of all the identified links between the monetary policy and the prices of financial assets. A further and more comprehensive discussion of the limitations of the dissertation is presented in the 5th part of the dissertation.

The results of this dissertation have been published in the following peer-reviewed *journals*:

1. Žukauskas, V., & Hülsmann, J. G. (2019). Financial asset valuations: The total demand approach. *The Quarterly Review of Economics and Finance*, 72, 123-131. Internet access: <https://doi.org/10.1016/j.qref.2018.11.004>
2. Žukauskas, V. (2020). Measuring the Quality of Money. *The Quarterly Journal of Austrian Economics*, vol. 23, no. 43). (Article is accepted, the planned publishing date is December 2020).

The results have also been presented in the following international *conferences*:

1. Žukauskas, V. (2019). Valuation of financial assets: the total demand approach. Austrian Economics Research Conference, Mises Institute, Auburn, Alabama, U.S., 22<sup>nd</sup> of March, 2019.
2. Žukauskas, V. (2019). Valuation of financial assets: the total demand approach. The Austrian School of Economics in the 21st Century, 8th International Conference, Oesterreichische Nationalbank, Viena, Austrija, 14<sup>th</sup> of November.



# 1. Financial assets in the standard transmission mechanism of monetary policy

## 1.1. Monetary policy

It is crucial to identify what actions of central banks constitute monetary policy and what their parameters are to investigate their impact on the prices of financial assets. We will start by defining monetary policy as different types of intervention. Later on, we will distinguish between conventional and unconventional monetary policy and then will go through the instruments of monetary policy and describe their *modus operandi* to the extent that is necessary to understand their impact on financial markets.

### 1.1.1. Monetary policy as interventionism

Oppenheimer (1926, pp. 24-25) made the distinction between the economic and political means for satisfying human desires:

There are two fundamentally opposed means whereby man, requiring sustenance, is impelled to obtain the necessary means for satisfying his desires. <..> I propose in the following discussion to call one's own labor and the equivalent exchange of one's own labor for the labor of others, the "economic means" for the satisfaction of needs, while the unrequited appropriation of the labor of others will be called the "political means".

Violence, intervention or invasive action is the introduction of aggressive physical force or the threat of it into human relationships and society (Šilėnas & Žukauskas, 2016, p. 308). It is the antipode of voluntary actions. The intervener is an individual or group of individuals that initiates violent intervention in the free actions of people.

All violent actions and interventions can be classified into three categories (Rothbard, 1962/2009, pp. 1058-1060):

- Autistic intervention - actions of an intruder, which restrict another person's use of his property. The intervener commands or restricts an individual to do or not to do certain things with that person's property when no exchange is involved. Examples of autistic intervention are murder, assault, prohibitions to possess certain items, the prohibition of free speech or religious practice, etc.

- Binary intervention – actions of an intruder that forcibly establish a relationship or a forced trade between the intruder and another person. Examples of binary interventions are robbery, theft, slavery, war, taxation, compulsory purchase of goods, etc.
- Triangular intervention – actions of an intruder that forcibly establish or forbid a relationship or an exchange between two or more economic subjects. Examples of triangular intervention are price controls, the prohibition of certain products, licenses, tariffs, etc.

Using this classification, we can categorize actions of central banks in conducting monetary policy.

#### Autistic monetary intervention

- Monopoly of money<sup>2</sup> - government and central banks are the only legitimate producers of money, which means that individuals cannot legally produce money. Moreover, legal tender laws require individuals to use government-provided money in their transactions.

#### Triangular monetary intervention

- Regulation of the financial sector - financial institutions are mandated to fulfill certain requirements of central banks and financial regulators in order to be able to enter into transactions with other market participants. Setting of mandatory reserves is also a triangular intervention, since it mandates commercial banks to keep reserves at the central bank in order to be able to transact with other market participants.

#### Binary monetary interventions

- Buying (and selling) assets - central banks directly participate in the financial market by buying and selling financial assets. Although central banks do not force market participants to buy or sell assets, money with which these operations are conducted is created through the monopoly power.

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<sup>2</sup> According to Hülsmann (2014b, p. 10) “*Fiat money is a generally used medium of exchange (money) the use of which is being imposed on the citizens, typically through monopoly privilege or through legal-tender laws*”.

- Lending - central banks give out loans to the participants of financial markets. Similarly, although central banks do not force market participants to borrow, money with which lending operations are conducted is created through the monopoly power.

Buying and selling assets or lending by the central bank are not directly (violent) interventions in themselves, but they stem from the monopolization of money. The monetary intervention in both cases arises from the central bank being the only institution that is able to legally create money and buy assets or lend them.

Controlling the information flow about its current and future actions – is not in itself a monetary intervention. However, the present and future actions which are the basis of information flows are monetary interventions, as discussed above.

The understanding of monetary policy as interventionism is instructive and is related to the method and the principle of the investigation of monetary policy on the value and prices of financial assets. This recognition implies that the investigation of the impact of monetary policy on the value and prices of financial assets is done on the basis of comparing the impact and the results of the intervention with the situation which would emerge in the market without this intervention. The comparison is with prices and value of financial assets which would emerge in the market with only voluntary actions and voluntary exchanges.

### **1.1.2. Instruments of monetary policy of the Eurosystem**

This section will review the instruments of monetary policy of the European central bank (ECB) and the Eurosystem. Particular focus will be on two questions, which are important for the topic of the dissertation. Firstly, we will aim to grasp the difference between the conventional and the unconventional instruments of monetary policy of the Eurosystem and to see the relative weight of the conventional vs the unconventional instruments in the monetary policy of the ECB over the years. Secondly, the focus of the analysis will also be on the different links between the instruments of monetary policy and prices of financial assets that stem from the inner workings of these instruments. We will argue that these two questions are connected – instruments of unconventional monetary policy have stronger links to financial assets and their prices.

## **Evolution of monetary policy of the Eurosystem**

The instruments through which ECB conducts monetary policy have changed significantly over its existence for over 20 years. The monetary authority officially has terminated only few of the instruments of monetary policy. However, the shift happened by the introduction of new instruments which have crowded-out the old ones making some of them almost redundant in the implementation of the objectives of monetary policy. This section will offer a brief overview of the ECB's instruments of monetary policy – the ones that have been established since the inception of ECB and those that have been introduced over the years.

At the introduction of the Euro in 1999, the ECB had seven instruments of monetary policy: four open market operations (Main refinancing operations (MRO), Longer-term refinancing operations (LTRO), Fine-tuning operations (FTO), Structural operations (SO)), two standing facilities (Marginal lending facility and Deposit facility) and the requirement of minimum mandatory reserves for credit institutions (see Fig. 1 below). Using these instruments ECB managed the liquidity position of credit institutions and short-term interest rate in the money market until the emergence of the unconventional instruments of monetary policy.

The fall of the global financial services firm Lehman Brothers Holdings Inc. in 2008 marked the beginning of the global financial crisis, which in Europe turned into an economic and sovereign debt crisis. Reacting to the tensions in financial markets, slow economic growth, lower than targeted price inflation, and big yield spreads of sovereign debt between European countries, the ECB introduced new instruments of monetary policy, which are considered to be unconventional (e.g. Eser, Amaro, Iacobelli, and Rubens (2012), Alvarez et al. (2017), Bock et al. (2018)). Most of the unconventional instruments were introduced in the period from 2009 to 2016 (see Fig. 1 below).

## Timeline of ECB's monetary policy instruments

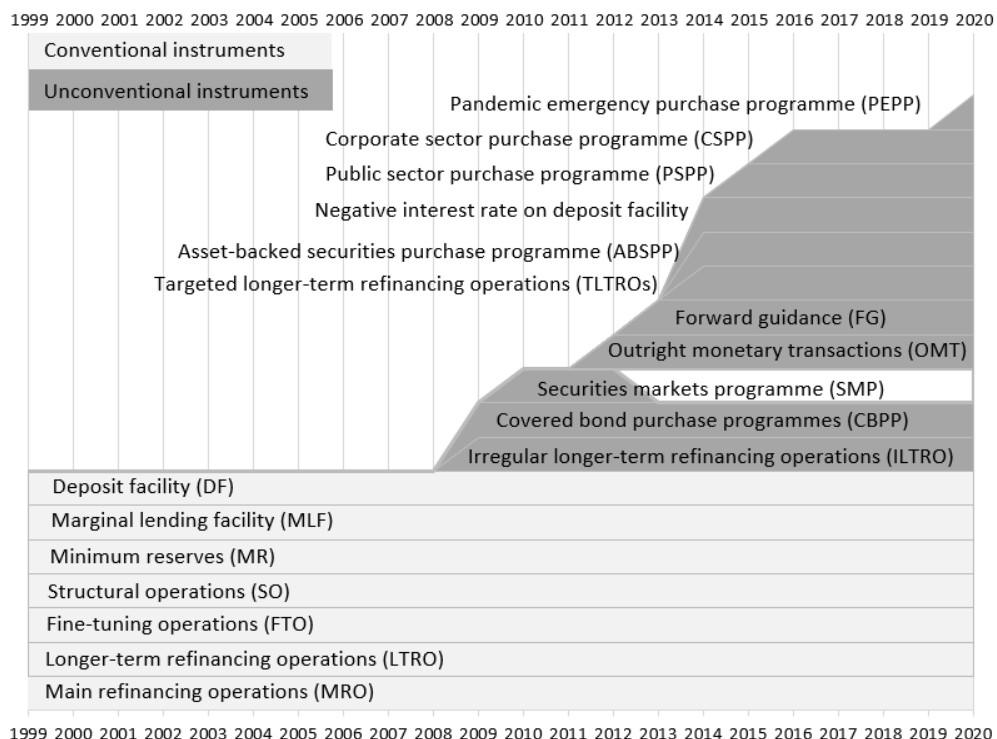


Fig. 1. Timeline of ECB's monetary policy instruments. Source: compiled by author using ECB (2020b)

In 2009, the ECB started irregular longer-term refinancing operations of maturity from 6 months to 3 years (regular LTROs used to have the maturity of three months). Moreover, in the same year the ECB introduced the first instrument of asset purchases - Covered bond purchase program (CBPP). This program was the first time the ECB embarked on outright purchases for monetary policy purposes - it marks the start of the shift of monetary policy from the lending-based instruments to asset-purchases-based instruments. Securities Markets Program (SMP) was introduced in 2010. Through this instrument the ECB purchased bonds issued by Greece, Italy, Portugal, Spain and Ireland with the objective to lower the yields of the bonds originating from these countries. SMP was terminated in 2012 with the introduction of the Outright monetary transactions (OMT). Even though this instrument has not been used yet, the announcement of it was another important step towards the shift of the ECB's monetary policy. OMT allows the ECB to perform unlimited amounts of outright

purchases in the secondary sovereign bond markets, subject to the countries complying with certain conditionality.

Forward guidance as yet another tool of monetary policy started to be used 2013, when the ECB started managing expectations by providing information about its future key interest rates, amounts of future asset purchases and other modalities of monetary policy (e.g. extensions of fixed-rate-full-allotment tenders, which allow credit institutions to borrow unlimited amounts from the ECB at the target rate through the open market operations).

The deposit rate on the deposit facility at the ECB was turned negative for the first time in 2014, which means that the counterparties have to pay interest to the ECB on reserves in excess of the minimum reserve requirement. The deposit rate was further lowered up to -0.5 percent in 2019. In 2014, the ECB also introduced Asset purchase program (APP), which initially consisted of updated Covered bond purchase program (CBPP) and Asset-backed securities purchase program (ABSPP). The APP was supplemented by Public sector purchase program (PSPP) in 2015 and Corporate sector purchase program (CSPP) in 2016. All four legs of APP target specific markets of financial assets with outright purchases of securities. Lastly, in 2020 ECB announced the Pandemic emergency purchase program (PEPP), which in essence is the reemergence of asset purchases in the spirit of APP in response to economic and financial struggles caused by the spread of the COVID19 virus.

To sum up, the Euro and the ECB were established with seven instruments of conventional monetary policy in 1999. From 2009 to 2020, the ECB has introduced 11 instruments of unconventional monetary policy. In the next sections, we will discuss this shift in more detail. First, we will identify the properties of unconventional instruments, which separate them from the conventional ones. After this, we will look at the balance sheet of the ECB with an aim to investigate the relative importance of different instruments used in conducting the monetary policy by the ECB.

### **Conventional and unconventional monetary policy of the ECB**

Before discussing the features of conventional and unconventional monetary policy of the ECB and the Eurosystem, we will briefly look at the theory of conventional and unconventional monetary policy and how their differences are described in the

scientific literature. After this, we will focus on the monetary policy instruments of the ECB.

Conventional monetary policy, briefly, is inflation targeting using open market operations to change short-term interest rate according to the Taylor rule.

The aim of monetary policy was to achieve low and stable inflation, the policy framework was inflation targeting, the instrument was a short-term interest rate at which the central bank provided funds to banks or the interbank market and the impact of this official rate on market rates and the wider economy was reliably quantified. Within this framework, the setting of interest rates was done judgmentally using a wide variety of macroeconomic signals but in a manner that could be approximated with reference to so-called Taylor rules, whereby interest rates responded more than one for one to changes in inflation and also responded to fluctuations in the output gap. (Joyce et al., 2012, p. 271)

The target of conventional monetary policy is the short-term interest rate, which is achieved through open market operations by either buying or selling financial assets from the banking system. This influences the level of reserves held by commercial banks. The particular volume and fluctuation of reserves is not the target itself in conventional monetary policy. Quantities of open market operations are almost irrelevant; they are just a byproduct, a means to achieve a desired change in the interest rate.

There are at least two reasons why the abilities of conventional monetary policy to stimulate the economy greatly diminish in the times of economic and financial crisis (Mishkin, 2013, p. 425). The first is the zero lower bound problem. Firstly, using tools of conventional monetary policy, the central bank is unable to stimulate the economy when short-term interest rates reach the zero level, because nominal interest rates cannot be negative in the framework of the conventional monetary policy. The second one is the weak relationship between the official interest rate and market interest rate (and similarly between reserves of commercial banks and lending). The reasoning is that the financial system freezes and seizes up to such an extent that it becomes impossible to allocate capital to productive uses through the financial system. Conventional tools are not enough to prop up financial markets and this may lead to the collapse of investment and the economy. Higher monetary base may not increase

the money supply due to the excess reserves held by the commercial banks if they choose not to lend on top of these reserves.<sup>3</sup>

Due to both of these reasons, conventional policy in troubled times is often seen as unfit to solve economic and financial problems and boost economic growth. According to the proponents of unconventional monetary policy, these problems can be overcome by shifting the focus of monetary policy from interest rate to the size of the balance sheet. In unconventional monetary policy central banks start to purchase other financial assets and/or purchase them to a higher extent than is needed to target the interest rate. Thus conventional monetary policy differs in both the quantity and the object of purchased assets. The focus of unconventional asset purchases is the quantities of assets purchased, not their impact on the interest rate.

It is quite tricky to define unconventional monetary policy, because it is more easily defined by what it is not, rather than what it is. Unconventional monetary policy takes many forms.

In some cases (for instance Denmark), it involves the use of negative interest rates. Some commentators advocate suspension or changes to inflation targets. The more common forms of unconventional monetary policy involve massive expansion of central banks' balance sheets and attempts at influencing interest rates other than the usual short-term official rates. For instance, the Federal Reserve implemented policies known as 'credit easing' when they purchased mortgage-backed securities. The purchase of these securities meant that the Fed now held more assets and so its balance sheet expanded. The purchase of these assets also provided liquidity to a market that had dried up in the wake of

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<sup>3</sup> Joyce et al. (2012, p. 272):

The depth of the recession in many countries meant that Taylor rules would recommend negative nominal interest rates but market interest rates are effectively bounded by zero (or close to zero) because agents can always hold non-interest bearing cash. With the interest rates that central banks can set at or close to zero, other interest rates or forms of monetary policy needed to be considered. The second problem occurred due to the disruption of the financial system itself. Given the scale of losses incurred the aftermath of the bubble bursting, the solvency of many banks and borrowers called into question. The result was that the usually reliable relationship between changes in official interest rates and market interest rates broke down, again leading central banks to consider other forms of intervention. Related to this were fears that banks were holding onto funds to improve their viability rather than on-lending to private sector, requiring some central banks to intervene with the direct provision of credit.



the financial crisis and helped lower mortgage interest rates directly and provided credit lines to an important part of the economy. The Federal Reserve has also implemented 'Operation Twist'. In this case the size of the balance sheet of a central bank is not affected but the central bank tries to influence non-standard interest rates. In Operation Twist, the Fed sells short-term government bonds and uses the proceeds to buy long-term bonds. Because its sales and purchases are of equal amount, the balance sheet of the central bank is unaffected but through its purchase of long-term bonds, it drives up their price and lowers long-term interest rates. (Joyce et al., 2012, p. 272)

Large-scale asset purchases, or quantitative easing, is the most important instrument of unconventional monetary policy. The idea is that by purchasing vast amounts of targeted financial assets central bank expands its balance sheet and reserves of commercial banks, reduces interest rates (in general, or for particular segments of the term structure or for particular financial assets) and increases liquidity in the market. Bernanke and Reinhart (2004, p. 87) explain the crux of quantitative easing:

Even if the price of reserves (the overnight rate) becomes pinned at zero, the central bank can still expand the quantity of reserves beyond the level required to hold the overnight rate at zero, a policy sometimes referred to as "quantitative easing."<sup>4</sup>

Although the effects of quantitative easing and unconventional monetary policy in general are yet less researched<sup>5</sup>, it is claimed that quantitative easing stimulates economy and props up aggregate demand. The term "quantitative easing" was first used to describe monetary policies in Japan.<sup>6</sup>

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<sup>4</sup> "Quantitative easing may also work by altering expectations of the future path of policy rates.<...> the act of setting and meeting a high reserves target is more visible, and hence may be more credible, than a purely verbal promise about future short-term interest rates." (Bernanke & Reinhart, 2004, p. 88) Thus, quantitative easing may work together with forward guidance, which will be discussed below.

<sup>5</sup> Joyce et al. (2012, p. 275):

Conventional monetary policy was also based on substantial evidence on how short term official interest rates affected the economy. Knowledge of that transmission mechanism meant that the setting of interest rates could be done with an awareness of what quantum of interest rate changes were necessary to deliver an appropriate response. No such evidential basis yet exists for unconventional monetary policy.

<sup>6</sup> Joyce et al. (2012, p. 274):

The phrase 'Quantitative Easing' was introduced to signal shift in focus towards targeting quantity variables. With interest rates at their Zero Lower Bound, the Bank of Japan

There are two important parameters of quantitative easing. The first is its *extent* or quantity of assets purchased. The second is the *object* or the mix of financial assets that are purchased. The result of an asset purchase is that the demand for the targeted financial assets increases, and the quantity of these assets held in the hands of the private sector decreases (the quantity of money – increases). In effect, quantitative easing changes the composition of assets held by the private sector:

In doing so, the central bank expands its balance sheet and shifts the portfolio mix of assets held by the private sector who come to hold more claims on the central bank ('money' - the liability side of the central bank's balance sheet) and fewer of the claims that the central bank has acquired (which now form the asset side of its balance sheet). The central bank's balance sheet rises; its extra liabilities - most of which are likely to be in the form of greater reserves held by the banking system - matched by greater assets. (Joyce et al., 2012, p. 276)

Quantitative easing can alter term premiums and yields, by shifting the composition of holdings of financial assets in the hands of financial market participants, e.g. from shorter to longer dated ones.

In simple terms, if the liquidity or risk characteristics of securities differ, so that investors do not treat all securities as perfect substitutes, then changes in relative demands by a large purchaser have the potential to alter relative prices of financial assets. The same logic might lead the central bank to consider purchasing assets other than government securities, such as corporate bonds or stocks or foreign government bonds. (Bernanke & Reinhart, 2004, p. 86)

By buying long-term government bonds, the central bank aims to directly influence the long-term interest rate (as opposed to open market operations, where the influences is through changes in the short-term rates). The choice of central bank to purchase long-term securities, e.g. long-term government bonds, can change long-term interest rates relative to short-term interest rates. Gagnon, Raskin, Remache, and Sack

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aimed at purchasing government securities from banking sector and thereby boosting the level of cash reserves the banks held in system. The hope was that by targeting a high enough level of reserves, eventually this would spill over into lending into the broader economy, helping drive asset prices up and remove deflationary forces.

(2011b) estimated the decline in long-term interest rates following the Fed's asset purchase programs of about 100 basis points (one percentage point).

Therefore, an important characteristic of asset purchase programs is that they are directed towards altering particular segments of financial markets through changing the composition of the central bank's balance sheet. In contrast to regular open market operations, asset purchases through quantitative easing may directly affect a) the longer term interest rate and b) (relative) yields among different financial assets.

Using event studies, Kuttner (2018, p. 127) calculates that 4 rounds of quantitative easing performed by the Fed in 2007-2015 had a cumulative effect on the 10-year Treasury yield of at least 150 basis points. However, the author also gives five reasons why the evidence should be interpreted with caution and why the results are fully generalizable to other situations. Greenwood, Hanson, and Liao (2018) show that it takes some time for the changes in the asset compositions to be fully reflected in prices and yields.<sup>7</sup>

Another targeted effect of quantitative easing is propping up of particular parts of financial markets. By expanding the balance sheet of the central bank and by changing its composition, the central bank may aim for changing the functioning of particular segments of financial markets or credit easing (as opposed to quantitative easing),<sup>8</sup> e.g. the central bank can engage in purchasing mortgage-backed securities in an attempt to lower the interest rate on residential mortgages and to stimulate housing market.

Another unconventional tool of monetary policy is the central bank's commitment to future monetary policy actions. This means that the central bank announces or gives signals about its future actions and expresses its commitment to them.

According to Bernanke and Reinhart (2004, p. 85), the pricing of long-lived financial assets depends on the current short-term interest rate as well as on the expected future path of the short-term interest rate. Therefore, central banks can affect asset

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<sup>7</sup> Kuttner (2018, p. 131):

The dilemma is that an event window of sufficient length to account for a gradual response will include "noise" resulting from the arrival of additional information and events, making it less likely to discern a statistically significant impact of the policy.

<sup>8</sup> Indeed, Bernanke was adamant that the Fed's policies should not be characterized as quantitative easing.

prices by changing market participants' expectations of the future short-term interest rates. This is referred to as management of expectations or forward guidance.

So even with the overnight nominal interest rate at or near zero, additional stimulus can be imparted by offering some form of commitment to the public to keep the short rate low for a longer period than previously expected. For this reason central banks have worked hard to improve communication with the public; a key objective of this effort is better alignment of market expectations of policy with the policy-making committee's own intentions. (Bernanke & Reinhart, 2004, pp. 85-86)

To sum up, there are fundamental differences between conventional and unconventional monetary policy, which translate into important differences of how the value and prices of financial assets are affected by the monetary policy. In the next section, we will focus on the European central bank, and look more deeply at the differences of the conventional and unconventional monetary policy in the Eurozone and how these differences affect financial markets.

Having discussed the theory behind conventional and unconventional monetary policy, the rest of this section aims to identify the main differences between conventional and unconventional instruments of monetary policy at the ECB by comparing them and finding their characterizing features.

### ***Regularity and aims***

Unconventional monetary policy relies on non-regular instruments and programs, which have period-specific objectives. Creation of unconventional programs were usually a response to particular conditions (crises) in the economy or financial markets.

Conventional instruments of monetary policy predominantly rely on instruments of monetary policy, which are executed in regular fashion (MRO's, LTRO's, and standing facilities). Through these instruments, the ECB steers the short-term interest rate in the money market to its target, which is set depending on economic conditions and respective aims of the monetary policy.

Instruments of unconventional monetary mostly rely on irregular instruments. They usually have limited life spans and tentative amounts, they were created as a response to particular conditions in economy and financial markets and have period specific

objectives. The responsive nature of unconventional instruments of monetary policy shows that ECB policy has shifted. It has moved from having narrow economic and financial aims and targets (inflation target), to having broader economic and financial considerations (economic growth, financial stability) and even political considerations (sovereign debt crisis, monetary and political union).

### ***Maturity***

The maturity of monetary policy instruments (both lending and asset purchases) has increased, and they became more focused on the long-term interest rates (as opposed to the short-term ones).

The maturity of conventional instruments of monetary policy is relatively short. ECB conventional monetary policy is based on setting the money market interest rate to target interest rate and it mostly relies on MROs, which have frequency and maturity of one week. Maturity of standard LTROs is three months, structural open market operations can have a maturity up to 12 months. Securities eligible for purchase in the asset purchase programs of ECB can have the maturity of up to 31 years. These programs do not limit how long the securities purchased through the asset purchase programs can stay on the balance sheet of the ECB.

Open market operations and asset purchase programs of longer maturity mean that the ECB is not only trying to set the short-term interest rate in money market, but also to influence longer term interest rates over the yield curve.

### ***Scope of securities***

The introduction of unconventional instruments of monetary policy came together with the expansion of eligible collateral and expansion of securities used for monetary policy through outright purchases.

Lending as a conventional way to influence liquidity and manage short-term interest rates in the money market works through the open market operations (MROs, LTROs SOs) when the ECB executes reverse transactions - lends money against eligible collateral. Collateral rules define which assets can be pledged as collateral when borrowing from the ECB. The emergence of unconventional instruments of monetary policy has significantly increased the scope of securities and financial assets that are used to conduct monetary policy. This was done in the following ways.

First, collateral rules have been changed to include a broader range of securities to be pledged as collateral. New types of securities were added to eligible collateral (for more detailed analysis of changes in the collateral framework at ECB see Appendix I). Moreover, the criteria for the qualitative assessment of securities have been lowered to broaden the eligible collateral.

Second, the introduction of asset purchase programs has significantly increased the scope of securities through which ECB transmits monetary policy. Asset purchase program of ECB consists of four programs: Public sector purchase program, Covered bond purchase program, Corporate sector purchase program and Asset-backed securities purchase program. Through these programs, the ECB conducts outright purchases of different kinds of securities in the primary and secondary markets. Each program has rules that define the criteria for eligibility of securities to participate in these programs. These criteria broadly follow the collateral eligibility rules. This means that, generally, securities that can be purchased by the ECB are the ones that can be pledged as collateral to borrow from the ECB. However, there is an important difference between outright purchases and open market operations. When conducting asset purchase programs ECB can choose to purchase large amounts of specific securities or groups of securities and hold them in the balance sheet, as opposed to lending to credit institutions for limited periods against any eligible collateral, which is chosen to be pledged by the credit institutions. A particular security becomes a part of transmission of monetary policy in lending through open market operation only if credit institutions choose to borrow money from the ECB against it with and pay the target interest rate. In the case of outright purchases, the ECB chooses the amounts of particular securities to be purchased. Effectively, asset purchase programs allows the ECB to increase the extent of securities that the ECB hold and conducts monetary policy through beyond the amount which is needed to steer the short-term interest rate in the money market.

Third, the outright purchases of securities also means that the ECB can engage not only with eligible credit institutions, as is the case for open market purchases. The sellers of securities in asset purchase programs can also be other financial institutions (e.g. brokers, dealers). This means that unconventional policy also leads to the expansion of counterparties of the central bank.

### ***Size and limits***

Unconventional instruments of monetary policy mean an operational change of money creation from loans to purchases, which reduce the limits of money creation. Asset purchase programs of the ECB are significantly bigger compared to conventional instruments, liquidity created through them is not absorbed, and they have significantly increased the size of the balance sheet and excess liquidity in the Eurosystem. Moreover, the ECB in its communication often stresses the limitlessness of outright purchases programs (e.g. OMT).

Unconventional instruments of monetary policy are significantly more extensive in their capacity to create monetary base and are less limited in their operations than conventional instruments. Central banks control money supply and interest rates by creating money (currency in circulation and monetary base). Instruments of monetary policy define how money is disbursed into the market. Technically, there are three ways how newly created money by the central bank can reach the market: through loans, through purchases and through handouts. Instruments of monetary policy embody the rules of money creation and disbursement, which are defined by the monetary system. Importantly, these rules define the limits of these instruments and their capacity for money creation.

Conventional instruments of monetary policy at the ECB create and disburse money through open market operations, which means through loans to eligible credit institutions. Asset purchase programs which are a part of unconventional tools of monetary policy create money through purchases of financial assets. The important difference between these methods is that they set different limits for money creation.

The amount of borrowing and money creation done through an open market operation ultimately depends on the target of short-term interest rate in the money market. The lower is the target interest rate, the higher is the amount of liquidity (lending) that the ECB needs to provide the market with to set the money market rate to the target interest rate. The idea behind conventional open market operations is that once the money market rate reaches the target interest rate, the liquidity injections stops. Even if the central bank continues the amount of liquidity injected through open market operations depends on the amount that credit institutions want to borrow at each rate. The target rate and willingness of credit institutions to borrow is a restraint, it creates

an operational limit for the central bank of the creation of liquidity and monetary base through the open market operations.

Money creation through outright purchases of financial assets done by the central bank is not limited by this factor. Outright purchases are not constrained by the target interest rate. They are constructed to increase the liquidity and the balance sheet of the central banks beyond the limit, which is needed to steer the interest rate. Moreover, purchasing of assets is not constrained by the willingness of credit institutions to borrow money. Asset purchases are only constrained by the amount of financial assets available to purchase and considerations of the quality of these assets (and quality of the balance sheet of the central bank). Moreover, the availability of financial assets for purchasing is hardly a limitation due to a) the enormous size of the financial markets, b) the incentive created by the asset purchases to create more financial assets, and c) the broad and increasing array of financial assets that the ECB find eligible for purchases.

Reduced constraints on the liquidity and money creation of the outright purchases vs. lending is seen in the effects of asset purchase programs on the growth of the balance sheet of the ECB and excess liquidity in the Eurosystem. The size of the Assets purchase program of the ECB is enormous in its size. Since the introduction of this program and some other instruments (e.g. TLTRO), the ECB's balance sheet has increased significantly (see the section below). Another reason, next to the size of these programs, of their effects on the size of the balance sheet, is that the liquidity created by them is not absorbed by the central bank.

Lack of constraints is also seen in the communication of the ECB when describing the programs of outright purchases. They are announced by defining the monetary amounts of assets that are going to be purchased per different periods. In many cases these programs are resumed and their sizes are increased after the initial periods. The instrument Outright monetary transactions, initiated in 2012 as a response to a sovereign debt crisis in the Eurozone was presented as virtually without limits or caps. The only limit and the reason for its legality was its conditionality.

### ***Targeting and discretion***

Unconventional instruments of monetary policy at the ECB target specific behavior of counterparties (e.g. TLTROs) or specific groups of financial assets (e.g. instruments



in the APP). The targeting nature of unconventional instruments introduces higher levels of discretion in the actions of the ECB.

Instruments of conventional monetary policy at the ECB are generally broad and they do not target specific securities or counterparties. All eligible counterparties can borrow from ECB through standing facilities or open market operations using relatively broad collateral. Introduction of unconventional monetary policy significantly increased the extent to which ECB and its instruments target a) counterparties with specific behavior, b) specific markets and financial assets.

TLTROs, which are unconventional instruments of open market operations introduced in 2014, target behavior of credit institutions. The amount of borrowing which a specific credit institution can receive through these instruments depends on the amount of lending that it does to non-financial corporations and households.

Instruments in the Asset purchase program, namely PSPP, CBPP, CSPP and ABSPP target specific groups of financial assets (respectively government bonds, covered bonds, corporate bonds and asset-backed securities) in an attempt to prop up their prices. The ECB decides upon the monetary amounts of purchases that are targeted towards different instruments and asset groups in the Asset purchase program.

The development of the collateral framework of the Eurosystem also has the direction of targeting specific securities, or countries. Collateral rules made country-based exceptions in the criteria of eligibility for financial assets originating from Greece and Cyprus (assets with higher risk rating are allowed for purchase from these particular countries). The evolution of collateral rules allows the ECB to exercise a certain amount of discretion on deciding if a particular security is eligible to be used as collateral (Bindseil, Corsi, Sahel, & Visser, 2017). Similarly, discretion is exercised when the ECB decides which counterparties are eligible to have access to borrowing from the ECB.

A good example of an instrument that targets specific groups of assets is the Outright monetary transactions, introduced in 2012. According to this instrument, the ECB can choose to purchase unlimited amounts of sovereign debt of a specific country conditional to some specific actions of the sovereign.

### ***Channels of impact***

Unconventional tools of monetary policy are aimed to work not only through short-term interest rates, but also through portfolio rebalancing and signaling channels.

Conventional monetary policy is transmitted through the short-term interest rate, or so called direct pass-through. This channel operates through lending to credit institutions. Lending at low short-term interest rates influences the prices of credit that financial intermediaries set. Unconventional policies of ECB also work through the direct pass-through channel:

For instance, such effects are achieved by the TLTROs and the purchases of asset-backed securities and covered bonds under the APP. By targeting the pricing of banks' liabilities, such as central bank credit and wholesale funding, the direct pass-through influences the pricing of bank credit. (Alvarez et al., 2017, p. 13)

However, unconventional instruments of monetary were constructed with the premise of two more channels of impact. First, the portfolio rebalancing channel, which works through the compression of returns of the financial assets under the direct impact of the ECB, incentivizes market participants to shift their demand to the higher risk and maturity assets, which bids up their prices.<sup>9</sup> Second, the signaling channel is attributed to both the asset purchases (communication about the duration of purchases) and the forward guidance of interest rates. The signaling channel works through the commitment of the ECB to future actions and it influences longer-term interest rates. Introduction of asset purchase programs allows the ECB to not only communicate its

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<sup>9</sup> Alvarez et al. (2017, p. 17):

In particular, the large-scale purchase of sovereign bonds depresses the term premium and provides impetus for banks to rebalance their balance sheets, increasing their asset holdings and lending as well as offloading their cash reserves, which is further incentivised by the negative interest rate policy.

Also, Alvarez et al. (2017, p. 45):

Such large-scale asset purchase programmes had been used by other central banks in the past. These programmes lower long-term bond yields by increasing the demand of such securities and removing interest rate risk from the market, thus incentivising market participants to rebalance their portfolios towards riskier assets. They also increase the amount of central bank liquidity in the banking system pushing short-term money market rates close to the deposit rate floor, which contributes to lowering the term premium on money market rates and increases incentives for portfolio rebalancing. Via the portfolio rebalancing channel, banks have incentives to increase lending to the real economy. Due to portfolio rebalancing there are also spill-overs into markets that are not directly covered by the purchase programmes.

commitments about the future interest rates, but also the amounts and targets of asset purchases.

With the emergence of unconventional monetary policy, the assurance of the financial market participants in different forms started playing an important role in the implementation of monetary policy. Forward guidance of interest rates and commitment to future asset purchases are the primary examples. But there are more examples. The fixed-rate full allotment procedure in open market operations was introduced in 2009. It means that credit institutions can be sure that they will be able to borrow any amount from the central bank that they desire at a particular rate of the open market operation. Fixed-rate full allotment procedures were introduced as a temporary measure, but it was later extended and expanded. Another example of assurance was the introduction of OMT, through which the ECB signaled its determination to purchase unlimited amounts of sovereign debt if needed. Even though this program was not used, it had a big impact on the sentiment of financial markets.

To sum up, the introduction of unconventional monetary policy instruments has changed some of the restrictions on the actions of the ECB that were present in conventional instruments. There has been an increase in the discretion of the central bank, allowing for more direct targeting of particular markets of financial assets and even countries. Moreover, with unconventional monetary instruments came the big expansion of the type of securities that the central bank purchases, there was an increase in the maturity of these instruments. Lastly, programs of non-conventional instruments are significantly higher in scale; they have caused more rapid expansion of the balance sheet of the central bank.

### **Balance sheet of the ECB and the relative importance of instruments**

This section will take a closer look at the balance sheet of the ECB in order to see which instruments of monetary policy were used the most over the years. Eurosystem liquidity management is based on the Eurosystem balance sheet (e.g. Mercier and Papadia (2011)). Analysis of the central bank balance sheet reveals how much liquidity created by the central bank there is in circulation (Eser et al., 2012, p. 15). Moreover, the balance sheet of the central bank can show what are the monetary policy

instruments through which the central bank creates the liquidity. By investigating the relative sizes of different parts of the balance sheet that correspond to particular instruments of monetary policy we can have an overall picture of what are the instruments that the central bank relies on while conducting monetary policy. This exercise can also show the relative importance of conventional vs. unconventional instruments of monetary policy in the creation of monetary base.

Fig. 2 below shows the evolution of the balance sheet of the ECB from 1998 to 2020. One obvious trend is the significant growth of the balance sheet. From the end of 1998 to the beginning of 2020 the balance sheet of the ECB expanded by 7.5 times: from 697 billion Euros at the end of 1999 to 5 trillion 200 billion Euros in the beginning of 2020. There was also quite a dramatic change in the composition of the balance sheet of the ECB.

Balance sheet of ECB according to instruments of monetary policy (1999-2020, millions of Euro)

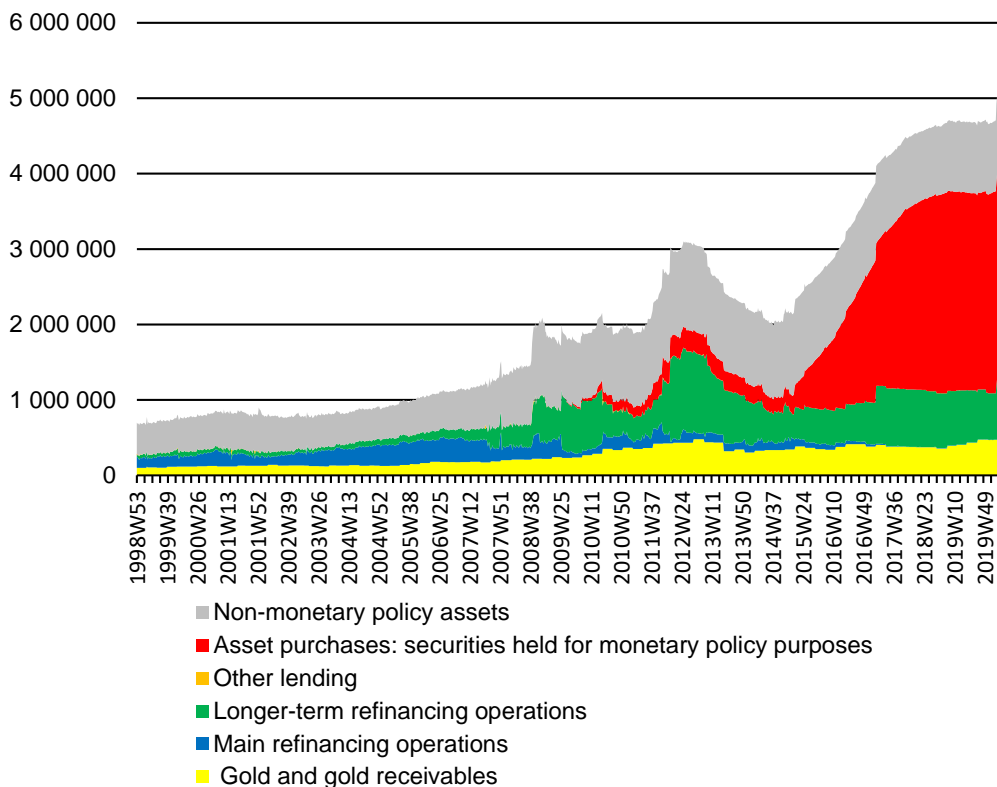


Fig. 2. Balance sheet of the ECB according to the instruments of monetary policy (1999-2020, millions of Euro). Source: ECB (2020a)

Since the beginning of the Eurosystem until the mid-2007, main refinancing operations were the dominant monetary policy instrument of the ECB. During this period about a quarter of ECB's balance sheet was in MROs (see Fig. 3). This is about three quarters of the ECB's assets that are used for monetary policy purposes (see Fig. 4). The situation started to change rapidly in mid-2007, when the share of MROs dropped sharply, and they were replaced by longer term refinancing operations. In September of 2007 for the first time in the ECB's existence, the monetary amount of LTRO's was higher than the monetary amount of MROs. LTROs with some ups and downs dominated the monetary policy of the ECB until about the end of 2014. MRO's during this period were significantly less important (the opposite situation to the one until 2007). From mid-2007 to the end of 2014 TLTRO's on average consisted 26 percent of the ECB's balance sheet (see Fig. 3) This is on average about 65% of total assets used for monetary policy purposes (see Fig. 4).

Balance sheet of ECB according to instruments of monetary policy (1999-2020, percentages)

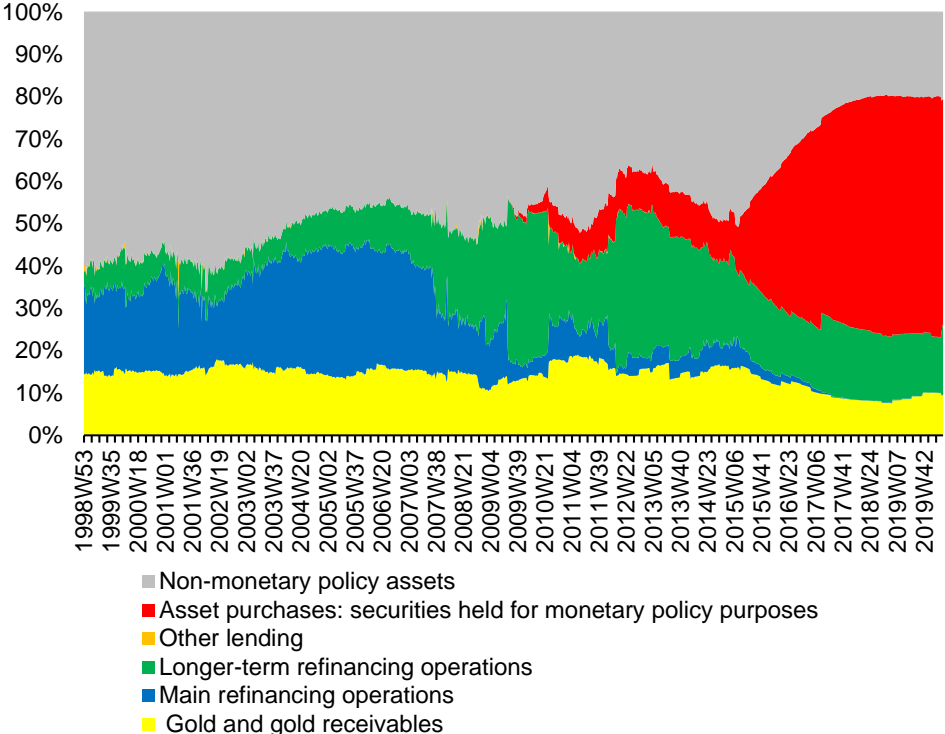


Fig. 3. Balance sheet of ECB according to instruments of monetary policy (1999-2020, percentages). Source: ECB (2020a)

Starting from 2015, the situation started to change again. Asset purchases, which started in July 2009, but which were still a relatively negligible part of the ECB's balance sheet, took off. Rapid expansion of securities held for monetary policy purposes at the balance sheet of the ECB from 2015 show that asset purchases became a dominating instrument of monetary policy at the ECB. By the end of 2017 the securities held for monetary policy purposes constituted 53 percent of the balance sheet of ECB (see Fig. 3), which is 76 percent of assets used for monetary policy purposes (see Fig. 4). At the same time, MROs were no longer used and the relative share of TLRO's shrank significantly.

Relative weights of MRO, LTRO and asset purchases in the balance sheet of the ECB (percentages from monetary policy assets)

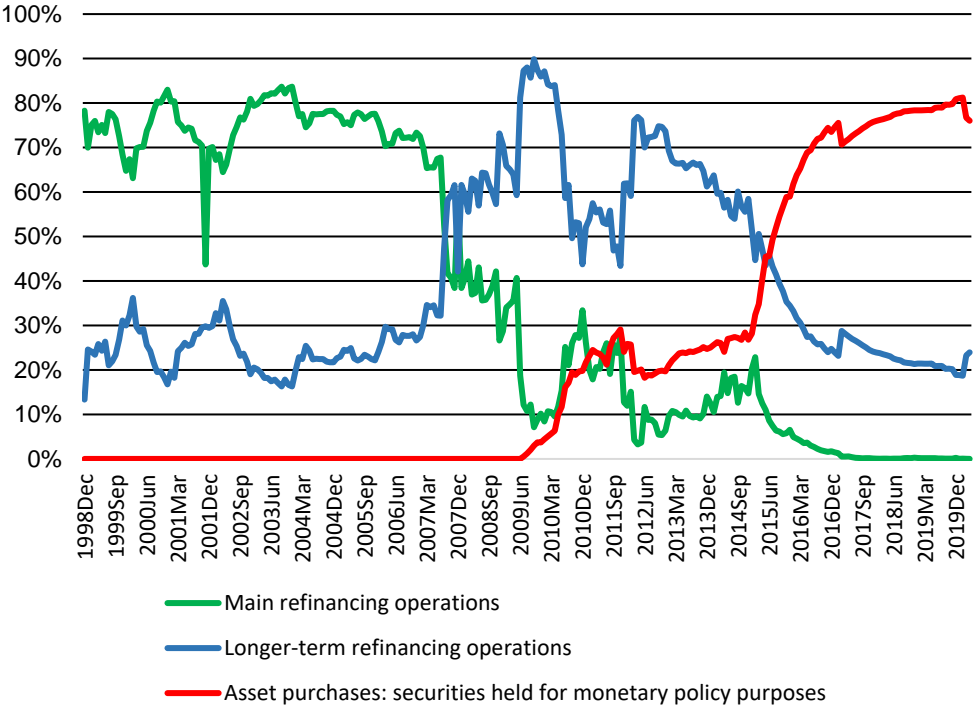


Fig. 4. Relative weights of MRO, LTRO and asset purchases in the balance sheet of the ECB (percentages from monetary policy assets). Source: ECB (2020a)

This situation and relative importance of monetary policy instruments has not change since. In the beginning of 2020 the share of asset purchases were 57 percent of the

balance sheet of the ECB (81 percent from the assets used for monetary policy instruments). The numbers for LTRO's are accordingly 13 percent and 19 percent. The balance sheet of the ECB in the beginning of 2020 did not contain any assets related to MROs.

The analysis of the evolution of the balance sheet shows that ECB moved from conventional to unconventional instruments of monetary policy. Monetary policy based on short-term lending through marginal refinancing, which represents conventional monetary policy, where replaced by longer-term borrowing through longer-term refinancing operations by 2007, which were eventually replaced by asset purchase programs by 2015.

### **Monetary policy and financial assets**

Using the insights of the previous analysis here we will shortly discuss how the shift of ECB's monetary policy from conventional to unconventional instruments affected the relationship between monetary policy and financial markets and financial assets.

Monetary policy inevitably influences financial assets because central banks transmit it through the financial markets. Through conventional and unconventional instruments of monetary policy, the ECB loans to credit institutions and buys financial assets in order to steer the interest rate and change prices of financial assets. Thus, monetary policy and financial markets are closely related. The effects of monetary policy reaches the economy through financial assets, therefore the ECB is not only an observer, but also an influencer of financial markets. Moreover, with the evolution of the instruments used by ECB and emergence of unconventional monetary policy, the influence of monetary policy on financial assets has become stronger.

Only by looking at the size of the balance sheet and monetary operations of the ECB, it is clear that the ECB became a significantly bigger player in the financial markets and the economy. From 1999 to 2019 the ratio of the ECB's balance sheet to the nominal GDP of Eurozone<sup>10</sup> grew by 3.7 times – from 11% to 39%. Since the ECB transmits monetary policy through financial markets, growth in relative size of the ECB's monetary operations show that monetary policy potentially has more influence on them. Moreover, there are other dimensions of monetary policy besides its relative

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<sup>10</sup> Euro area - changing composition.

size that show the potentially higher impact of monetary policy on the financial markets and financial assets.

The emergence of unconventional monetary policy expanded the reach of monetary policy instruments towards longer maturity and broader scope of financial assets. To the degree that the extension of monetary policy to longer term interest rates (e.g. through unconventional instruments of longer term lending, purchases of longer term financial assets, forward guidance) is successful in directly influencing longer term rates (as opposed to only steering short-term interest rates), this policy has a more extensive effect on prices of financial assets. Prices of financial assets depend on the present value of future cash flows originating from them, thus prices of financial assets with longer maturity are sensitive to interest rates. Moreover, through asset purchases the ECB has expanded the scope of financial assets through which it transmits monetary policy. Asset purchase programs directly target particular markets of financial assets to a much higher extent than conventional instruments, thus the impact of monetary policy on these markets potentially became much stronger. Targeting particular markets or financial assets is an important feature of unconventional monetary policy. Conventional instruments of monetary policy, which mainly steers short-term interest rate through lending, have relatively homogenous effects on financial assets. Whereas unconventional monetary policy based on instruments, which target specific markets or financial assets, have effects that are potentially heterogeneous. They are specific to different groups of financial assets or even specific financial assets.

The broader and more extensive effect of unconventional instruments of monetary policy on the prices of financial assets is at least partly recognized by the two transmission channels of monetary policy, which are specific to unconventional instruments, namely the signaling effect and the portfolio balance effect. The signaling effect emphasizes the impact of forward guidance on the long-term interest rates. The portfolio balance effect explains how asset purchases affect prices of not only those assets the central bank directly purchases, but also those that have similar risk and return characteristics.

To sum up, the instruments through which the ECB conducts monetary policy have changed significantly over the years. In the beginning of ECB's existence, monetary



policy relied on conventional instruments. Currently, monetary policy is conducted mostly through unconventional ones. The difference is not only technical; there are important differences between conventional and unconventional instruments, which determine that the ECB's reach into financial markets has expanded significantly in the dimensions of maturity, scope of securities, size, targeting and transmission channels. Implementation of unconventional instruments results in a significantly higher impact of monetary policy on the financial markets in the Eurozone.

## **1.2. Regulation of the financial markets**

In this chapter, we will discuss the most important parts of the regulation of financial markets. Regulation of financial markets is closely related to monetary policy and it too has a heavy influence on the development of financial markets and, potentially, prices of financial assets.

Typically there are several reasons given a for why central banks and other governmental institutions regulate financial markets (Cecchetti & Schoenholtz, 2015, p. 364):

- To maintain the stability of the financial system. The financial system is unstable because of several reasons: mismatching liquidities of assets in the balance sheets of financial institutions (relatively illiquid assets and liquid liabilities), information asymmetries, risk of contagion and high interdependence between financial institutions.
- To protect investors. Small, unprofessional investors are often seen as unable to make sound investment decisions and the aim of government is to protect them from making wrong choices or from the mismanagement or malfeasance of the financial institutions.
- To protect market participants from monopolistic exploitation. It is reasoned that in financial markets small firms tend to merge into bigger ones and increase their potential of exploiting their customers (e.g. by raising prices). Therefore, government must step in to prevent this.

We can roughly distinguish between two types of regulation of financial markets. The first kind aims at providing a safety net for the consumers and for the providers of

financial services in order to avoid financial panics. The second kind restricts certain actions of financial institutions in order to avoid or limit their unwanted behavior.

### **Guarantees and the safety net**

There are several instruments of regulation that are aimed at providing guarantees and creating a safety net for the consumers and providers of financial services. These are deposit insurance, lender of last resort policies, bailouts and too-big-to-fail policies.

Authorities and regulators of financial markets provide deposit insurance, which guarantees that depositors will receive their deposits and money in their accounts up to some maximum amount should an institution fail. In case of deposit insurance, the problem of bank runs and failures become that of the insurer, not the customer of the bank. Since the insurance by the financial authorities is run by the government, backed by the power of taxation and debt monetization, technically this insurance can withstand any amount of losses. The European deposit insurance scheme apply to deposits below €100 000 of all banks in the banking union (European Commission, 2020b).

Central banks operate as the *lender of last resort*, extending loans to banks that face quick deposit outflows. The idea is that the best way to stop a failure of a particular bank turning into financial panic and potentially failure of the whole banking sector is to make sure that all solvent commercial banks can meet the withdrawal requests of their depositors. This was proposed in 1873 by British economist Walter Bagehot as the need for monetary authorities to provide this function of *lender of last resort*. Bagehot proposed that central bank should lend easily while accepting good collateral at a relatively high rate of interest. Good collateral would provide assurance that the borrowing institution is solvent, and a high interest rate would penalize the borrower for failing to have enough reserves to meet the demands of depositors and would incentive the quick repayment of the debt (Cecchetti & Schoenholtz, 2015, p. 366).

In the Euro area the ECB together with the 19 national central banks have the role of lender of last resort. The national banks through this instrument offer the safety net for banks that have problems getting the funding they need in the market. This is called emergency liquidity assistance (ECB, 2020d). Moreover, Garcia-de-Andoain, Heider, Hoerova, and Manganeli (2016) argue that ECB *de facto* acted as a lender of last

resort to the banking system of Euro zone since October 2008 by providing virtually unlimited liquidity against eligible collateral.

Government official and financial regulators tend to be more worried about the big financial institutions because their financial troubles tend to pose a threat to the whole financial system. Therefore some of the financial institutions are treated as *too big to fail* or *too interconnected* to fail (Cecchetti & Schoenholtz, 2015, p. 371). The idea is that these institutions cannot be put through a regular bankruptcy procedure in case of insolvency, because that would cause other financial institutions, firms and individuals to go bankrupt and the whole financial system to break down. Thus regulators consider that the bankruptcy of these firms have unacceptable spillover effects.

Bailouts may happen in several forms. Government and financial authorities may a) extend a loan as a lender of last resort, b) find a buyer for the institution and give financial incentive to buy insolvent institution, c) guarantee all liabilities of the institution, which is equal to promise that holders of bonds issued by the bank will not incur any losses, d) recapitalize failed financial institutions by giving them public money in return for partial ownership rights.

### **Restrictions on the actions of financial institutions**

The safety net created by the government for financial institutions and for their customers creates a problem of moral hazard<sup>11</sup>. To limit the incentives of market

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<sup>11</sup> Deposit insurance changes people's behavior. Insured depositors have very limited incentive to evaluate and monitor the behavior, risk and the financial situation of the bank in which they deposit the money. On the other side, banks are able to assume more risk in their operations (and potentially pay a higher interest rate on the deposits), because they know that their depositors are not sensitive to risk due to the insurance.

Similar incentives are created by the policy of lender of last resort. Government officials have to be able to distinguish between illiquid and insolvent institution. This means that they have to judge the market value of the balance sheet of the institution (which may be difficult, especially in the circumstances of financial turmoil). They have an incentive to be generous in evaluating the value of the balance sheet and to grant loans even in the case of insolvent banks, because they do not want the financial panic to spread. This creates the problem of moral hazard, because bank managers knowing this will tend to assume more risk in their actions (Cecchetti & Schoenholtz, 2015, p. 367). More risk can be assumed by making riskier loans or buying riskier securities, increase leverage of the firm, and relying too much on short-term financing.

The too big to fail assumption and treatment adds even more to the problem of moral hazard. Deposit insurance only works up to a maximum amount. However, if financial institutions and their creditors assume that a particular bank is going to be treated by the government as *too big to fail*, then there will be little incentive even for big depositors (the ones over the maximum limit

participants to take more risk governments and central banks engage in financial regulation, that is, they put restrictions on the actions of financial institutions. These restrictions consist of control of mergers and acquisitions, requirements on the capital and asset holdings, disclosure requirements, stress tests and macro-prudential regulation.

One of the policy goals of financial regulators is to prevent financial institutions from growing too big. This is for two reasons. Bankruptcy of big financial institutions threaten the stability of financial system. Moreover, big financial institutions are said to be subject to less competition and are able to exploit their customers (Cecchetti & Schoenholtz, 2015, p. 375). Therefore, mergers of financial institutions often require government approval, which is granted after officials are convinced the merger will not constitute monopoly or will not have too much market power.

Financial authorities try to prevent financial institutions from exploiting their safety net by engaging in risky behavior by controlling their balance sheets. This can happen in two forms. First is by regulating the size of capital and level of leverage. Second is by regulating what type of assets are on the balance sheets of financial institutions.

Financial institutions face restrictions on the type, grade and quantity of financial assets that a financial institution can hold. Moreover, banks face restriction on the loans that they can issue. Regulations of similar kind on asset management are applicable to insurance companies, securities firms and pension funds and other financial institutions. Capital requirements are imposed to assure particular minimum resilience of the bank against financial problems as well as to limit the problem of moral hazard.

The Basel Accord in 1988 established requirements for internationally active banks to hold capital to the extent of 8 percent of their risk-adjusted assets. All assets held by banks were placed in four different categories according to their risk of default,

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of deposit insurance) to worry about their deposits. The exemption from the normal process of bankruptcy significantly reduces the benefit of performing due diligence by anyone considering becoming a creditor of the bank. This incentivizes managers of these financial institutions to take on more risk, because they and their creditors assume that the government will find a way to bail them out. Even if governments claim in good times that they will not engage in bailouts, financial institutions and their creditors often assume that it will be very difficult to resist doing that when the crisis comes. Therefore these promises often lack credibility (this is what is called the problem of time consistency) (Cecchetti & Schoenholtz, 2015, p. 28).

associated risk weights would range from zero to 100 percent (sovereign debt issued by industrialized countries (0%), claims on industrialized countries' banks (20%), residential mortgages (50%), consumer and corporate loans (100%)).

Basel II updated the estimation of risk-adjusted assets trying to reflect more accurately the risks that banks take by differentiating between different ranks of bonds (e.g. bonds issued by highly rated corporations receive a 20 percent weight; junk bonds, a 150 percent weight).

Basel III expanded the coverage of assets for which banks are required to hold capital, tightened the definition of capital itself, and in this way doubled the capital a typical bank is required to hold. Basel III was a second line of defense (next to capital requirements of risk-weighted assets) by introducing another restriction of minimum ratio of total assets to equity (leverage restriction). This was done because risk-weighting is difficult, subjective, and subject to evasion by banks, a leverage is supposed to work in cases when some assets turn out to be much riskier than anyone thought (Cecchetti & Schoenholtz, 2015, p. 379).

Basel III also set three so-called buffers over the minimum capital requirement: capital conservation buffer (which restricts the payments of dividends and bonuses), countercyclical capital buffer (which rises in good times and declines in bad times) and systemic capital surcharge (raises the minimum capital requirement for institutions who are deemed to be systemically important financial institutions). Moreover, Basel III added a liquidity requirement that oblige banks to hold so called high-quality liquid assets (e.g. short-term government bonds) to meet possible financial outflows during a crisis.

Basel III also combined above- mentioned institutional level requirements with macro-prudential tools addressing system-level risks. Micro-prudential regulation is when financial regulators focus on institutional oversight, trying to reduce the risks and probability of failure of particular financial institutions. The goal of macro-prudential regulation is to address the systemic risk and focus on the whole financial system (instead of individual institutions) by installing rules that a) promote better risk management and b) reduce the vulnerability of the financial system in case of bankruptcy of any single financial institution (Bank for International Settlements, 2009, pp. 128–135). The macro-prudential regulation identifies two sources of systemic risk

related to externalities: *common exposure* and *pro-cyclicality*<sup>12</sup>. Macro-prudential regulation aims to make financial institutions either *internalize or bear* the costs related to these externalities.

Macro-prudential policy applies familiar regulatory tools in innovative ways. Regulatory capital requirements varies with a financial institution's contribution to the system risk, which depends on its interconnectedness and riskiness of its balance sheet. Companies which are judged to be contributing more to the systemic risk are required to maintain a level of capital that is higher by the amount of *system capital surcharge*. The same can be applied for countering the pro-cyclicality – capital requirements can vary according to the business cycle, rising above average in the periods of growth to create a capital buffer which can be used in the periods of financial distress, when regulators would lower these requirements below average (Hanson, Kashyap, & Stein, 2011).

Lastly, financial institutions have to abide by the rules of transparent pricing providing their customers with information about it in a standardized way. In addition, banks and other financial institutions are required to provide the market with information about their balance sheets in a standardized way according to clearly specified accounting rules. The idea is that with this information, both regulators and the financial markets can penalize banks that are taking too much risk. Financial authorities also conduct so-called stress tests, in which they evaluate the financial performance of the biggest financial institutions under the hypothetical adverse conditions. These tests are aimed at reassuring market participants of the stability of financial institutions.

This short review suggests that regulation has a significant impact on the incentives and actions of institutions and customers in the financial markets. The particular ways in which regulation of financial markets may influence the value and prices of financial assets will be discussed in the second part of the dissertation.

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<sup>12</sup> *Common exposure* is when financial institutions are all exposed to the same specific risk factor, which makes it vulnerable. The specific risk factors may be common exposure to frail financial institutions through contracts (directly or through counterparties), common exposure to defaults of particular group of securities (e.g. mortgages). Large financial institutions tend to have higher interconnectedness. *Pro-cyclicality* is interaction between financial and economic activity which is mutually reinforcing (through adverse feedback (Cecchetti & Schoenholtz, 2015, p. 364)) and therefore can pose a risk to the stability of the financial system during different financial and economic cycles.

## **1.3. Financial assets and transmission of monetary policy**

### **1.3.1. Prices of financial assets as a target of monetary policy**

The traditional, or inflation targeting, view maintains that monetary policy should react to asset prices only to the extent that they provide information about the primary goal of the central bank - future inflation. According to this view monetary policy contributes to financial stability through the achievement of price stability (Schwartz (1995), Vickers (1999), Bernanke and Gertler (1999), Bernanke and Gertler (2000), Bernanke and Gertler (2001) Gertler (1998), Bordo et al. (2002), Bordo et al. (2003), Taylor (2007)). Moreover, if there are any financial imbalances, central banks should deal with them utilizing other measures, such as regulation or lender of last resort policies. (Schwartz, 2003). In this context Taylor rule was offered as the guideline for the central bank policy.

Several reasons why the traditional view held that monetary policy should not react to asset prices. Asset prices are too volatile and detached from the economic activity to be included into monetary policy. Asset bubbles are too difficult to detect and any mistakes made while responding to asset prices would be costly in terms of increasing the variance of output and risk of sending the economy into recession (e.g. Cogley (1999), Lansing (2003)). In general, interest rate management is a very “blunt” instrument, and its use while reacting to asset prices would have unintended collateral consequences (Galí & Gambletti, 2013). Thus Greenspan (2004) argued that central banks should address the consequences of asset bubbles rather than trying to prevent them.

Some did not accept the traditional view, arguing that monetary policy tightening is an appropriate response to “irrational exuberance” or when asset prices become misaligned with fundamentals (Smets (1997), Bryan, Cecchetti, and O'Sullivan (2001)). Cecchetti (2003) argued that other components in the Taylor rule are not easier to identify than asset bubbles. Thus, the critics of the traditional view proposed that central banks should “lean against the wind”, which means that once asset bubbles are identified central banks should raise interest rates to stop them from growing further, even if that means deviating from the output and inflation targets (e.g. Borio and Lowe (2002), Cecchetti, Genberg, Lipsky, and Wadhvani (2000)). This view

argues, that any unintended consequences from this kind of policy would be more than offset by the avoidance of the future burst of the bubble.

The financial crisis, which started after the U.S. housing bust in 2006, and Great Recession led many economists and policy makers view financial stability and overall macro stability as an important goal of central banks next to the price stability. This gave birth to the macro prudential monetary policy, which makes asset prices a more important part of monetary policy than before (Bordo & Landon-Lane, 2013). In the macro prudential regulation central banks are monitoring asset prices and conditions in the financial system and looking for any imbalances. In case they are found, central banks apply macro prudential measures, such as countercyclical capital requirements, liquidity ratios and other (Kashyap et al., 2008).

This debate, and especially the recent shift in thinking, is important in understanding the impact of monetary policy on the prices of financial assets. It is clear from our previous discussion about the instruments of monetary policy of the ECB that through unconventional monetary policy central banks became more active in financial markets and view financial assets not only as a vehicle of transmission, but as a target in itself. Targeting prices of financial assets, trying to prevent asset bubbles and financial instability became one of the aims of monetary policy. The normative dimension in the question of the prices of financial assets (e.g. what are balanced prices, or prices which are in line with fundamentals) became more important, as opposed to monetary authorities only caring about the prices to the extent that it allows them to transmit monetary policy to the economy.

### **1.3.2. Standard transmission mechanism of monetary policy via financial assets**

In this section, we will provide a summary of the traditional view of the transmission channels of monetary policy, which directly or indirectly influence prices of financial assets. The second part of the dissertation will be dedicated to developing an alternative approach to analyze the links between monetary policy and financial assets. However, before offering an alternative, we must review the established approach.

The standard transmission mechanism of monetary policy (presented by Mishkin (1995), Bank of England (1999), Kuttner and Mosser (2002), Agitis and Pitelis (2001)



ant others) relies heavily on the financial market and financial assets. In the standard transmission, actions of central banks affect economic activity through various causal channels or transmission mechanisms (Mishkin, 2013, p. 687). Some of these mechanisms work through the changes in the prices of stocks, bonds, real estate, and exchange rates. Such changes in turn affect the investment and consumption decisions of firms and households (see Fig. 5 below).

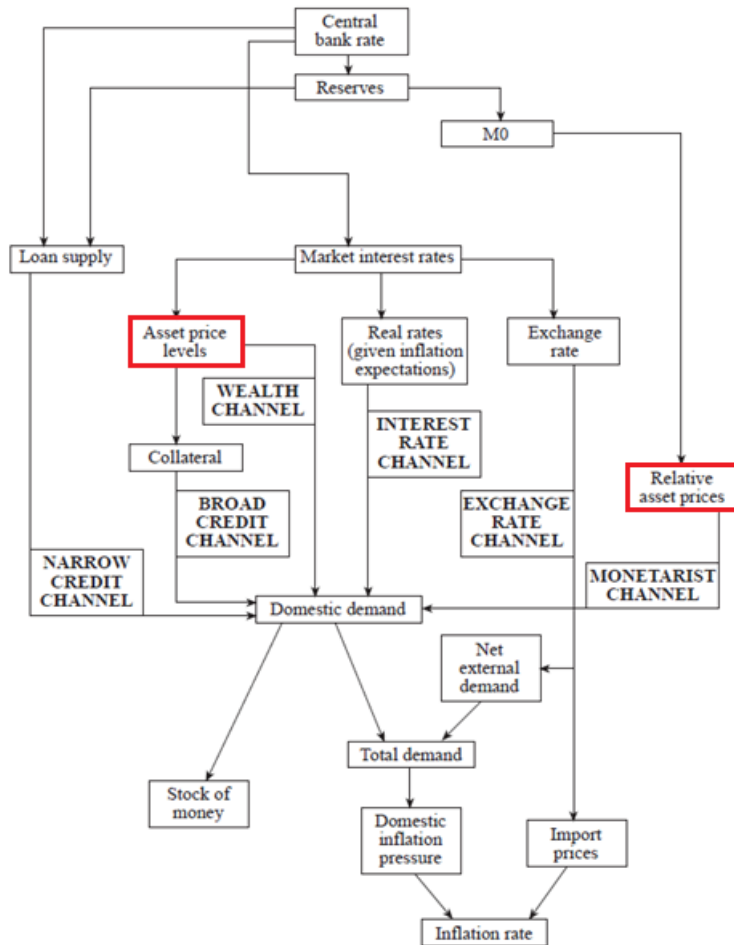


Fig. 5. Prices of financial assets in the standard monetary policy transmission (indicated in red). Source: adapted using Arestis and Sawyer (2004, p. 43)

We will discuss those channels of transmission, which are directly or indirectly related with the changes in the prices of financial assets.

## **Interest rate channel**

Central banks set the short-term interest rate in the economy. Reduction in the short-term interest rate means lower cost of capital, or borrowing costs for firms and households. Lower cost of capital, in turn, increases spending on durable goods, such as fixed investment, inventories, housing and consumer durables (Bernanke & Gertler, 1995, p. 27). Moreover, the interest rate channel may also include “availability” effects (Arestis & Sawyer, 2002). Reacting to the reduction of the short-term interest rate financial institutions may decide to relax the credit rationing instead of just adjusting their interest rates (Stiglitz & Weiss, 1981).

If we look at the price of financial asset as the present value of its future cash flows, there are fundamentally two ways in which monetary policy influences prices of financial assets. One is by changing the discount rate used by market participants and other one is altering the expected cash flows (Ioannidis & Kontonikas, 2006, pp. 1-2). The interest rate channel affects the discount rate.

## **Portfolio balance channel**

Portfolio balance effect explains that central banks influence other asset prices, not just the ones purchased or sold in the open market operations, as part of the transmission mechanism of monetary policy. Friedman and Schwartz (1963), Tobin (1969) and Brunner and Meltzer (1973) described this transmission channel.

If financial assets are perfect substitutes, arbitrage would equalize their expected returns. However, if financial assets are not perfect substitutes, each of them will have a downward sloping demand curve and changes in the relative supplies of these assets will change their prices and yields.<sup>13</sup> This supply-and-demand mechanism

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<sup>13</sup> Arestis and Sawyer (2002, p. 11):

Monetary policy can be undertaken with greater certainty by acting directly to influence and control interest rates than by seeking to control the money supply. Monetary authorities have to provide, however, much monetary base it takes to achieve their target interest rate. If, by contrast, the degree of substitutability between money and a wide range of assets, including real assets, is high, then the impact of money supply changes would crucially depend on relative price changes. This monetarist channel, therefore, works through relative asset price changes. Interest rate changes do not play a special role, other than as one of many relative price changes. Since the effect of monetary policy is on relative ‘real’ rates, it is pointless looking at the rate of interest to represent the thrust of monetary policy. Monetary policy should, thus, set the money supply and let interest rates become the endogenous magnitude. It is relative asset prices that can have an impact on aggregate demand.

creates portfolio balance effects that were part of the macroeconomics models in the 1960s and 1970s (e.g. Tobin (1963)).

There are at least two reasons of imperfect substitutability. One is that prices of longer maturity financial assets are more sensitive to interest rate fluctuations, which means that they contain more interest rate risk and investors require higher expected return from the long-term financial assets. This is what is called term premium. Another reason is the market segmentation. Modigliani and Sutch (1966) reasoned that market segmentation prevents perfect substitutability of financial assets. Investors have preferences for specific types of assets (this is referred to “preferred habitats”). Investors may also have requirements for minimum share of portfolios in particular financial assets (e.g. securities free from default risk).<sup>14</sup> Unconventional monetary policy recently has revived the interest in the portfolio balance effects:

[...] arrival of unconventional policies has prompted a reexamination of the linkages between monetary policy and financial markets and led to renewed interest in models characterized by imperfect substitutability between assets. (Kuttner, 2018, p. 126).

Portfolio balance effect infers how the demand of market participants for assets changes after the intervention of the central bank. When central bank purchases particular financial assets, they are transferred from the market participants to the central bank. Portfolio balance effect assumes that this initial change (additional demand for particular financial assets by the central bank) causes market participants to change their demands for other financial assets. This means that the initial purchase changes not only the demand for targeted asset, but eventually it impacts the demands and prices of other assets. Portfolio balance explains, in what way the demands for and prices of other financial assets change while market participants rebalance their portfolios after the initial purchase of assets by the central bank.

By purchasing a particular asset, a central bank reduces the amount of the security that the private sector holds, displacing some investors and reducing the holdings of others, while simultaneously increasing the amount of short-term, risk-free bank reserves held by the private sector. In order for investors to

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<sup>14</sup> Vayanos and Vila (2009) incorporated preferred habitat and portfolio balance models.

be willing to make those adjustments, the expected return on the purchased security has to fall. (Gagnon et al., 2011a, p. 6)

After the sale of financial assets market participants have more money, but it does not necessarily mean that they want to hold it. It may be just a temporary step in the rearrangement of the portfolios of market participants. It is likely that additional liquidity (higher than is demanded) will be spent and will increase the demand for the securities comparable to the ones that were sold in an open market operation. The prices of these securities will increase as a result. The sellers of these assets may also find themselves holding more cash and will in turn readjust their portfolios. Therefore, this effect will ripple further, increasing the demands and prices of assets down the line. Eventually, this effect will reach the non-financial goods too. Moreover, higher prices of financial assets means better terms at which they can be sold which incentivizes market participants to issue more financial assets.

It [open market purchase] would first affect the prices (rate of return) on short – term government securities, then via a portfolio balance substitution mechanism, the price (rate of return) of long-term government securities then corporate securities, equities, real estate, old masters and commodities including gold would be bid up (their returns lowered). Thus substitution from more to less liquid assets would occur as returns on the former decline relative to the latter. Thus the impact of expansionary monetary policy will impact securities, assets and commodities and finally the overall price level. This view sees asset prices as possible harbingers of future inflation. (Bordo & Landon-Lane, 2013, pp. 7-8)

We can also look at this process of adjustment through the lens of the yield, and what changes must happen in order for the market participants to be willing to hold the lower amount of assets after the open market purchase. If the amount of money in the hands of market participants increases, and the amount of assets decreases – in order for people to be satisfied with the amounts of money and financial assets in their hands, the yield on money needs to increase relative to the yield on the financial assets.

When the supply of any asset is increased, the structure of rates of return, on this and other assets, must change in a way that induces the public to hold the new supply. When the asset's own rate can rise, a large part of the necessary

adjustment can occur in this way. But if the rate is fixed, the whole adjustment must take place through reductions in other rates or increases in prices of other assets. This is the secret of the special role of money; it is a secret that would be shared by any other asset with a fixed interest rate. (Tobin, 1969, p. 26)

So to the extent that investors do not see different financial assets as perfect substitutes, the reduction in the supply of the riskier or longer-term assets (when they are targeted by the open market purchase) reduces the risk premiums that investors require to hold them and this in turn reduces their yields. This effect may also be explained by pointing out that if the supply of a particular financial asset (e.g. riskier asset) decreases, those investors, who are the most willing holders of the asset (which means that they will want to hold it instead of selling it even at a higher price), will be the ones left holding them.

Portfolio balance effect is usually identified as the primary channel of impact of non-conventional monetary policy, particularly large-scale asset purchases. Portfolio balance effect indicates that the impact is through the change in risk premiums that investors require from financial assets, rather than change in expectations of future short-term rates.

The primary channel through which LSAPs appear to work is by affecting the risk premium on the asset being purchased. By purchasing a particular asset, a central bank reduces the amount of the security that the private sector holds, displacing some investors and reducing the holdings of others, while simultaneously increasing the amount of short-term, risk-free bank reserves held by the private sector. In order for investors to be willing to make those adjustments, the expected return on the purchased security has to fall. Put differently, the purchases bid up the price of the asset and hence lower its yield. (Gagnon et al., 2011b, p. 3) <sup>15</sup>

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<sup>15</sup> Gagnon et al. (2011b, p. 2) also presents “[...] evidence that the purchases led to economically meaningful and long-lasting reductions in longer-term interest rates on a range of securities, including securities that were not included in the purchase programs. These reductions in interest rates primarily reflect lower risk premiums, including term premiums, rather than lower expectations of future short-term interest rates.”

## Signaling channel

The idea behind the signaling channel is that long-term interest rates (and thus asset prices) depend on the expectations of *future* short-term interest rates. Thus, different forms of central bank's communication (e.g. press conferences, announcements, speeches), will affect the economy "to the extent that they provide information about the likely path of future policy" (Kuttner, 2018, p. 126). This time of communication is common under conventional or unconventional monetary policy. However, under unconventional monetary policy the forward guidance is usually more explicit.

The traditional decomposition of interest rate on long-term government bonds is the average level of short-term interest rates over the maturity of the bond (risk neutral rate) and term premium. It is argued that asset purchases conducted by the central bank may influence both of these components. As discussed above, large-scale asset purchases reduce the amount of available financial assets in the market and therefore reduce the component of the term premium. However, asset purchases can also influence the component of the expected short-term interest rates. Through the *signaling channel*, asset purchases reduce the yields of financial assets by lowering the average expected short-term interest component in the long-term interest rates.

In general, LSAP announcements may signal to market participants that the central bank has changed its views on current or future economic conditions. Alternatively, they may be thought to convey information about changes in the monetary policy reaction function or policy objectives, such as the inflation target. In such cases, investors may alter their expectations of the future path of the policy rate, perhaps by lengthening the expected period of near-zero short-term interest rates. According to such a signaling channel, announcements of LSAPs would lower the expectations component of long-term yields. (Bauer & Rudebusch, 2013, p. 242)

There are two ways how forward guidance can affect expectations and thus interest rates. One interpretation, called "Odyssean" by Campbell et al. (2012), is when central banks commit to forward guidance and will pursue the policy even allowing the inflation rate to exceed the target for some period of time. If the commitment is credible it reduces the future expected short-term interest rates (Eggertsson & Woodford, 2003).

Alternatively, Campbell et al. (2012) referred to forward guidance as “Delphic” if it does not imply a commitment. In this case there are two possibilities (Kuttner, 2018, p. 127):

One possibility is that an expansionary forward guidance announcement reveals to the private sector proprietary Fed information that the economy is weaker than previously thought, which in turn implies that interest rates are likely to remain low for a longer time. However, as noted by Woodford (2012), if current real expenditures depended on expected future income, then an announcement that led to a more downbeat view of the economy could be contractionary. A second way in which forward guidance could affect expectations is by communicating information about the Fed’s policy rule. This channel may be especially important when markets had no clear sense of how economic conditions would affect how long interest rates would remain near zero. (Kuttner, 2018, p. 127)

Femina, Friedman, and Sack (2013) empirically demonstrated that forward guidance postponed the expected date of the first increase in the interest rate. Swanson and Williams (2014) recorded that forward guidance decreased the sensitivity of longer-term interest rates to economic news.

### **Credit channel (balance sheet and bank lending effects)**

Impact of monetary policy on the long-term interest rate is traditionally explained through the models of “frictions” in credit markets (e.g. transaction costs and costly enforcement of contracts, imperfect information). These mechanisms are usually called the *credit channel* of monetary transmission.

According to the credit channel theory, the direct effects of monetary policy on interest rates are amplified by endogenous changes in the external finance premium, which is the difference in cost between funds raised externally (by issuing equity or debt) and funds generated internally (by retaining earnings). (Bernanke & Gertler, 1995, p. 28)

Problems of imperfect information mean that businesses cannot always get credit even for the profitable projects. Therefore, “*bank credit plays a unique and important role in the economy, because banks are able to gather information about borrowers that*

would not be available to the general public, or even to the financial markets” (Arestis & Sawyer, 2002, p. 11).

The credit channel works through reducing the problems of adverse selection<sup>16</sup> and moral hazard<sup>17</sup>, which leads to more and cheaper lending to firms and thus more investment (Mishkin, 2013, p. 668). The literature describes two ways through which the credit channel might manifest.

The *balance sheet channel*, also termed *broad credit channel*, is the impact of monetary policy on the balance sheets and income statements (including net worth, liquid assets, cash flows) of the businesses in the economy. Stronger balance sheets mean that borrowers can reduce the problem of adverse selection or moral hazard by self-financing part of the investment project, or by offering more collateral to guarantee the loan. This induces banks to borrow more and for lower interest rates. Moreover, higher quality of the balance sheet may increase firm’s investment and spending. The reasoning is that stronger balance sheets and cash flows of borrowers in the economy influence the amount of borrowing and thus, the total amount of spending in the economy (Bernanke and Gertler (1989), Bernanke and Gertler (1999); Bernanke, Gertler, and Gilchrist (1999)).

There are several ways in which monetary policy can influence the balance sheet of the potential borrower (Bernanke & Gertler, 1995, p. 28). First, lower short-term interest rate reduces interest expenses, increasing net cash flows and strengthening the borrower's financial position. Second, decreasing interest rates are typically associated with increasing asset prices (through lower discount rate), which increases the value of the borrower's collateral. Third, an indirect effect is through the increase in revenues: balance sheet effect (and others) may induce more spending of other

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<sup>16</sup> “The problem of adverse selection comes from asymmetric information and it occurs when borrowers have limited information about companies and companies with bad credit risk are the ones who are more likely to seek out for loans and accept higher borrowing costs. Adverse selection increases the probability that the credit risk will be bad, because firms with good credit risk will be unwilling to accept borrowing costs on the market (because they themselves are aware of their good credit risk). This may lead to the situation where lenders may decide not to make loans even though good credit risk exists in the market.” (Žukauskas & Hülsmann, 2019, p. 125)

<sup>17</sup> “The problem of moral hazard is a principal-agent problem which occurs when managers of the firm are either only partial owners of the firms, or they do not own equity of the firm at all. Due to this the managers may act in their own interest rather than in the interest of the owners of the firm.” (Žukauskas & Hülsmann, 2019, p. 125)



companies that are customers of the particular firm. Empirical surveys on credit view were done by Bernanke and Gertler (1995), Cecchetti (1995), Hubbard (1995), Hubbard (2001), Bernanke et al. (1999).

The *bank lending*, also termed *narrow credit*, channel (Hall, 2001) is another channel, which works through the increase in lending to firms. This channel focuses on banks as lenders (e.g. Roosa (1951), Bernanke and Blinder (1988), Bernanke and Gertler (1995)).

It claims that monetary policy may increase the amount of loans made by commercial banks. The assumption is that commercial banks play an important role on the credit markets of overcoming the problems information asymmetry and other market frictions and therefore many borrowers prone to these problems are bank-dependent. Banks rely on short-term deposits to fund loans and they are required to hold reserves. The bank lending channel claims that the increase in bank reserves due to the expansionary monetary policy increases banks' ability to extend loans (e.g. Bernanke and Blinder (1988), Kashyap and Stein (1994), Arestis and Sawyer (2004)). Moreover, a reduction in the interest rate will increase the market value of banks' equity, which may also lead to more lending (Kuttner, 2018). The bank lending channel is also relevant for unconventional monetary policy in the context of portfolio balance effects. Large-scale asset purchases may increase the prices of financial assets and the value of banks' balance sheets. This increases banks' capital ratios and allows them to extend more loans.

### **Household liquidity and wealth channels**

Household liquidity and wealth effects are similar to the one of the balance. However, they work not through firms', but households' spending decisions influencing households' desire to spend (Mishkin, 2001, p. 3). The wealth effect was developed by Modigliani (1971) who defined consumption as spending on nondurable goods and services. Modigliani's life cycle model suggest that current consumption is a function of lifetime resources of the consumers. In other words, consumers smooth out their consumption over their lifetime, so what determines current consumption spending is their lifetime wealth, not only their current income. Since financial assets are part of household wealth, the wealth effect states that there is a link between asset prices and consumption. Wealthier individuals consume more, *ceteris paribus*. When prices of

financial assets go up, the wealth of households increases and this leads to more consumption. Empirical research done by Modigliani (1971) and Lettau, Ludvigson, and Steindel (2002) has found that the wealth effect in U.S. is present, but the size of it is not exactly clear. Poterba (2000) has investigated the effects of stock prices on consumption and has found that an increase of \$1 in the prices of financial assets is associated to a 3 cents increase in the consumption.

Quite similarly, the liquidity effect claims that an increase in the liquidity of household wealth induces households to increase their spending on consumer durables and housing. The explanation is that consumer durables and housing are relatively illiquid assets, therefore in the case of financial stress consumers would suffer a big loss if they had to raise money selling the acquired consumer durables or housing. This is because they would not be able to realize their assets in full value due to a distress sale. Because of uncertainty about their future income, households make consumer durable or housing expenditures only when they have sufficient liquidity (Mishkin, 2001, p. 4). Financial assets, as opposed to consumer durables or housing, are much more liquid. Thus the liquidity effect works when an increase in the prices of financial assets increases households' liquidity. Then household spending on consumer durables and housing increase too. Surveys on household liquidity effect in US were done by Mishkin (1976), Mishkin, Gordon, and Hymans (1977).

### **Stock market channel on Investment or Tobin's q**

Tobin (1969) proposed an explanation of how movements in stock prices affect economy. It is often referred to as Tobin's q theory. He argued that the ratio of the stock market price to the replacement cost of capital should be a good indicator of a firm's investment incentives. Tobin's q is defined as the market value of all equity in the economy divided by the replacement cost of capital of the firms.

When the ratio is low (lower than 1), market value of the firms is lower than the cost of its capital. This means that if companies were to issue new shares, the additional capital raised would be relatively low compared to the price of the new investment. Then it makes more sense for companies to purchase other firms and acquire old capital. Thus in these circumstances investment spending (purchase of new investment goods) will be low (Mishkin, 2013, p. 664). Alternatively, when the ratio is high (higher than 1), the market price of firms is high relative to the replacement cost

of capital. Companies are then incentivized to issue new stock, because they can buy a lot of investment goods with relatively small issues of the stock. This increases the investment made by firms.<sup>18</sup>

### **Risk premium channel**

The standard view of the asset pricing states that wealth holders like return and dislike risk which variations in the return. Since movements in the stock market are usually substantial, investors demand a premium if they are to hold stocks instead of fixed income financial assets (Hamburger & Kochin, 1972, p. 233). The risk premium effect claims, that fluctuations in the prices of financial assets which are caused by the monetary policy are likely to be a significant contributor to the risk premium demanded by the holders of equities.

To the extent that fluctuations in the money stock are a major explanation of movements in the economy, the variability of the growth rate of the money supply is a determinant of the variability of the economy. This will, in turn, affect the risk premium attached to stock prices. As the variability of money rises so does the variability of the economy-the risk premium rises and stock prices fall. The most direct way of examining the truth of these propositions is by asking: Can much of the movement in stock market prices be explained by the changing variability of monetary growth? (Hamburger & Kochin, 1972, p. 234)

There can be several levels of variation in return on financial assets that may be caused by changes in money supply. Firstly, change in money supply can influence the variation of nominal price and nominal returns of stocks. Moreover, the real value of promises to pay nominal money varies inversely with the price level. So there is a second variation in return, namely, the variation in price level, which ultimately means variation in real price and real return. Thirdly, changes in money supply not only effect

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<sup>18</sup> Empirical research, however, has shown that Tobin's  $q$  is not always a good indicator of firms' actions. "*Tobin's Q performs poorly in investment regressions. Q is hardly a sufficient statistic. Other variables such as output or cash flow and even lagged Q prove useful in forecasting investment.*" (Gilchrist & Leahy, 2002, p. 82). Blanchard, Rhee, and Summers (1993) claim that when market prices diverge from fundamentals, managers of companies may ignore the signals arising from the financial markets and make investment decisions based on their own information, which is in these cases superior. Bond (2000) claims that alternative measure, constructed from the forecasts of profit, predicts investment better than Tobin's  $q$ .

returns on stocks, but also other sources of income (and other parts of the hypothetical portfolio). Therefore, changes in money supply may increase variation in return on stocks relative to other assets, or relative returns.

### **Summary of the standard view**

What conclusions can we draw from the survey of the traditional channels of monetary policy, which directly or indirectly influence prices of financial assets? In summary central banks directly influence the price of financial assets that were purchased or sold through the interest rate channel. Moreover, short-term interest rate also affects cost of capital for firms as and the discount rate, albeit for short-term financial assets. The impact on the longer-term interest rates and longer-term financial assets is explained through the portfolio balance and signaling channels. Portfolio balance effect works through changing the stock (composition) of financial assets (money vs financial assets) in the market and thus induces market participants to purchase other financial assets, which in turn changes the prices and yields of these financial assets. The signaling channel works through the change in the expected future short-term interest rate, which impacts current longer-term interest rates, and through this - the discount rates and required yields of longer-term financial assets.

Tobin's  $q$ , balance sheet, bank lending, household liquidity and wealth channels are somewhat different, because they already assume that expansionary monetary policy increases the prices of financial assets. These channels discuss the effect of the increase on investment and consumption. So, in this sense these channels are dependent on the ones that draw the causal connection between monetary policy and prices of financial assets. However, these channels may have secondary effects on the prices of financial assets through their impact on consumption and investment. Higher consumption or investment may lead to higher revenues and returns and cash flows for companies who are providers of the investment or consumption goods. It may also lead to the higher general growth of the economy, which may have the same impact on firms in general. The risk premium channel works through changing the volatility of prices in financial markets, which is a dimension of risk of financial assets.

Therefore, in the traditional view, monetary policy influences prices of financial through the central bank's control of the short-term interest rate, money supply, supply of financial assets (or the central bank's demand for financial assets) and signaling of the

future of monetary policy. Using these instruments central banks influence other variables in the economy, which influence supply and preferences of market participants towards financial assets.

In the second part of this work, we will develop an alternative approach to the traditional one which will explain the impact of monetary policy on the value and prices of financial assets. This approach will allow us to have a more complete view of the implications of monetary policy for the value and prices of financial assets.

## **2. Subjective value and the impact of monetary policy on the value and prices of financial assets**

The second part of this dissertation is aimed at developing an alternative framework based on the subjective value theory, which explains the value and prices of financial assets and eventually the impact of monetary policy on the value and prices of financial assets. We will start by describing the theoretical basis of this analysis. We will then discuss price formation of financial assets and proceed to the development of a theoretical framework. Lastly, we will apply this framework to determine how monetary policy influences the value and prices of financial assets.

### **2.1. Theoretical principles of the analysis**

The theoretical approach of the dissertation leans on the theory of subjective value. It was developed by Menger (1871/2007) and his followers Mises (1933/2002), Hayek (1984) Rothbard (1962/2009), more recently Hülsmann (2002). The theory of subjective value evolved with the development of price theories, which are based on the principle of marginal utility. *“In the 1870s, a breakthrough came for these new theories when Carl Menger, Léon Walras, and William Stanley Jevons, working independently from one another, developed theories that traced back market prices to the relative utility of particular units of goods.”* (Hülsmann, 2002, p. xii).

The discovery of the principle that economic goods are evaluated at a margin, rather than in a bundle or entirety, led economists to realize another important principle – subjectivism. This principle means that marginal utility of economic goods depends on an individual person who makes the valuation of the unit under consideration.

An important feature of the subjective value theory is that *“[i] ts purpose is not to causally explain values, but to study the real-world repercussions of given values. It recognizes that human decisions are made under the impact of the subjective values cherished by the decision-maker, and that these values may be “rational” (reflecting objectively the best interest of the decision-maker) from some point of view [...]”* (Hülsmann, 2002, p. xxv). This means that value is always bound with specific circumstances and implies different things in different economic contexts. The essence of subjectivism is that value depends on personal preferences, which cannot be reduced to any objective denominator or measurement (Machaj, 2012, p. 79).

Another analytical tool which will be utilized in the analysis is the total-demand approach introduced by Wicksteed (1944/1910) and later applied to the analysis of price formation in the market by Boulding (1966), Patinkin (1965) and Rothbard (1962/2009). The total demand approach, which is an alternative to the usual supply and demand analysis, is instrumental in showing subjective causes of prices and the way in which different factors in the economy (e.g. monetary policy) can influence them. Therefore, it is not a coincidence that in this work analysis of the prices of financial assets is based on the application of the subjective value theory together with the total demand approach. The total-demand approach is presented and applied more thoroughly to financial assets in chapter 2.3.

## **2.2. Subjective value and exchange of financial assets**

This chapter will briefly discuss the general principles of price formation of financial assets in the market. To see how monetary policy may influence prices of financial assets, we first need to understand how prices emerge in the market.

### **2.2.1. The value of financial assets**

#### **Definition of financial assets**

Before dwelling on the value of financial assets, let us first define what we mean by financial assets and which financial assets will be the object of our analysis. According to international accounting standards, “*a financial instrument is any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity*” (International Accounting Standards Board, 2011, p. 2).

Financial assets (or titles, claims) are not commodities but rights, expectations, or legally enforceable contractual claims. All financial assets possess this common characteristic. Financial title is a right to certain future benefits (from the side of the owner of the title). It is also an obligation to grant certain future benefits to the owner (from the side of the issuer of the title).

Financial titles are claims on future payments of money to be made by natural or juridical persons. The different financial claims or “products” are different contractual specifications of the conditions under which a promisee can obtain a future payment from a promisor. (Hülsmann, 2014b, p. 4)

The category of financial titles or claims that are written, exchanged on financial markets and endowed with guarantees are called “securities”. They are traded in organized exchanges.

Financial asset, or security, can be described as an expectation, since the owner of the security expects to receive certain benefits in the future, the issuer of the security expects to grant certain benefits (Boulding, 1966, p. 154). Future benefits usually consist of sums of money, but they do not have to consist of *definite* sums of money (in the case of stocks – the right to share residual profits or to participate in the control of the company).

According to International Accounting Standards Board (2011, p. 2) financial asset is any asset that is:

- Cash (or bank deposit);
- An equity instrument of another entity (shares of a company);
- A contractual right:
  - to receive cash or another financial asset from another entity (bonds, trade receivables, loan receivables);
  - to exchange financial assets or financial liabilities with another entity under conditions that are potentially favorable to the entity (derivative assets);
- A contract that will or may be settled in an entity’s own equity instruments (convertible corporate bonds).<sup>19</sup>

Usually financial assets are categorized into debt (e.g. bonds), equity (e.g. common stocks) and derivatives (e.g. futures, options, swaps).

This dissertation will focus on bonds and stocks (debt and equity). Terms “financial assets”, “financial instruments”, “financial titles” or “securities” will be used to describe bonds and stocks. A bond in a broad sense means a security which consists of the right for an owner to receive and the obligation for the issuer to pay definite sums of money on definite future dates. A share of stock (or a stock) is a security which represents a right for the owner to receive or the obligation for the issuer to pay a

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<sup>19</sup> Examples in the parentheses are provided by the author.



series of expected future payments of divided profits of a business, whose magnitude depends on the future profitability of the business.

### **Sources of value of financial assets**

In order to explain prices of financial assets that originate in the market, we first need to dwell on the meaning and sources value. What motivates market participants to value financial assets? Conceptually value comes before prices because prices in the market originate from exchange, which is driven by value (or more precisely – value differentials). Ultimately, the owners of financial assets are engaged in saving and investing:

[...] in a free-market economy, the boundaries of financial markets are established through the competitive market process. Financial claims then exist only to the extent that they provide greater services to savers, and to the users of savings, than all other forms of using one's income. Financial markets therefore tend to encourage additional savings and to improve the use of available savings. (Hülsmann, 2014b, p. 7)

The value of a financial asset as an investment good comes from two sources.<sup>20</sup> The first source is a contractual claim stemming from the financial asset. Financial asset is a claim for future goods/benefits. In case of bonds, the money (present good) is exchanged for a claim to definite, fixed payments (coupons/interest and/or principle payment) in the future (future good). In this case, the source of value is anticipated future cash flows coming to the owner of the financial asset. In the case of stocks, money (present good) is exchanged for a claim to a series of expected payments (profit of the company in the form of dividends) in the future (future good). A stock is also partly a present good, since owning stocks of a company means partial or full ownership of the company and allows participation in the company's decision making processes.<sup>21</sup> The second source of the value of financial assets is proceeds from the

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<sup>20</sup>Rothbard (1962/2009, p. 223):

<...> any good may have either *direct use-value* to its owner or *exchange-value* or a mixture of both. At any time, each owner of a consumers' good must judge on his value scale whether its exchange-value or its highest direct use-value is the greater.

<sup>21</sup> There are two types of claims: on present goods and on future goods: "*The several types of claims, therefore, are: on present goods, by such means as warehouse receipts or shares of joint ownership in a good; and on future goods, arising from credit transactions. These are evidences of ownership, or, as in the latter case, objects that will become evidence of ownership*"

anticipated sale of the financial asset at some time in the future (before the maturity of the bond). In the case of future sale, money (present good) is exchanged for the anticipated monetary proceeds from the future sale (future good).

Thus, the value of a financial asset depends on the future cash flow from a claim (claim value) or a future sale (exchange value) or a combination of them. It is possible to hold a financial asset and receive some cash flows coming from the claim as an owner (coupons or dividends) and then sell the financial asset and receive the proceeds coming from the exchange value. While making a decision to buy or sell a particular financial asset, a subject grounds this decision on whichever value of the financial asset (claim value, exchange value or the combination of them) is the highest for him or her.

Anticipated cash flows stemming from the claim value or exchange value are in the future. Therefore, to get their present value they need to be discounted by the time discount rate.<sup>22</sup> One of the most basic principles in finance is that the value of an investment depends on the present value of future cash flows which this investment generates during its lifetime. The value of a stock or a bond is derived by its future cash flows accruing to the investor:

The value of securities is calculated as the capital value of the expected return, and is thus the result of so-called capitalization, which combines the two factors—the return and the capitalization rate. If the expected return and the capitalization rate are given, then, allowing for a risk and uncertainty premium, the price of the security is also determined. If the yield prospects or the capitalization rate change, then the security prices will also change. (Machlup, 1940, p. 274)

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*at a later date.*" (Rothbard, 1962/2009, p. 168). Strictly speaking, a bond is a credit transaction, whereas a stock is a claim on a present good, since it represents joint ownership in currently existing assets. However, from the point of view of the owner of a particular stock in the circumstances of a normally operating business (as opposed to bankruptcy) the value of the stock comes from the future financial cash flows coming from the stock. In this respect it is quite similar to a credit transaction or claim on the future goods.

<sup>22</sup> Rothbard (1962/2009, p. 159), emphasis in the original:

The direct users of a good must *also anticipate their desires for a good* when they purchase it. At the time of purchase, their actual use of a good will be at some date in the future, even if in the very near future. The position of the good on their value scales is an estimate of its expected future value in these periods, discounted by time preferences.

## Value scales and marginal utility

Market supply and demand for financial assets are the sum of the amounts of financial assets respectively offered and demanded at different prices by all the individuals in the market. And these are determined by the value of the units of financial assets (to be bought and sold) on the individuals' value scales (Rothbard, 1962/2009, p. 126). The ultimate reason for an exchange of a financial asset for money in the market is the relative positions of the two goods (financial asset and money) in the value scale of an individual.<sup>23</sup> The relative position or rankings of goods in the value scale are influenced by the law of marginal utility.

An individual in the market will demand a financial asset if the marginal utility of a unit of the financial asset purchased is higher than the marginal utility of the money that has to be given up in the purchase. On the other hand, another individual in the market will be a seller if his valuations are in reverse: the marginal utility of the money received in a sale is higher than the marginal utility of the financial assets given up.<sup>24</sup>

The law of marginal utility states that "*<...> as a man's stock of goods declines, the value placed on each unit remaining increases; conversely, as a man's stock of goods increases, the marginal utility of each unit declines*" (Rothbard, 1962/2009, p. 122). The opposite is true, "*<...> as the seller disposes of his stock [of a good sold for money], its marginal utility to him tends to rise, while the marginal utility of the money acquired tends to fall*" (Rothbard, 1962/2009, p. 244).

Therefore, according to the law of marginal utility, buying an additional unit of a financial asset decreases its marginal utility and increases the marginal utility of money. With an increase in the quantity purchased both of these factors reduce the maximum buying price of the financial asset for an individual.<sup>25</sup> Therefore, an individual

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<sup>23</sup> "An individual will decide whether or not to make an exchange on the basis of the relative positions of the two goods on his value scale." (Rothbard, 1962/2009, p. 107). Also, "The money price is determined by actions decided according to individual value scales." (Rothbard, 1962/2009, p. 238)

<sup>24</sup> Rothbard (1962/2009, p. 131):

We remember that, at any given price, the amount of a good that an individual will buy or sell is determined by the position of the sale good and the purchase good on his value scale. He will demand a good if the marginal utility of adding a unit of the purchase good is greater than the marginal utility of the sale good that he must give up. On the other hand, another individual will be a seller if his valuations of the units are in a reverse order.

<sup>25</sup>Rothbard (1962/2009, p. 124):

will buy financial assets until the marginal utility of adding a unit of the financial asset ceases to be greater than the marginal utility of money which he has to pay for the asset.

### **Properties of financial assets**

When two goods are being exchanged in the market, there are many elements of the exchange that are involved and describe it. These elements are dimensions of an exchange and they pertain to a) circumstances in which the exchange happens (time, place, ratio of goods exchanged (price) etc.) and b) properties of goods exchanged (quantity, any other physical or non-physical properties of the goods that are relevant for the parties involved). These different dimensions of the exchanged cannot be ignored if we want to understand the value and the formation of prices in the market:

The important fact for catallactics is that a man always chooses a bundle of *money income plus other psychic factors* and that he will maximize his money income only if psychic factors are neutral with respect to his choices. If they are not, then these factors must always be kept in view by the economist. (Rothbard, 1962/2009, p. 216)

Every purchase and sale of a financial asset has unique characteristics of the exchange that influence what value people attach to the exchange. The elements or dimensions of the exchange that matter to market participants are subjective, they depend on every individual participating in the exchange.

We know that "*Financial assets differ through specifications and conditions under which future payments can be obtained*" (Hülsmann, 2014b, p. 2). These specifications and conditions are properties of financial assets. Since valuation is subjective, it is

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If he considers buying a second horse, the marginal utility of the additional horse will be less than the utility of the first one, and the marginal utility of the same amount of fish that he would have to give up will increase. If the marginal utility of the purchases declines as more are made, and the marginal utility of the good given up increases, these factors result in lower maximum buying prices for each successive horse bought.

Rothbard (1962/2009, p. 239):

This result is always true, and stems from the law of utility; as he adds pounds of butter to his ownership, the marginal utility of each pound declines. On the other hand, as he dispenses with grains of gold, the marginal utility to him of each remaining grain increases. Both these forces impel the maximum buying price of an additional unit to decline with an increase in the quantity purchased.

impossible to compile an exhaustive list of properties of financial assets that are universally relevant for their value. However, there are particular properties of financial assets that we can identify as common and related to the sources of value of financial assets (claim value and exchange value). These are:

- *Type of financial asset* (stock, bond, derivative).
- *Size of the expected cash flow (return)* from the claim. In case of bonds, it is coupon and/or just principle payment. In case of stocks, it is expected payoff of dividends.
- *Counterparty (credit) risk* associated with expected cash flow. In case of bonds, it is default risk. In case of stocks, it is uncertainty related to the expected payoff of dividends.
- *Market risk associated with price fluctuation*. Price fluctuations represent changes in the preferences of market participants towards a financial asset (this also impacts the size of the proceeds from the future sale).
- *Maturity of the asset*. In case of bonds, maturity is fixed and known in advance. In case of stocks, there is no predetermined maturity. Maturity determines the timing of cash flows and hence the extent of discounting of future value to the present. Also, maturity may be relevant if a subject who does valuation of a financial asset has preference to receive money at a specific time in the future.
- *Liquidity of the financial asset*. That is, relative ease and speed with which an asset can be sold. Current liquidity of the financial asset is often a sign of future liquidity (and hence the size of the proceeds from the future sale).

The list of characteristics or properties of financial assets that we have derived by analyzing the claim and exchange values of financial assets is not exhaustive. There may be other properties that an owner may subjectively pay attention to when valuing a particular financial asset (e.g. an owner of a financial asset may value it also because of the personal attachment to the firm). However, the properties discussed above usually represent the main factors of value.

In addition to the properties of financial assets, other circumstances of an exchange may also be relevant for the value originating in the exchange. Relevant circumstances may be market conditions (interest rate, growth of the economy), the amount of money and other wealth in the possession of the parties involved, their individual aims,

expectations and perception of the present and future, and so on. Discount rate is crucial for the valuation of the financial asset to bring its future value to present (discount future cash flows and/or proceeds from future sale to the present). However, a discount rate is not a property of financial asset itself. A discount rate depends on the subject who does valuation (his time preference, returns on alternative investments) and/or market (interest rate in the market).

Both properties of financial assets and market circumstances vary through time. So the nature of exchange and the mechanism of price formation can be grasped only by acknowledging various dimensions of an exchange that matter to the individuals engaged in it. They can never be exhaustively identified or described.

### **2.2.2. Value of money**

After analyzing the sources of value of financial assets and connecting them to the properties of financial assets, we will briefly discuss the marginal value of the other good in the exchange – money. The object of this dissertation is value and prices of financial assets. However, we cannot avoid discussing value of money, because the price of financial assets is always a ratio of two goods: a financial asset and money.

To understand the value of money, we need to acknowledge that the ownership of money, as a universal medium of exchange, tremendously broadens the range of choice for an individual, since money can be used to purchase any other good. In this respect, alternative uses of money are far wider than for any other good. Being used as a medium of exchange to purchase other goods is the primary source of the value of money.<sup>26</sup>

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<sup>26</sup> Rothbard (1962/2009, p. 279):

Horses or houses can be allocated to several uses, raw materials to many areas of production, but money can be allocated in expenditure on every single type of exchangeable good in the society, whether a tangible commodity or an intangible service, a consumers' or a capital or a natural good, or claims to these goods. Money serves greatly to expand the range of choice; and it itself becomes a key *means* to be allocated to the most highly valued of alternative ends.

Money can only be used for three purposes:<sup>2728</sup>

- a) Consumption, that is expenditure on consumer's goods;
- b) Investment, that is directly or indirectly buying factors of production;
- c) Adding money to cash balance.

The value coming from adding and keeping money in cash balances is due to a fundamental uncertainty in the market. Individuals are uncertain about a) their future preferences and needs and b) the prices they will need to pay in the future to acquire goods and services to fulfill their needs. Holding cash balances is a way to cope with this uncertainty:

Uncertainty, indeed, is a fundamental feature of all human action, and uncertainty about changing prices and changing value scales are aspects of this basic uncertainty. If an individual, for example, anticipates a rise in the purchasing power of the monetary unit in the near future, he will tend to postpone his purchases toward that day and add now to his cash balance. On the other hand, if he anticipates a fall in purchasing power, he will tend to buy more at present and draw down his cash balance. (Rothbard, 1962/2009, p. 265)

Hence, in its capacity as a medium of exchange, money is only useful inasmuch as it can be used to acquire other goods and services (Murphy, 2011, p. 59). Subjective value of money comes from the fact that money has an objective (expressed in terms of prices) purchasing power. People value money because they value consumer or investment goods which they can purchase with money in the future.

Thus, even in the case of adding money to cash balances (as opposed to spending on consumption or investment goods), the value of money possessed depends on its purchasing power. All existing goods always compete in value at a particular exchange

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<sup>27</sup> Since we are talking about price formation in a fiat money system, we exclude the nonmonetary, direct use of the money commodity in consumption (as opposed to being used as a medium of exchange) in case of a commodity money system.

<sup>28</sup> Rothbard (1962/2009, p. 219):

Every man must allocate his money resources in three and only three ways: in consumption spending, in investment expenditure, and in addition to his cash balance.

ratio (price) with money which is held in reserve to fulfil the function of dealing with uncertainty (until it is spent).

The seller of any good or service for money, therefore, ranks the marginal utility of the money that he will obtain against the marginal utility of holding on to the good or service. Whoever spends money to buy any good or service ranks the marginal utility which keeping the money has for him against the marginal utility of acquiring the good. These value scales of the various buyers and sellers determine the individual supply-demand schedules and hence all money prices; yet, in order to rank money and goods on his value scale, money must *already* have a marginal utility for each person, and this marginal utility *must* be based on the fact of pre-existing money prices of the various goods. (Rothbard, 1962/2009, p. 269)

It is also true, that money also obeys the law of marginal utility, just as any other good – as the stock of money in the hands of individual increases, its marginal utility declines. As the stock of money declines, its marginal utility to the individual increases.

To sum up, people demand money, because money is a good, it has a specific ranking in the value scales of individuals. The value of money stems from its purchasing power, because it determines the amount of other goods that can be purchased in exchange for money (in the very near or distant future). Thus the decisions of market participants to purchase or to sell goods include three kinds of subjective valuations:

- A potential *buyer* of a good ranks the *value of money* (that can be used to purchase other goods or held in cash balance) against the *value of the good* that he considers purchasing.
- A potential *seller* of a good ranks the *value of the good* in his possession against the *value of money* (that again can be used to purchase other goods or held in cash balance it) that he can receive in return for the good.<sup>29</sup>

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<sup>29</sup> Rothbard (1962/2009, pp. 252-253):

What of the *seller* of the consumers' good or producers' good—why is he demanding money in exchange? The seller demands money because of the marginal utility of money to him, and for this reason he ranks the money acquired above possession of the goods that he sells.



- An individual holding money ranks its *value when held in a cash balance* (it will be used for future purchases) against its *value in a transaction* (value of goods that he can purchase using money).

### 2.2.3. Exchange and market prices of financial assets

Having discussed the value of financial assets and the value of money, we will move on to the exchange of financial assets and their price formation in the market. Price in the market has to do with practical transactions in the market; it is a more tangible category than value (Fetter, 1912, p. 783).

Market can be defined as a place (physical or virtual) where goods are exchanged. In the securities market the goods that are exchanged are securities and money. The motivation for an exchange, i.e. to purchase or to sell a financial asset (which is the exchange of money for financial asset), is an increase in the subjective wellbeing of an individual. In other words, the good received (a financial asset in purchase, and money in sale) has a higher subjective value for an individual than the good parted with (money in purchase, and a financial asset in sale) (Böhm-Bawerk, 1891/1930, p. 195).<sup>30</sup>

The actions of both buyers and sellers on the market may be related to the concepts of psychic revenue, profit, and cost. We remember that the aim of every actor is the highest position of psychic revenue and thus the making of a psychic profit compared to his next best alternative—his cost. (Rothbard, 1962/2009, p. 135)

What are the sources of the psychic profit in the case of purchase or sell of a financial asset?<sup>31</sup> It stems from marginal utilities of a financial asset and of money discussed above.

The (psychic) profit for the *buyer* is the difference between his psychic revenue and psychic cost.

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<sup>30</sup> Böhm-Bawerk (1891/1930, p. 195):

The meaning of the expression obviously is—to exchange in such a way that the exchanger gains more in wellbeing from the goods he gets than he loses in the goods he gives; or, since the importance that goods have for life and wellbeing is expressed in their subjective value, to exchange in such a way that the goods received possess a greater subjective value than the goods parted with.

<sup>31</sup> Adapted for financial assets using Rothbard (1962/2009, pp. 135-136, 278-279).

*Revenue* for the *buyer* is whichever is higher between:

- Marginal utility coming from an additional financial asset's claim to future cash flows (claim value);
- Marginal utility of holding an additional financial asset and anticipating to resell it for a higher price in the future (exchange value);
- A combination of claim value and exchange value.

*Cost* for the *buyer* is:

- Marginal utility of the units of money forgone in the exchange.

The (psychic) profit for the *seller* is also the difference between his psychic revenue and psychic cost.

*Revenue* for the *seller* is:

- Marginal utility of additional units of money received in the exchange;

*Cost* for the *seller* is whichever is higher between:

- Marginal utility of the forgone financial asset's claim to future cash flows (claim value);
- Marginal utility of holding the forgone financial asset and anticipating to resell it for higher price in the future (exchange value<sup>32</sup>).

Thus, the exchange between the seller and a buyer of a financial asset in the market happens because they both value what they gain in a purchase more than what they have to forgo. Since the valuation of what they are receiving and forgoing is subjective, the price of the financial assets is determined by subjective factors in the pursuit of the psychic profit.

The *price* in the market is the quantities of goods actually exchanged (Menger, 1871/2007, p. 191). It is the amount of one good divided by the amount of the other good in the exchange. In monetary economy, price is the quantity of money divided by the quantity of unit of the good exchanged, yielding a numerical ratio. Or simply

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<sup>32</sup> In this case part of the exchange value will be claim value, if by holding the financial asset until selling them the owners receives some of the cash flows (e.g. coupon or dividends).

speaking, the amount of money paid per unit for a good (Black, Hashimzade, & Myles, 2012).

Financial assets are goods; therefore, general laws of price formation in the market are applicable for them as for all the other goods. Thus, a price of a financial asset or security is a ratio of exchange in a transaction. Quantity of the security is usually measured in some conventional nominal units (e.g. one 1000 euro bond, or 300 shares of stock).

*Equilibrium price* in the market emerges when the quantity of the security offered for sale is equal to the quantity demanded for purchase. Equilibrium price marks the price at which the total demand for the security equals the supply and at which there is no excess demand or excess supply (Boulding, 1966, p. 156). At any point of time, the equilibrium price of a financial asset is determined by the interactions of the supply and demand of money and the financial asset.<sup>33</sup> Supply and demand schedules are the sum of the units of goods supplied and demanded at each price in the market.

The discovery of the equilibrium price in the market for financial assets happens through the bidding process<sup>34</sup>. Exchanges in the market take place until the stock of financial assets are in the hands of the most capable possessors (valuing financial assets the highest on their value scales against money) and equilibrium price is established. Further exchanges in the market may happen only if valuations of the existing stock of financial assets change, that is, the position of financial assets vs. money in the value scales of market participants change in the way that the most capable possessors change.

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<sup>33</sup> Rothbard (1962/2009, p. 270):

On day X <...> the money price of each good is determined by the interactions of the supply and demand schedules of money and the good by the buyers and sellers on that day.

Also, Rothbard (1962/2009, pp. 249-250):

Every money price of a good on the market, therefore, is determined by the supply and demand schedules of the individual buyers and sellers, and their action tends to establish a uniform equilibrium price on the market at the point of intersection, which changes only when the schedules do.

<sup>34</sup> If price in the market is lower than the equilibrium price, the quantity demanded is higher than the quantity supplied, and buyers will bid the price up. If price in the market is higher than the equilibrium price, the quantity supplied is higher than the quantity demanded, and sellers will bid the price down.

A change in the equilibrium price may only be a result of the shift of either supply or demand in the market of financial assets. An increase in the demand schedule for financial assets signifies a rise in the importance of financial assets on the value scales of buyers due to a) rise in the claim value, b) rise in the exchange value of the financial asset and c) decline in the exchange value of money.<sup>35</sup>

An increase in the supply schedule also signifies a change of the relative positions of financial assets vs. money in the value scales of the sellers. This change has two sources. First, it may happen because of the change in the preferences of current owners towards financial assets (when the amount of total stock of financial asset is not changing). An increase in the supply in this case is due to a) a decline in the claim value of a financial asset, b) a decline in the exchange value of a financial asset, c) increase in the exchange value of money.<sup>36</sup> Second, it may arise from new issuance and increase in the total stock of financial asset. An inflow of new financial assets in the market increases the supply schedule of financial assets.<sup>37 38</sup>

Ultimately, the price of a financial asset in the market is the result of the exchange of two goods, which is motivated by the marginal utilities of these two goods for the individuals engaged in the exchange. Every choice of market participants to buy, sell or hold financial assets is the manifestation, expression of their subjective preferences.

## **2.3. Total demand and prices of financial assets**

### **2.3.1. The total demand approach as an alternative to supply-demand analysis**

We have discussed the conventional way of thinking about the formation of prices in the market - through the concepts of supply and demand. However, for the purposes of our analysis we will look at an alternative way to explain the price formation in the market and we will apply this approach for financial assets. An alternative framework

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<sup>35</sup> See Rothbard (1962/2009, p. 146)

<sup>36</sup> See Rothbard (1962/2009, p. 147)

<sup>37</sup> Adapted to the analysis of financial assets from Rothbard (1962/2009, pp. 255-256)

<sup>38</sup> The reason of why the supply curve has two sources of change is that the supply curve is the result of two factors: total stock of financial asset and reservation demand for financial asset (more specifically, supply is stock *minus* the reservation demand). Reservation demand will be discussed below. If the stock of the financial asset is constant, then the only source of the shift in the supply curve is the shift in preferences of current owners. If the stock of the financial asset is not constant, then the sources are – changing preferences of current owners and change in the stock of the financial asset.

will subsequently allow us to see more clearly how monetary policy influences prices of financial assets.

Wicksteed (1944a) points out that the distinction between supply and demand as two independent and ultimate causes of the pricing process is misleading. Ultimately, prices derive from the demand alone. Supply schedules are not independent from the ultimate causes of price formation. Rather, supply schedules are determined by the “reservation demand” that the current owners have for the units that they already own.<sup>39</sup>

Let us dwell on this idea in a little bit more detail. First of all, consider that it is unwarranted to imagine buyers and sellers as separate groups. For example, one and the same person may buy eggs when the price is low, sell them when the price is high, and simply own or hold them at some intermediate price range. Whether any given person is a buyer, or an owner who wishes to sell, or an owner who does not wish to sell, depends on the market price. In Wicksteed's words:

It may very well be that some or all of the dealers would rather not sell at all than sell below some particular price; that is to say, they have put a reserve price on their goods. There may be many reasons for this, the most obvious being that the goods have a direct and immediate use for the sellers themselves. (Wicksteed, 1944a, p. 229)

The crucial idea here is that the current owners may exercise a reservation demand. If the market price is too low, they may not wish to sell, but rather withhold one or more of the units that they already own. So the total stock of the good is either reserved (reservation demand) or supplied into the market (supply):

The stock of any good is the total quantity of that good in existence. Some will be supplied in exchange, and the remainder will be *reserved*. At any hypothetical price, it will be recalled, adding the demand to buy and the *reserved* demand of the supplier gives the *total demand to hold* on the part of both groups. The total demand to hold includes the demand in exchange by present non-owners and

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<sup>39</sup> The present paragraph and the three subsequent ones have previously been published in Žukauskas and Hülsmann (2019, p. 127).

the reservation demand to hold by the present owners. (Rothbard, 1962/2009, pp. 247-248)

A seller may have different reasons to withhold some of his stock from the market. For example, the good might have a personal use value for him and he might therefore be willing to buy additional units rather than sell what he already owns, if the market price is low enough. His reservation demand may also be motivated by the anticipation that the price of the good will increase in the future, so that it is more useful to withhold it from the market now and sell it later. In short, the reservation demand can originate either as a result of personal use value, or as an anticipated satisfaction of future buyers' needs:

When a seller keeps his stock instead of selling it, what is the source of his *reservation demand* for the good? We have seen that the quantity of a good reserved at any point is the quantity of stock that the seller refuses to sell at the given price. The sources of a reservation demand by the seller are two: (a) anticipation of later sale at a higher price; this is the speculative factor analyzed above; and (b) direct use of the good by the seller. (Rothbard, 1962/2009, p. 253)<sup>40</sup>

In developed economies, where goods are produced under specialization and division of labor, the direct use-value of the product for producers is low or almost nonexistent. The more specialized production is, the less use-value the product has for the producer:

It is clear that, if the owner of the consumers' good is also the original producer, the direct use-value to him will be almost nil. The specialized producer who produces and owns houses or television sets or washing machines finds that the direct use value to him of this stock is practically nonexistent. For him, the exchange-value is the only important factor, and his interest lies *solely* in maximizing his money income from the stock and therefore in attaining the

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<sup>40</sup> Rothbard (1962/2009, p. 137):

This withholding is caused by one of the factors mentioned above as possible costs of the exchange: either the direct use of the good (say the horse) has greater utility than the receipt of the fish in direct use; or else the horse could be exchanged for some other good; or, finally, the seller expects the final price to be higher, so that he can profitably delay the sale.

highest money prices in the sale of each good. (Rothbard, 1962/2009, pp. 224-225)

Therefore, in the reservation demand schedule (also supply schedule), the direct-use element disappears and the only reason for the producer to reserve the good is speculative – the anticipation of a higher price for the good in the future. However, the length of time that producers can reserve their goods is, dependent on the durability of the good. If the good is perishable it can not be reserved for long. Therefore, the reservation demand for highly perishable goods in the specialized production is almost nonexistent. And “[...] if there is no reservation demand, then the supply curve will be vertical, and equal to the stock” (Rothbard, 1962/2009, p. 249). However, if a good is durable, producers and owners of goods have the option of postponing the sale, if they believe that the price will be higher in the future<sup>41</sup> and they will be able to sell it later for a profit.

The upshot of Wicksteed’s analysis is that there is no such thing as a supply schedule as an independent ultimate cause of price determination. The supply schedule is just a logical implication of the current owners’ reservation demand. At each price, the current owner of a good is either willing to hold it, or to sell it. There is no other possibility. Therefore, at each price, all units that are not demanded by the owner himself are by definition supplied to the market. “*The so-called supply curve, therefore, is simply a part of the total demand curve [ . . . ]*.” (Wicksteed, 1944b, p. 785).<sup>42</sup>

According to Wicksteed, the market prices of any good are ultimately determined by two causes: the total demand for that good (being the sum of the quantities that are demanded by current and would-be owners at any price) resulting from the subjective value scales of these current and would-be owners on the one hand, and the existing stock of that good on the other hand (Wicksteed, 1944b, p. 498). Supply schedules and demand schedules originate from the same principle – from the subjective valuations of a good against money.<sup>43</sup> The distinction between buyers and sellers is

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<sup>41</sup> “<...> provided that the higher price will cover the disadvantage to him of waiting (his time preference) and the expenses of storing *P* until the sale is made.” (Rothbard, 1962/2009, p. 227)

<sup>42</sup> The present paragraph and the subsequent one have previously been published in Žukauskas and Hülsmann (2019, p. 127).

<sup>43</sup> Rothbard (1962/2009, p. 141):

The total demand-stock analysis is a useful twin companion to the supply-demand analysis. Each has advantages for use in different spheres. One relative defect of the

not relevant when we talk about the ultimate forces that determine the price (Wicksteed, 1944b, p. 516).

### **Total demand and prices of financial assets**

Let us now apply the total demand and stock approach to the pricing of financial assets. Firstly, we have to acknowledge that both the total-demand approach and the conventional supply-demand approach lead to exactly the same result as far as unit prices are concerned.<sup>44</sup>: “<...> *equilibrium price not only equates the supply and demand on the market; it also equates the stock of a good to be held with the desire of people to hold it, buyers and sellers included*” (Rothbard, 1962/2009, p. 139). The total demand curve always intersects the total stock curve at exactly the same equilibrium price at which the exchange demand and the supply schedules intersect. This can be best illustrated with Fig. 6 below.<sup>45</sup>

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total demand-stock analysis is that it does not reveal the differences between the buyers and the sellers. In considering total demand, it abstracts from actual exchanges, and therefore does not, in contrast to the supply-demand curves, determine the quantity of exchanges. It reveals only the equilibrium price, without demonstrating the equilibrium quantity exchanged. However, it focuses more sharply on the fundamental truth that price is determined solely by utility. The supply curve is reducible to a reservation demand curve and to a quantity of physical stock. The demand-stock analysis therefore shows that the supply curve is not based on some sort of “cost” that is independent of utility on individual value scales. We see that the fundamental determinants of price are the value scales of all individuals (buyers and sellers) in the market and that the physical stock simply assumes its place on these scales.

<sup>44</sup> For the mathematical demonstration see Rothbard (1962/2009, p. 248)

<sup>45</sup> The present paragraph and the five subsequent ones have previously been published in Žukauskas and Hülsmann (2019, p. 128).



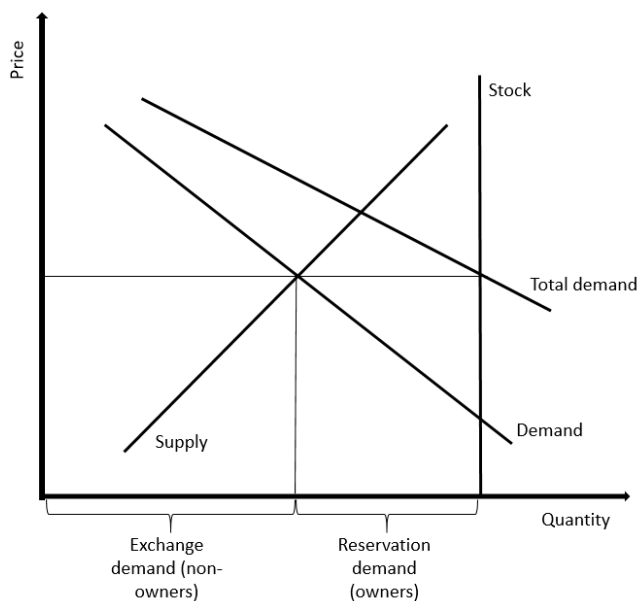


Fig. 6. Supply and demand analysis vs. total demand approach in price formation. Source: Based on Rothbard (1962/2009, p. 249), Figure 35.

The total-demand approach is least useful whenever reservation demand is negligible as compared to the exchange demand, as, for example, in the case of perishable consumers' goods such as eggs or raw milk. The demand of egg producers for their own egg output is negligible in comparison to the demand of all other market participants. Their reservation demand therefore has no noticeable impact on the egg price. Things are very different whenever reservation demand is large relative to exchange demand. Typically, this holds true for all durable goods, most notably for real estate, for money, and for financial assets. So in the pricing of financial assets we can rely on Rothbard (1962/2009), who had applied the Wicksteedian approach to the study of money prices.

The supply of a financial asset (e.g. a share of company) may come from two sources: (1) the first sale of new shares on the primary market and (2) subsequent sales of already issued (and owned) shares on the secondary market. The exchange demand for these shares may be motivated by the usual, well-known reasons: anticipation of a higher price in the future, anticipated cash flows (dividends), and ownership or controlling privileges. The same motivations also pertain to the current owners of these

shares, who exercise a reservation demand for them. These current owners may want to sell some of their financial assets and to withhold the remainder.

Current owners exercise a reservation demand whenever the financial asset has a higher subjective value for them than the money potentially received for it at the particular price. For each unit of a financial asset they are willing to withhold from the market, the marginal utility of the financial asset is higher than the marginal utility of money. The reservation demand by owners is downward sloping because of the law of diminishing marginal utility (the higher the quantity they already own, the lower the willingness to hold it).

The total demand to hold any given financial asset is the sum of the exchange demand coming from would-be owners, and of the reservation demand coming from the current owners. An important characteristic of the total-demand schedule is that it is more elastic than the exchange demand schedule (in Fig. 6, the total-demand curve is flatter than the demand-via-exchange curve). This is because lower prices not only increase the exchange demand by non-owners, they also increase reservation demand of the current owners.

Therefore, the equilibrium price of any financial asset results from the total stock of this asset and from the total demand to own it. The total stock of a financial asset is the total amount of particular financial asset in existence. It includes most notably all units that have already been issued, as well as all new units that have not yet been sold, but which are currently offered on the primary market. Therefore the stock of a financial asset in existence equals the sum of stock in the hands of the *issuers* of the asset (in primary market) and *old possessors* of the financial asset (secondary market). The stock is also equal to the sum of reservation demand (the amount they are willing to retain) and supply (the rest of the financial asset that they are willing to supply into the market at a given price) of issuers and old possessors. The supply schedule of issuers and old possessors will tend to either increase or be vertical (issuers and old possessors will tend to withhold less (if they want to withhold any) and supply more (if not all) of the financial asset to the market), as the price of the financial asset increases). This also means that the reservation demand of issuers and old possessors will decrease or be zero as the price increases. So reservation demand and supply schedules of issuers and old possessors will behave similarly. The

aggregate market-supply curve is the sum of the issuers' and old possessors' supply curves. The total demand schedule will equal the demand by buyers plus the reservation demand (if any) of the issuers and of the old possessors.<sup>46</sup>

Issuers will tend to have a lower reserved (retained) quantity of the financial asset at any price and the reservation demand schedule for the financial asset will be less elastic (if not vertical) than that of the old possessors. This is due to the fact that the motivation of the issuers of the financial assets is to issue and sell them for money, thereby raising capital for the firm.<sup>47</sup> This results in their lower willingness to reserve (retain) financial assets from the market at any price. Old possessors, on the other hand, are mainly motivated by the claim value (future financial flows) or future sale value of the financial asset. If it is true that the claim value and future sale value is more pronounced in the motivations of old possessors, their reservation demand schedule will be higher (shifted rightwards, given that the share of old stocks and newly issued stocks is equal) and more elastic (reservation quantity will be more responsive to the price) than the one of issuers. This also means that the supply curve of issuers will be less elastic than the supply curve of old possessors.

Another consideration related to the stock of financial assets is the proportion of the old stock (owned by old possessors) vs. new stock (owned by issuers). Since financial assets are durable goods (durability of bonds depends on their term), whereas durability of stocks is technically unlimited and related only to the bankruptcy or voluntary liquidation of the firm, in most cases the old stock of financial assets in the hands of old possessors will be a lot higher than the new stock issued in the primary market. It is a general tendency that the old stock is more important the greater the durability of the good (Rothbard, 1962/2009, p. 255). Thus the old stock of the financial assets (bonds are stocks) will tend to be greater than the new issues.

This suggests several insights. Firstly, preferences of old owners (represented by reservation demand and supply) will have a higher impact on the prices of financial assets (as opposed to preferences of new issuers). Secondly, since old owners have a higher and more elastic reservation demand, financial assets in general will tend to

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<sup>46</sup> Adapted for financial assets using Rothbard (1962/2009, p. 254).

<sup>47</sup> In other words, in the value scales of issuers money is relatively more important than financial assets than in the value scales of old owners.

have a relatively high reservation demand, as opposed to other, more perishable goods (where production in proportion to the old stock is relatively bigger). Thirdly, since one source of the marginal value of a financial asset is future sale (the other being the claim for future financial flows), durability of financial assets means that financial assets will tend to have a pronounced speculative element in their valuation (as opposed to value being based on the claim value only).

The total-demand and stock approach to the pricing of financial assets reveals the subjective mechanism behind the prices of financial assets. The equilibrium price of a financial asset is determined by the subjective valuations of that asset relative to money. In other words, this equilibrium price depends on the utility of a stock relative to the utility of money, on the value scales of the acting individuals (Rothbard, 1962/2009, p. 141). Changes in both supply and demand curves in the conventional exchange demand analysis are due to changes in the total demand of a financial asset by either sellers or buyers (owners and non-owners), which in turn are due to shifts in the utility of the financial asset relative to money (and consequently other goods) (Rothbard, 1962/2009, p. 147).<sup>48</sup>

### **2.3.2. Price determinants of financial assets**

In this section we will further apply the total demand approach and derive price determinants of financial assets. These price determinants will be the key to our analysis on how monetary policy influences the prices of financial assets. An exhaustive list of the determinants means that any impact of monetary policy on prices of financial assets will have to work through one or several of the price determinants of financial assets. They will be derived by first looking at the application of the total demand approach for prices in general. Then we will apply the analogous reasoning to financial assets.

Rothbard (1962/2009) uses the following logic while distilling the factors that determine prices in the market:

A particular price, as we have seen, is determined by the total demand for the good (exchange and reservation) and the stock of the good, increasing as the

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<sup>48</sup> The present paragraph have previously been published in Žukauskas and Hülsmann (2019, p. 128).

former increases and decreasing as the latter increases. We may therefore call the demand a “factor of increase” of the price, and the stock a “factor of decrease”. (Rothbard, 1962/2009, p. 815)

Using the total-demand approach we start with the proposition that the prices of financial assets are determined by the total demand for financial assets and the stock of financial assets, or in other words, by demand to hold financial assets, exchange demand for financial assets and total stock of financial assets. Exchange demand and reservation demand for financial assets are the factors of increase (an increase in the factor causes an increase in the price), stock of financial assets is a factor of decrease (an increase in the factor causes a decrease in the price). The factors of increase are going to be marked with a letter “I” and factors of decrease – a letter “D”.

<Price of financial assets> is determined by <exchange demand for financial assets (I)>, <reservation demand for financial assets (I)> and <stock of financial assets (D)>.

The second step is to analyze the reservation demand for financial assets. Rothbard (1962/2009, p. 816) shows that the reservation demand is a residual of other price determinants:

The *exchange* demand for each good—the amount of money that will be spent in exchange for the good—equals the stock of money in the society minus the following: the exchange demands for all other goods and the reservation demand for money. In short, the amount spent on *X* good equals the total money supply minus the amount spent on other goods and the amount kept in cash balances.

By splitting the exchange demand we incorporate the side of the money into the consideration of what determines the price of a particular good. This shows that what determines the price is not only the value considerations of the goods themselves, but also the value of money. Thus the exchange demand for financial assets is equal to the money supply, minus reservation demand for money and minus exchange demands for all other goods (non-monetary goods not including financial assets).

<Exchange demand for financial assets> is equal to <money stock (I)> - <reservation demand for money (D)> - <exchange demand for other goods (D)>

When Rothbard (1962/2009, p. 816) considers the price level of *all goods*, the exchange demand for all goods can be omitted, because there are no “other” goods:

The price of goods-in-general will now be determined by the monetary demand for all goods (factor of increase) and the stock of all goods (factor of decrease). Now, when all goods are considered, the exchange demand for goods equals the stock of money minus the reservation demand for money. (In contrast to any specific good, there is no need to subtract people's expenditures on *other* goods.) The total demand for goods, then, equals the stock of money minus the reservation demand for money, plus the reservation demand for all goods.

The ultimate determinants of the price of all goods are: the stock of money and the reservation demand for goods (factors of increase), and the stock of all goods and the reservation demand for money (factors of decrease).

However, this is where the analysis of the determinants of the prices of all goods in general (price level) and prices of financial assets differ. In case of the price of all goods, exchange demand for other goods was irrelevant, because there were no other goods. In the case of prices of financial assets, this item has to stay, because it represents the exchange demand for all other goods apart from financial assets. Therefore, if we connect the last two equations we have:

<Price of financial assets> is determined by <money stock (I)>, <reservation demand for money (D)>, <exchange demand for other goods (D)>, <reservation demand for financial assets (I)> and <stock of financial assets (D)>.

This means that if we think of financial assets as a group or even if we think of a particular financial asset, there are five determinants of its price. Two of them are on the money side (stock of money and reservation demand) and three are on the goods side.

Money side:

- Stock of money (factor of increase);
- Reservation demand for money (factor of decrease).

Goods side:

- Stock of financial assets (factor of decrease);
- Reservation demand for financial assets (factor of increase);
- Exchange demand for all the other goods (factor of decrease).

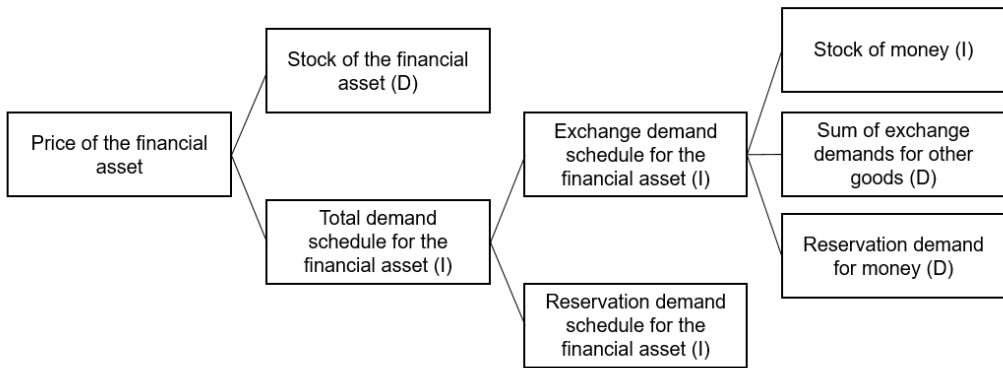


Fig. 7. Initial determinants of prices of financial assets. I – factor of increase, D – factor of decrease.

However, this analysis of the price determination of financial assets is not yet sufficient. This is because the sum of exchange demands for other goods and reservation demand for money depend on (or are connected to) further price determinants, namely stock (and variety) of other goods, and preferences towards other goods (exchange demand and reservation demand schedules for other goods) (see Fig. 8). Moreover, exchange demand for money also needs to be incorporated into this analysis, since it influences reservation demand schedules of financial assets and other goods. Let us proceed with the analysis.

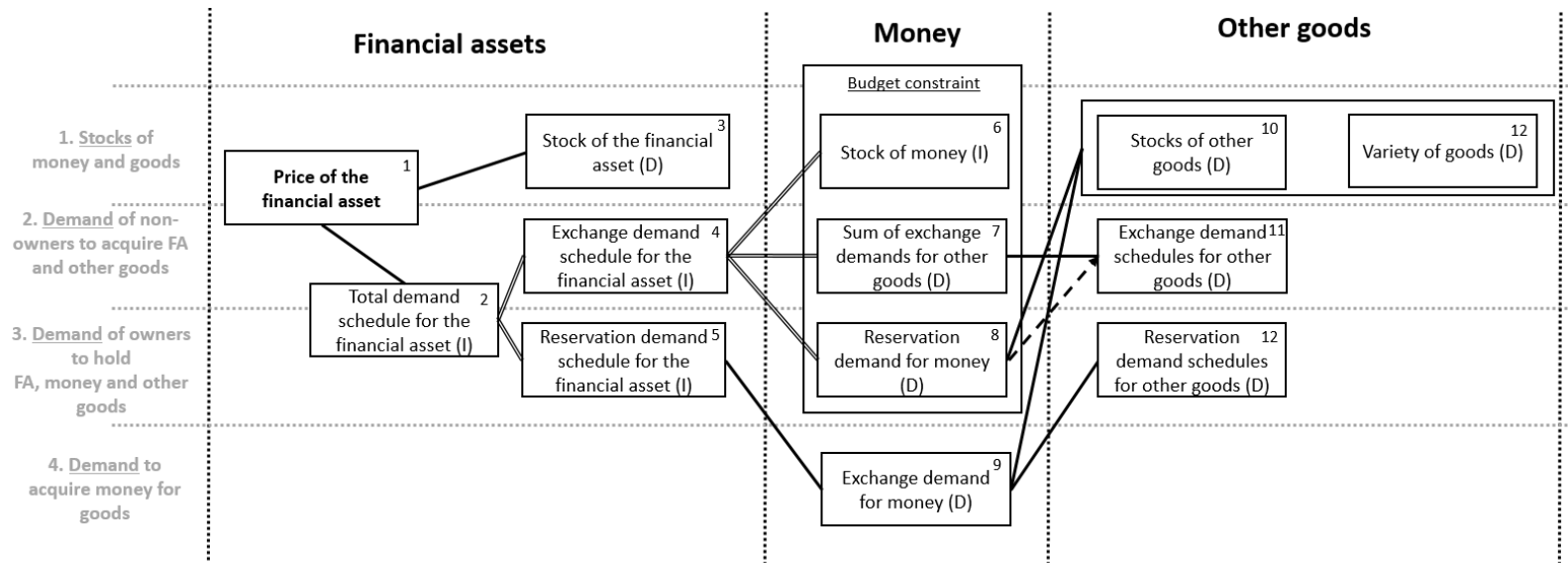


Fig. 8. Expanded version of price determinants of financial assets. I – factor of increase, D – factor of decrease.



The exchange demand schedule for a financial asset — the amount of money that will be spent in exchange for the financial asset at each price — equals the total stock of money (6 in Fig. 8) in the economy minus the exchange demand for all other goods (7 in Fig. 8) and minus the reservation demand for money (8 in Fig. 8) at each price of the financial asset.<sup>49</sup> This equality (*balance of money or budget constraint* in Fig. 8) means that the existing stock of money can either be spent (on the financial asset or other goods) or reserved in the cash balance. By splitting the exchange demand for a financial asset, we incorporated the side of the money into the consideration of what determines the price of a financial asset. This equality shows that if the stock of money increases, or reservation demand for money decreases, the equilibrium price of a financial asset will go up.

The reservation demand for money can change due to numerous subjective factors. Some of them, the ones related to monetary policy, will be discussed later. However, one factor which should be discussed while deriving the price determinants of financial assets is stocks of other goods (not money and not financial assets, 10 and 12 in Fig. 8). Stocks of other goods (and the variety of goods available in the economy) influence reservation and exchange demands for money (8 and 9 in Fig. 8). As the stocks and variety of goods increase, the current owners (producers) of these goods will be willing to sell them for money, the exchange demand for money increases<sup>50</sup> (9 in Fig. 8). An increase in the exchange demand for money decreases the reservation demand for goods (financial assets and/or other goods). This is because higher exchange demand for money means that people are more willing to let go and sell the goods that they own.

Moreover, new goods and new ways to fulfil wants through purchasing and consuming new goods increase willingness to hold money, because the opportunity to fulfil wants

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<sup>49</sup> The exchange demand for a financial asset (the amount of the financial asset demanded at each price along the curve) is necessarily the arithmetical result of the total amount of money (money stock), *minus* the amount of money that market participants are willing to keep in their money balance (reservation demand for money), *minus* the amount of money that market participants are willing to spend on other goods (sum of exchange demands for other goods). Let's call this equality a balance of money or a budget constraint. This constraint is analogous to the fact that there are only three ways in which money can be used (spending on consumption, investment goods or adding to cash balance).

<sup>50</sup> Money in the view of holders of goods becomes relatively scarcer vis-à-vis goods; the position of money in the value scales against goods becomes higher. This means that the sellers are willing to part with their goods for lesser units of money.

through exchange of money has increased.<sup>51</sup> Holders of money, willing to increase their money balances, will decrease their spending on goods and services. This means that the exchange demand schedule for goods and services (11 in Fig. 8), including financial assets (4 in Fig. 8), will decrease – at each price, holders of money will be willing to buy fewer goods and services. Therefore, increasing stocks and the variety of other goods influence prices of financial assets through its impact on the reservation demand for money (and in turn on the exchange demand schedule for the financial asset).

The third component in the equality is the sum of exchange demands for other goods (7 in Fig. 8). This component depends on how much market participants are willing to spend on other goods given their prices (or the array of exchange demand of other goods, 11 in Fig. 8), that is, on their subjective preferences towards other goods vis-à-vis financial assets and holding money. An increase in the exchange demand schedule of one or several other goods means increase in the sum of exchange demands for other goods (which in turn means a lower exchange demand for financial assets).<sup>52</sup> Moreover, if demand for other goods increases, it also affects the reservation demand for other goods (7 in Fig. 8), not only the exchange demand for other goods. Higher reservation demand for other goods means either lower exchange demand for money (9 in Fig. 8, people are more willing to hold and less willing to sell their goods for money thus having lower money income) or lower reservation demand for financial assets (5 in Fig. 8, people are more willing to hold and less willing to sell their goods for money thus selling more of their financial assets and having the same level of monetary income).<sup>53</sup>

This short analysis of the equilibrium price in the total demand approach allows us to come up with the price determinants of financial assets as listed below:

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<sup>51</sup> Contrast this with the situation when there were only few goods available in exchange. In this case the usefulness of (holding of) money and the willingness to do that would be very small.

<sup>52</sup> An increase in the exchange demand *for other goods* requires either a decrease in the exchange demand for financial assets or a decrease in the money balance (and reservation demand for money). But in this analysis, we keep demand for money constant in order to isolate the effect of the change in the reservation demand for other goods on the prices of financial assets.

<sup>53</sup> More on this below in section “Demand for other goods”.

Stocks:

1. *Stock of a financial asset* (D);
2. *Stock of money* (I), works through increasing the exchange demand for financial assets;
3. *Stock of variety of other goods* (D), works through increasing the exchange and reservation demands for money and thus decreasing the exchange and reservation demands for financial assets.

Preferences towards goods (financial asset, money and other goods):

4. *Exchange and reservation demand for other goods* (D), works through decreasing the exchange demand for financial assets;
5. *Reservation demand for other goods* (D), works through decreasing the reservation demands for financial assets;
6. *Exchange demand for money* (D), works through decreasing reservation demand for goods, including financial assets);
7. *Reservation demand for money* (D), works through decreasing the exchange demand for goods, including financial assets
8. *Exchange demand* for financial assets (I);
9. *Reservation demand* for financial assets (I).

There are a few important insights that can be drawn from these price determinants. Firstly, in order to understand the formation of prices of financial assets we need to not only look at the equilibrium conditions in the market of financial assets. This equilibrium depends on the equilibriums in the markets of money and other goods. That is, changes in the market for money or in the markets for all other goods affect the prices of financial assets. Secondly, there are two types of demands (preferences): to *acquire* a good (by non-owners) and to *hold* a good (by owners). Thirdly, there are two types of determinants: stocks of goods, and preferences of market participants towards these goods expressed in reservation and exchange demands. This shows that the equilibrium price in the market depends solely on the stock of goods and on the individuals' subjective preferences towards goods.

Ultimately, we see that all price determinants boil down to the demand (preference) for financial assets and stock of financial assets. All other determinants work through their influence on the preference towards financial assets. The relationship between preference (towards money and other goods) and stock (of money and other goods)

will determine people's relative preference towards financial assets (vs. money and other goods).

More philosophically, preference towards financial assets or other goods represents *human wants or ends*, and the stock represents the *scarcity* of them. It is only natural that price determinants and pricing of economic goods boil down to this fundamental relationship between urgency of human ends and scarcity (of means). The clash or tension between unlimited human desires and scarcity is related to the common definition of the economic science (Robbins, 1932) and one of the most important insights about economic reality. Prices in the market are the most important mechanism that serves to resolve this tension in an economizing way. Therefore the analysis of price formation must necessarily incorporate the notions of ends and scarcity, which is the case in our current analysis.

The list of price determinants is exhaustive in a sense that logically, any change in the equilibrium price will have to work through change in one or several of these determinants. Also, this total-demand approach is flexible in the sense that it does not contain or describe the actual amounts of stock of goods or the extent of relative preferences towards these goods or possible reasons why they might change. The list of these reasons can never be exhaustive due to the complexity of the market and the subjectivity of people's preferences. However, we can still investigate and incorporate any of the empirically or logically identified changes in the stock or the preferences of market participants by showing what impact it would have on the price of financial assets, and through which of the price determinant(s) it would work. This is exactly how we will analyze the impact of monetary policy on the prices of financial assets. The price determinants will be used in the chapter 2.4 to analyze how actions of central banks influence one or several price determinants and in turn the prices of the financial assets.

### **2.3.3. Impacts of the shifts of price determinants**

Having defined the price determinants of financial assets, we will discuss how shifts of these determinants change the prices of financial assets. We will go through all the determinants of financial assets and examine on a case-by-case basis what the link between a given determinant and the price is.

## The stock of financial assets

The first price determinant we will discuss is the stock of financial assets. A change in the stock of a financial asset influences its price. If the stock of a financial asset increases, this will shift the vertical stock line to the right and cause the price of the financial asset to decrease (see Fig. 9).

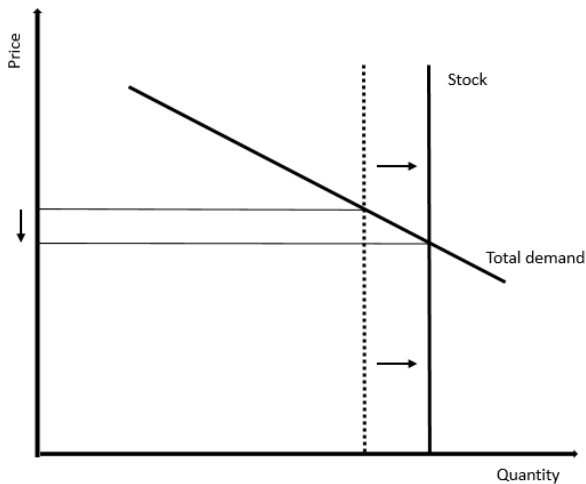


Fig. 9. Change in the price due to increased stock of a financial asset

The connection here is straightforward. An increased stock of a financial asset, which is the price determinant of a financial asset, will consequently decrease its price (connection between 3 and 1 in Fig. 10). In plain words, a decrease in the price of a financial asset occurs because the financial asset becomes less scarce (against money). A decline in the stock will have a reverse effect on the price of the financial asset.

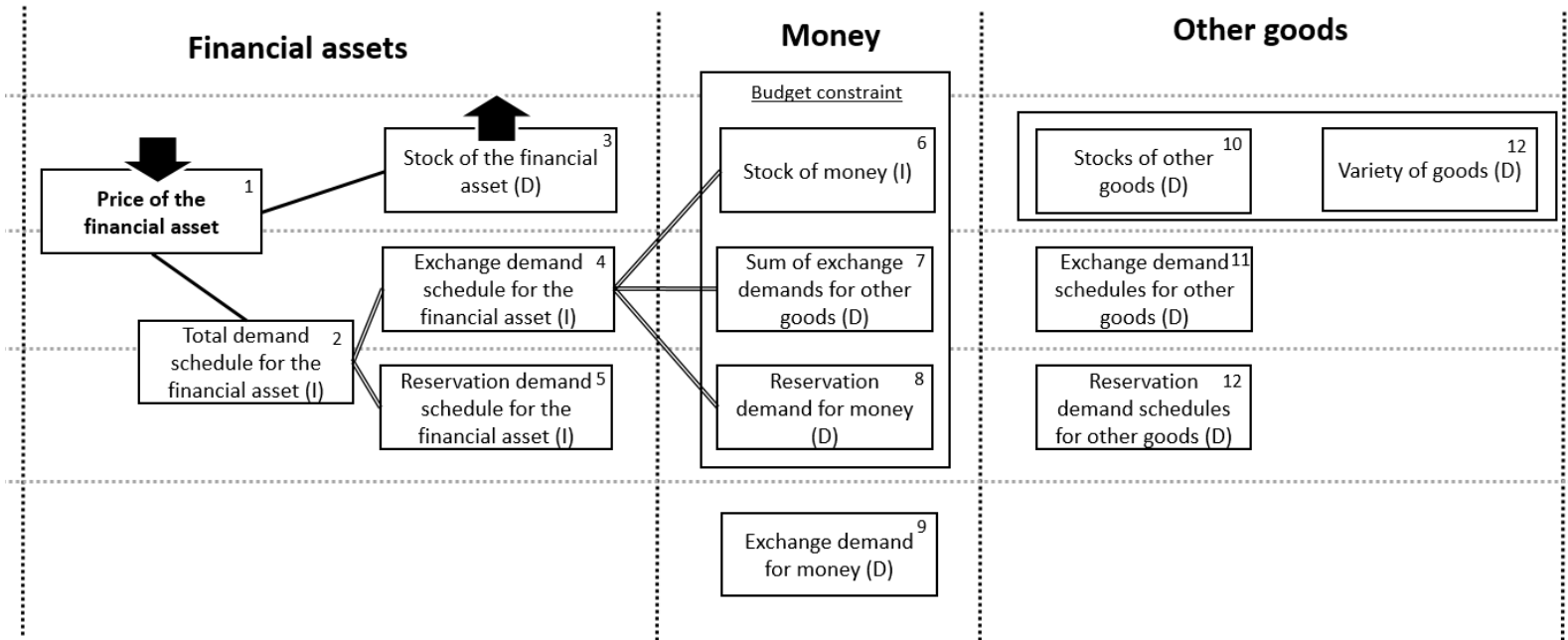


Fig. 10. Shift in the price determinants in the case of changes in the stock of financial assets. I – factor of increase, D – factor of decrease.

There is no reason to assume that an increase in the stock of financial asset in reality will not be accompanied by a change in the reservation demand schedule for the financial asset. It might be the case that an increase in the stock would be met by an increase in the reservation demand for the financial asset, and some or all effects of the increase in the stock would be absorbed by an increase in the reservation demand, and the supply would not change:

Thus, if an increased stock were at the same time absorbed by an equivalent increase in the reservation-demand schedule, the supply curve would not increase at all, and the price and quantity exchanged would remain unchanged. (Rothbard, 1962/2009, p. 151)

However, it is instructional to first separate the effect from an increased stock of a financial asset from the effects of changing preferences (reservation or exchange demands) towards it. Having done this, we will be able to investigate combined effects of multiple shifts in the price determinants, especially when they are caused by monetary policies.

### **The stock of money**

Prices of financial assets are influenced not only through changes in the stock of financial assets, but also through the stock of money. A change in the stock of money influences prices of financial assets through the exchange demand for the financial assets. Increasing the stock of money increases money balances in the hands of market participants. If the reservation demand (willingness of market participants to hold money) is constant, market participants find themselves having higher money balances than they wish. The only way to lower the money balances is to exchange money for goods – financial assets and other goods. Therefore, an increase in the stock of money (given that reservation demand for money does not change) increases exchange demands for financial assets and exchange demands for other goods (4 and 11 in Fig. 12). An increase in the exchange demand for financial assets causes the total demand for the financial assets to go up, which increases the prices of the financial assets (Fig. 11). The same applies to the prices of other goods. A decline in the money stock will have reverse effects on the prices of financial assets and other goods.

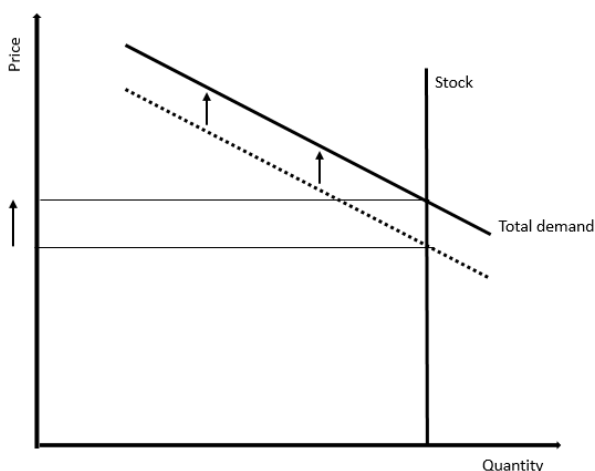


Fig. 11. Change in the price due to increased stock of money

*A priori* it is impossible to say which part of the unwanted balance of money will be spent on financial assets and which part on other goods. This will depend on subjective preferences of market participants towards financial assets vs. other goods. These preferences will manifest themselves in different shifts in the exchange demand for financial assets and exchange demands for all the other goods. The only thing that can be said is that the size of the effect of the change in money stock on prices of financial assets will depend on these preferences. The higher the preference towards financial assets, the higher the shift in the exchange demand for financial assets, and the bigger the change in the prices of financial assets. On the other hand, the higher the preference of market participants towards other goods is, the higher share of the increased money stock will be absorbed by the shift in exchange demands for other goods – the lower the change in prices of financial assets will be.

It is possible that an increase in money stock is related to shifting preferences of market participants (towards financial assets, money or other goods). Some of these reasons related to monetary policy, which affect the exchange demand towards financial assets, will be discussed later.



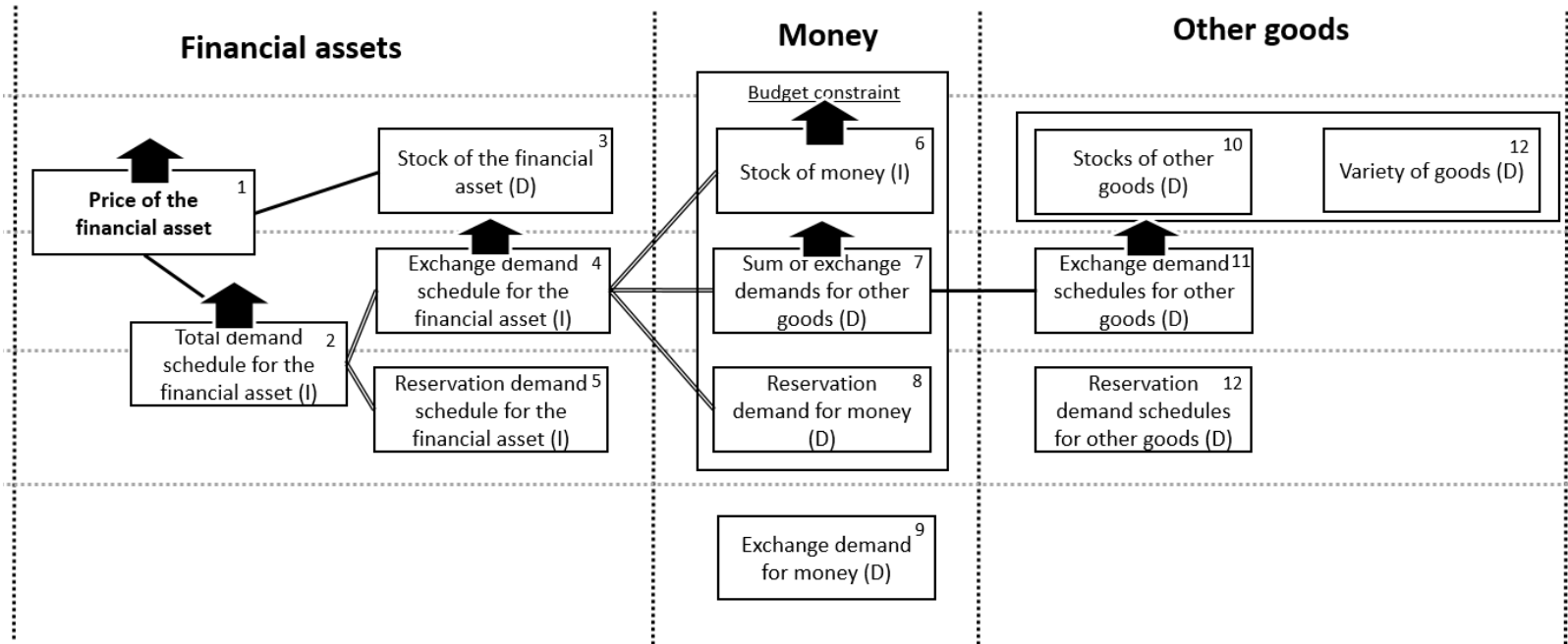


Fig. 12. Shifts in the price determinants in the case of a changing (increasing) money stock. I – factor of increase, D – factor of decrease.

## **Stocks of other goods**

Changes in the stocks of other goods influence prices of financial assets too. Productivity growth in the economy means that more of the already existing goods and services are produced. Available stocks of goods offered in the market increase. However, as the economy develops and grows, there is also a general tendency of an increase in the diversity and quality of goods. Human needs and desires that can be attained using economic goods are virtually unlimited. It is characteristic of a developing economy to discover constantly new ways and goods to fulfil them.

<...> an advancing economy provides ever more occasions for new exchanges as more and more commodities are offered on the market and as the number of stages of production increases. These greater opportunities tend greatly to increase the demand-for-money schedule. If an economy deteriorates, fewer opportunities for exchange exist, and the demand for money from this source will fall.<sup>54</sup> (Rothbard, 1962/2009, p. 771)

Thus, we can distinguish between two effects of growing and advancing economies on the availability of goods. The first one is a growing stock of already existing goods; the second one is a growing diversity of goods (the emergence of new goods that have not existed before)<sup>55</sup>. This section investigates the question of how an increase in the stocks and diversity of goods influences the prices of financial assets.

### ***Decrease in the prices of goods due to a higher demand for money***

The market price is the ratio of money exchanged per one unit of good. Inversely, the price of money on the market is the ratio of good(s) exchanged for one unit of money (e.g. 3 apples per Euro). The price of money is the purchasing power of money, or how many goods a unit of money commands.

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<sup>54</sup> Also, Murphy (2006, p. 139):

As an economy grows, there are more exchange opportunities and hence (*ceteris paribus*) an increase in the demand for money. On the other hand, the development of clearing systems reduces the demand for cash.

<sup>55</sup> This also includes goods of higher quality.

Like all goods, the price of money (or purchasing power of money) is the intersection of the demand and supply of money, or the total demand and stock of money.<sup>56</sup> The total demand for money consists of two parts:

- 1) Exchange demand for money which originates from sellers who wish to sell their goods and services (e.g. labor) in exchange for money;
- 2) Reservation demand for money, which originates from the owners of money who wish to hold money in their reserve (as opposed to spending it on goods and services).

As for other goods, the total demand schedule of money is downward sloping: as the price of money, or purchasing power of money, falls, people will demand a greater quantity of money (Murphy, 2006, p. 137). This is because the decreasing price of money (and purchasing power of money) means higher prices, and higher prices of goods and services induce people to want to sell more goods and services. This increases the supply of goods and services sold for money, and thus increases the exchange demand for money. Also, a decreasing price and purchasing power of money and higher prices of goods mean that people want to hold higher reserves of money, which means increased reservation demand for money.

How does an increase in the stock and diversity of goods change the prices of goods (the price level, or purchasing power of money)? This question is relevant for our analysis, because a developing economy and a growing diversity and stock of goods may influence prices of financial assets too.

Let us say that due to the growth of the economy the stock of existing goods has increased, also new goods that have not yet existed have been created and entered the supply (10 and 13 in Fig. 13). Since producers (owners) of increased stocks of goods and new goods want to sell them for money, the exchange demand for money increases (9 in Fig. 13). There are no reasons why an increased stock of existing goods would directly influence people's reservation demand for money and their willingness

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<sup>56</sup> Murphy (2006, p. 137):

Like all goods, the price of money is determined by the interaction between supply and demand. The total demand for money consists of (1) the *exchange demand* for money (by sellers of all other goods who wish to purchase money) and (2) the *reservation demand* (by those who already hold money). As with all goods, the demand curve for money is downward sloping: as the PPM falls, people will demand a greater quantity of the money commodity.

to hold money. However, new goods and new ways to fulfil wants through the purchase and consumption of new goods may increase the willingness to hold money. This is because the opportunity to fulfill wants through the exchange of money has increased.<sup>57</sup> This is why the reservation demand for money also increases (8 in Fig. 13).<sup>58</sup> The effects of these changes can be seen in Fig. 14. Exchange demand shifts from  $D$  to  $D'$  (increases) on the left hand side. Supply shifts from  $S$  to  $S'$  (decreases due to increased reservation demand). Both of these shifts result in the shift of the total demand for money from  $TD$  to  $TD'$ , on the right hand side.<sup>59</sup>

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<sup>57</sup> Contrast this with the situation when there were only few goods available in exchange. In this case the usefulness of (holding of) money and the willingness to do that would be relatively small.

<sup>58</sup> However, this is not a necessary condition for the analysis, since the effects on the price level would be the same if only the reservation demand increased.

<sup>59</sup> Here we operate under the assumption that the supply (stock of money) is fixed, which means that money supply is an exogenous variable which is kept constant. However, Hendershott (1969) argues that money supply is an endogenous variable and economic growth causes money supply to increase (the causal link is from output to money supply). In the short term (pp. 29-30):

Increases in  $Y$  raise the demand for bank loans, which, in turn, induces banks to reduce their excess reserves and to borrow more from the Federal Reserve. Free reserves decline. In addition, increases in interest rates, which historically occur during periods of rapid growth in income, reinforce banks' willingness to reduce their excess holdings and to increase their indebtedness to the Federal Reserve.

In the long term (p. 34):

If growth in the supply of output induced by population growth and technological advances is expected to lead to falling prices and/or rising unemployment, and if the Federal Reserve believes that expansionary monetary actions would prevent such happenings, the Federal Reserve will increase un-borrowed reserves in line with increases in output or prices.

Even if money supply is not exogenous but endogenous (automatically caused by changes in output), our analysis is still valid because it isolates the effects of the increased demand for money and shows how price determinants shift in the case of fixed supply (stock) of money. The mechanism of increased preferences and an increase in the total demand for money does not change even if supply of money automatically grows together with the increased supply (stock) of other goods (due to higher borrowing or actions of central banks). In order to explain the effects on prices of an increase in the total demand for money and an increase in the supply (stock) of money, we simply need to supplement this analysis with an additional shift of money supply (stock), discussed previously. In a nutshell, an increase in the supply (stock) of money will neutralize (absorb) some or all effects of an increased total demand for money on prices.

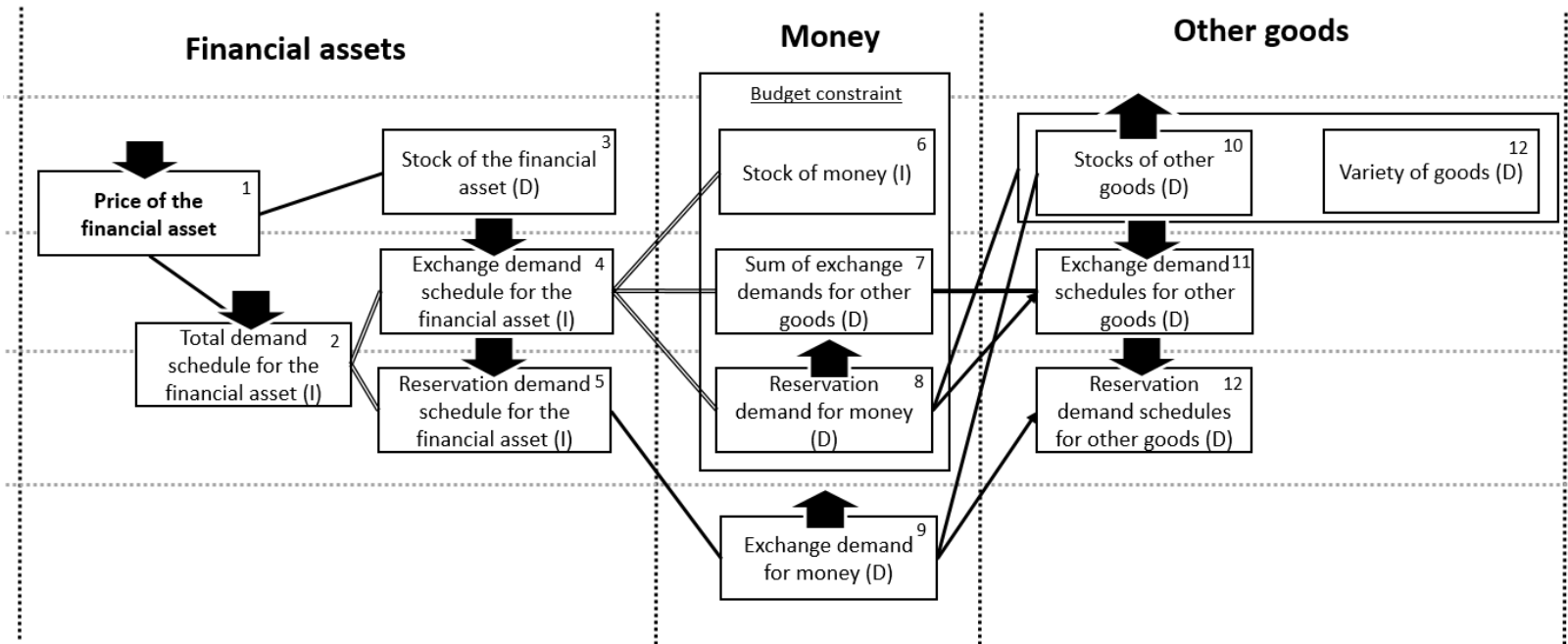


Fig. 13. Shifts in the price determinants in the case of a changing (increasing) stock and diversity of goods – demand-for-money effect. I – factor of increase, D – factor of decrease.

For further analysis it is instructional to think of the (exchange) demand curve for money as representing sellers of goods and services (who demand money in exchange for goods and services) and the supply curve of money as representing current holders of money (who are potential purchasers of goods and services for money).

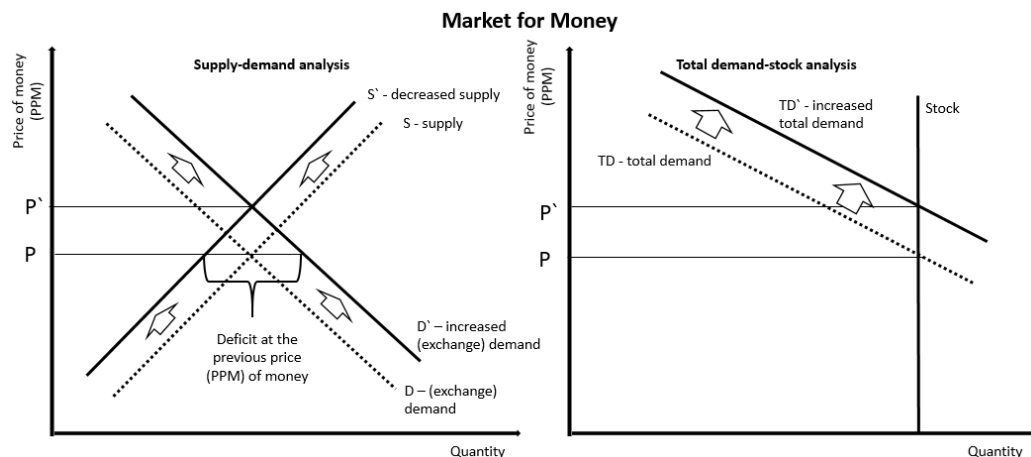


Fig. 14. Shifts in the supply and demand (and total demand) in the market for money in a growing economy

At the old price of money (purchasing power of money,  $P$  in Fig. 14), the quantity of money supplied into the market is lower than the quantity demanded, and therefore there is a shortage or deficit of money. Market participants want to hold more money in their balances than there is money available.

Two changes happen in the market for goods due to this shortage. Firstly, suppliers of goods and services (demanders of money in exchange) who want to increase their money balances will decrease the prices at which they are willing to sell goods. (Since money in their view becomes relatively scarcer and their position in the value scales against goods becomes higher. This means they are willing to part with their goods for fewer units of money.) This will shift (increase) the supply schedule of goods – at each price, owners of goods and services will be willing to provide more goods into the market (see Fig. 15, left hand side). This also means that the reservation demand for goods (including financial assets) will decrease (5 and 12 in Fig. 13). Secondly, holders of money, willing to increase their holdings of money, will decrease their spending on goods and services. This means that the (exchange) demand schedule for goods and

services (including financial assets) will shift (decrease) – at each price, holders of money will be willing to buy fewer goods and services (see Fig. 15, left hand side, and also 4, 11 and 7 in Fig. 13).<sup>60</sup> An increase in the supply schedule and a decrease in the demand schedule of goods will reduce the equilibrium price in the markets for goods and services (from  $P$  to  $P'$  in Fig. 15). Lower prices in the market for goods means a higher purchasing power of money, or higher price of money ( $P'$  in the Fig. 14). Consequently, a higher price of money will equilibrate the supply and demand schedules in the market for money.<sup>61</sup>

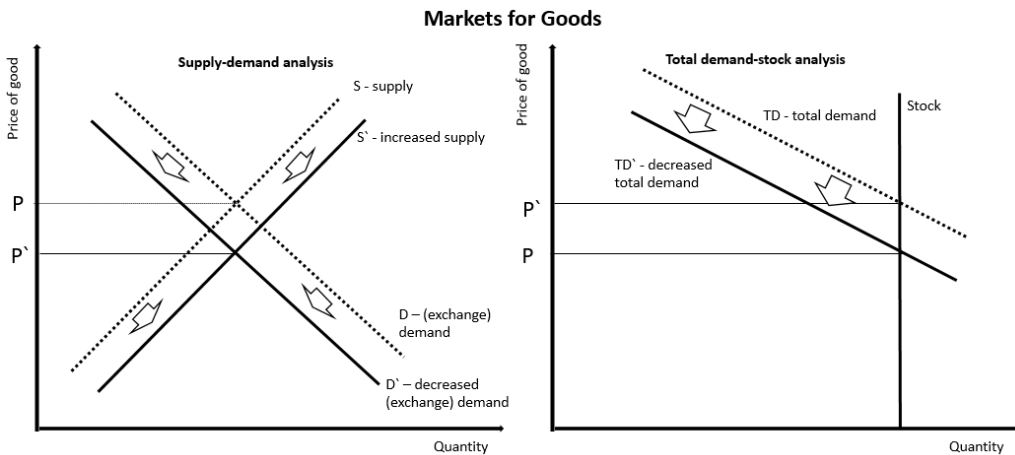


Fig. 15. Shifts in the supply and demand (and total demand) in the markets for goods in a growing economy

The conclusion of this analysis is that when the economy grows and the stock as well as the diversity of goods increase, this will increase the demand for money and will reduce the prices of goods (the price level). This effect works through the total demand (increase exchange and reservation demand) for money.

<sup>60</sup> As mentioned before, an increase in the reservation demand for money was not a necessary condition for the results of this analysis. However, in case the reservation demand does increase, there will also be a shift (decrease) in the exchange demand for goods. If the reservation demand for money does not change, there will be no shift in the exchange demand for goods.

<sup>61</sup> Murphy (2006, p. 138) explains this process in a few sentences:

If the demand for money increases, this means that people wish to hold a stock of money balances higher than the actual stock in existence. This "shortage" of money balances can be eliminated through a rise in the PPM of money; that is, if people want to hold higher money balances, they stop spending as liberally and thus the nominal money prices of other goods and services fall until equilibrium is reestablished.

Financial assets are also goods, therefore this process effects them too. Prices of financial assets in a growing economy will tend to decrease together with the prices of other goods.<sup>62</sup> An increased exchange demand for money reduces the reservation demand for financial assets. Also, an increased reservation demand for money decreases the exchange demand for financial assets. This leads to a lower total demand schedule and lower prices of financial assets (4, 5, 2 and 1 in Fig. 13).

***Decrease in the price level due to higher stocks of goods***

There is yet another effect which explains how changes in the stock of goods influence the prices of goods. This effect works not through the demand for money, but directly through the stocks of goods.

The total demand and stock approach to pricing shows that with an increase in the stock of a good, the price of the good goes down (Fig. 16). It works not because of an increased demand for money, but through the law of marginal utility. Higher amounts of a good in the hands of owners reduce the marginal utility of the good (against money). There is no change in the demand for the good (as was the case with a decrease in the price level due to a higher demand for money, which lead to a lower demand and higher supply of the good).

The differences between this effect (let us call it a *stock effect*) and the previously discussed effect (let us call it a *demand-for-money effect*) are the following:

- The stock effect works through a change (a shift of stock) in the goods market, whereas the demand-for-money effect works through a change (supply and demand shifts) in the money and a change (supply and demand shifts) in the goods markets;
- The stock effect influences the prices only of those goods whose stocks have increased, whereas the demand-for-money effect influences the prices of all goods.

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<sup>62</sup> Again, we should keep in mind that this analysis was applied under the condition of a constant money stock. This makes sense when we want to isolate the effect of a growth of the economy on the price level.



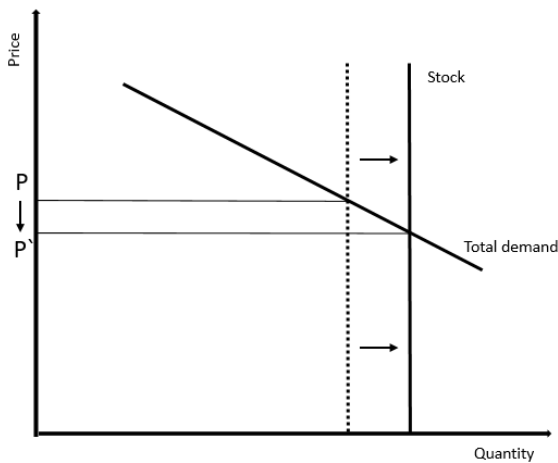


Fig. 16. Effect of an increased stock of a good on its price

The latter difference shows that the tendency of price decreases in a growing economy is relevant not only for goods whose stocks increase, but for all goods. Even when the stock of a particular good does not increase, its price will tend to fall due to a growth in the stock and diversity of other goods.

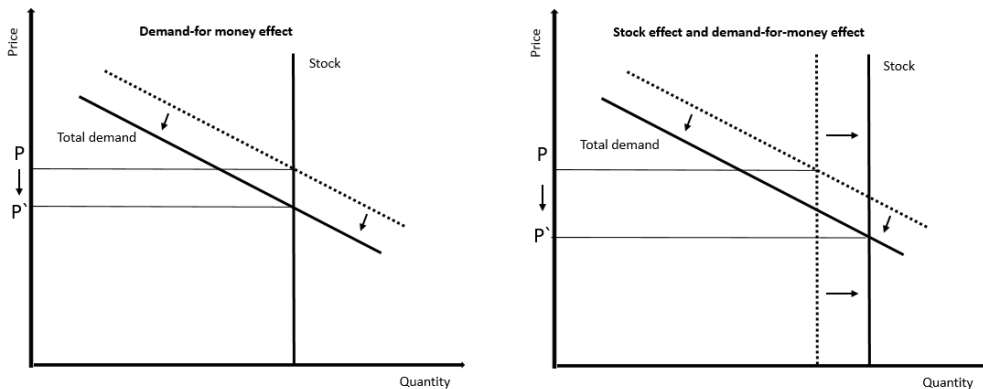


Fig. 17. Stock effect and demand-for-money effect on prices of goods

Fig. 17 illustrates this. The left hand side shows a decrease in the price of a particular good whose stock has not increased (there is no *stock effect*). The market for this good is still affected due to an increase in the stock of other goods (also an increase in the demand for money). As explained above, the total demand schedule for this good shifts (decreases), and this causes its price to decrease. The right hand side shows a situation where both effects (the *stock effect* and *demand-for-money effect*) work together. The price decreases due to a shift (increase) in the stock (*stock effect*) and

due to a shift (decrease) in the total demand schedule (*demand-for-money effect*). A decrease in the price when both effects are present is higher (in Fig. 17 the difference between  $P$  and  $P'$  on the right hand side is higher than that on the left hand side).

This example demonstrates that there are in fact two distinct effects of an increase in the stock of goods on the prices of goods. The fact that there are goods that are influenced by the demand-for-money effect but are not influenced by the stock effect (and the influence on prices in the latter case is less substantial) shows that there must be two different effects at work.

However, this still does not explain how the stock effect affects prices of financial assets when stocks of *other* goods change (increase). The question is this: what is the *indirect* impact of the stock effect on the prices of financial assets? The *direct* impact of the stock effect on the prices of financial assets is quite clear. An increase in the stock of a financial asset reduces the price of the financial asset. However, what we are after is the *indirect* effect: what is the impact of an increase in the stock of other goods on the prices of financial assets? Keeping in mind that we are looking at the stock effect, not the demand-for-money effect, which was already discussed above.

The indirect impact of the stock effect on the prices of financial assets works through the exchange demand for financial assets. Let us assume that the stock of a particular goods has increased. What is the impact of this change on the prices of other goods (including financial assets)? The impact will depend on two factors: a) whether the goods are substitutes or whether they are complements, and b) the demand elasticity of the particular good whose stock has increased.

Let us say that that the goods are *substitutes*. If the demand of  $A$  is *elastic*, an increase in the stock of  $A$  (10 in Fig. 18) means an increase in expenditure on the good  $A$ . An increase in the expenditure on the good  $A$  necessarily means decreased (leftward shifting) exchange demands for other goods (11, case a. in Fig. 18) and reduced total expenditure on other goods (14, case a. in Fig. 18).

The connection between the total expenditure on other goods, not including  $A$  (14 in Fig. 18) and total expenditure on other goods – including  $A$  (7 in Fig. 18) is important. It is clear that some part of the reduced expenditure on all other goods (except  $A$ ) will also fall on financial assets (which means that expenditure on financial assets will also decrease). Therefore, the total expenditure on financial assets will go down (which at

the same time means that the total sum of the exchange demands for the other goods including A will increase (7, case a. in Fig. 18). This will reduce (shift leftwards) the exchange demand and total demand schedule for financial assets and will reduce their prices (4, 2 and 1, case a. in Fig. 18). To put it simply, if the demand for A is elastic, an increase in the stock of A and a subsequent decrease in the price of A will reduce the expenditure on all other goods, including financial assets, and the price of financial assets will decrease.<sup>63</sup>

If, on the other hand the, the demand for the good A is *inelastic*, we have the opposite result (case b. in Fig. 18). A decrease in the price due to an increase in the stock will shift the exchange demand schedules of other goods (not including A) rightwards, which will increase the sum of exchange demands for other goods (not including A). Because part of the increase in the expenditure will fall on financial assets (which means that expenditure on other goods, including A, will fall), the exchange demand schedule of financial assets will increase and their prices will go up.

Therefore, the direction of the effect of an increase in the stock of A on the price of financial assets will depend on the demand elasticity of A. The size of the effect on the price of financial assets will depend on the extent to which the expenditure on financial asset (and the shift in the exchange demand for financial assets) will increase or decrease (depending on the elasticity).

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<sup>63</sup> Rothbard (1962/2009, p. 283):

If the stock of goods, in so far as they are substitutes for one another, are related as follows: When the stock of A rises and the price of A therefore *falls*, (1) if the demand schedule for A is elastic, there will be a tendency for a decline in the demand schedules for B, C, D, etc., and consequent declines in their prices; (2) if the demand schedule for A is inelastic, there will be a rise in the demand schedules for B, C, D, etc., and a consequent *rise* in their prices; (3) if the demand schedule has exactly neutral (or unitary) elasticity, so that there is no change in the amount of money expended on A, there will be no effect on the demands for and the prices of the other goods.

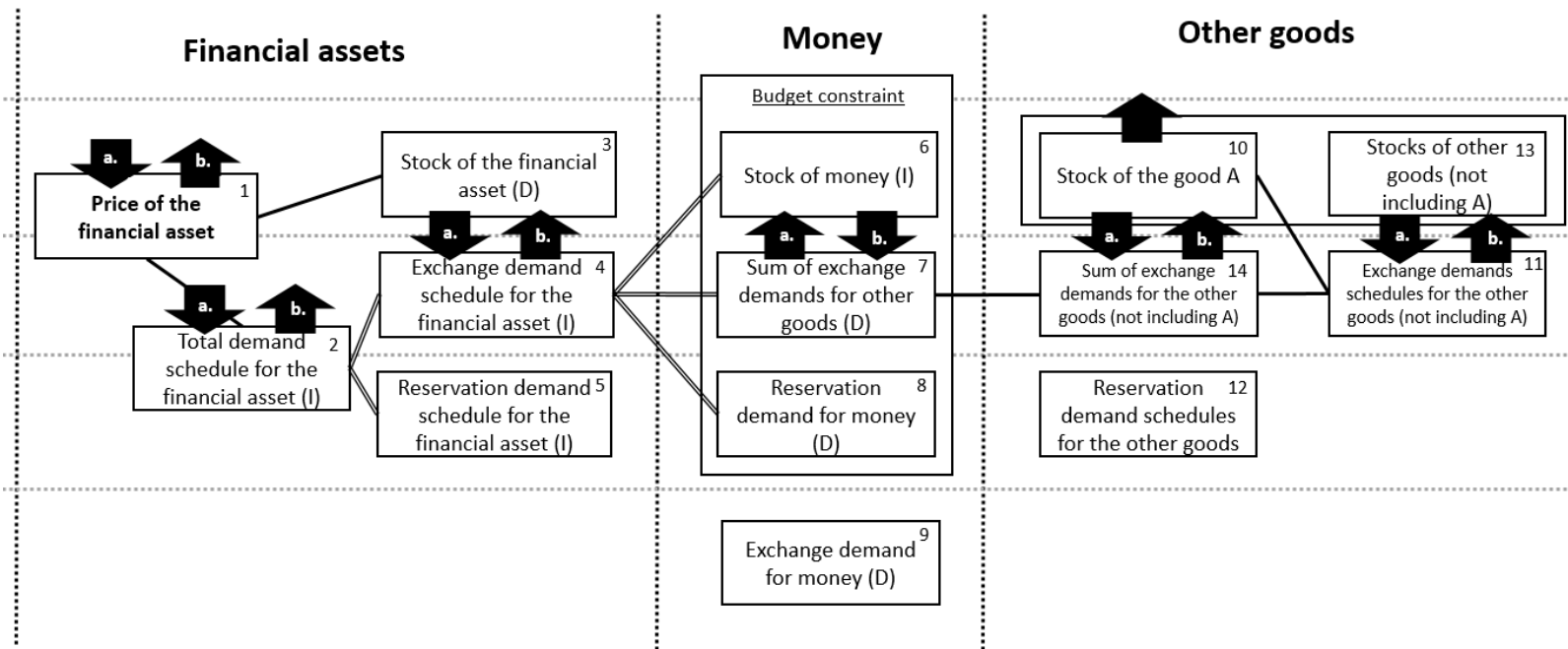


Fig. 18. Shifts in the price determinants in the case of a changing (increasing) stock of goods – the stock effect. I – factor of increase, D – factor of decrease.

This, in turn, depends on the preferences of market participants towards financial assets vs. other goods. If market participants prefer financial assets relatively more to other goods, then the reduction of the expenditure on financial assets (in the case of the elastic demand of the good A.) will be relatively smaller, and the price of financial assets will decrease to a lesser degree. Or, an increase in the expenditure on financial assets (in the case of the inelastic demand of the good A) will be relatively higher, and the price of financial assets will increase more.

### **Demand for financial assets**

Now we move on to discussing the preference towards and the demand of financial assets as a price determinant of financial assets. As with other goods, prices of financial assets depend on the relationship between the preference for financial assets and the stock thereof. By demanding to acquire and hold financial assets, people express their preference towards financial assets. These preferences manifest themselves in the context of different alternatives of money use:

Financial exchanges are constrained by the same legal rules as all other exchanges. Nobody is obliged to buy and keep financial claims. There are always at least four basic alternatives. The money that could be spent on a financial claim can just as well be (1) spent on consumers' goods, (2) spent on real estate, (3) spent on factors of production, or (4) held in cash. Financial exchanges take place if, and only if, in the eyes of both partners they appear to be more useful than those four alternatives in the eyes of the persons involved. (Hülsmann, 2014b, p. 7)

We discussed the sources of value of financial assets in section 2.2.1. As was noted, the claim and exchange value are the primary sources of value which motivate market participants to acquire and hold financial assets. However, people's willingness to acquire and hold financial assets depends on many other factors. Some of them are related to financial markets, others to broader economic processes. For example, an increased amount of saving in a society means that people are more willing to postpone their consumption either by saving more in cash or by investing more money in financial or other assets. Willingness to hold financial assets also depends on people's trust in them, claims that financial assets represent and other properties of financial assets, which we discussed above. Moreover, in chapter 2.4 we will show

how monetary policy may influence their properties and thus people's preferences to hold financial assets. Here we simply discuss how changes in preferences towards financial assets change their prices.

In the case of an increased preference for financial assets, there is an increase in both the reservation demand and exchange demand for financial assets (Fig. 19 and 4 and 5 in Fig. 20). An increase in preferences towards financial assets by the owners manifests itself through an increase (rightward shift) in the reservation demand (which is equivalent to a decrease or leftward shift of the supply) for financial assets. At each price, owners of financial assets are willing to withhold a higher amount of financial assets from the market (and supply a lower amount into the market).

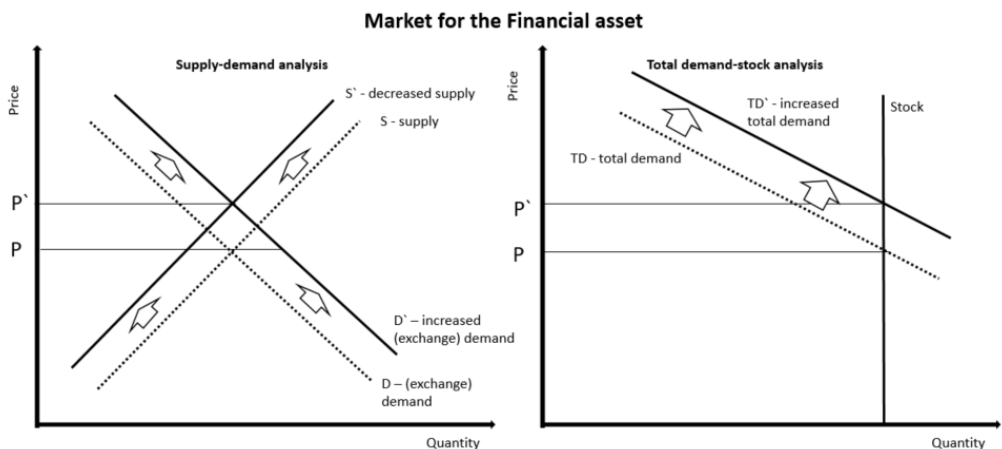


Fig. 19. Change in the price of a financial asset due to an increased preference for the financial asset

An increased preference towards financial assets by non-owners<sup>64</sup> manifests itself through an increase (rightward shift) of the exchange demand for financial assets. We see below (Fig. 20) the avenue of connections between a change in the preference for a financial asset, price determinants of the financial asset and the price of the financial asset. An increased preference for a financial asset increases the exchange and

<sup>64</sup> The category of „non-owners“ does not necessarily mean that these individuals do not own any amount of the good in question. It means that the exchange demand is towards the units of goods that are not (yet) in their possession (as opposed to the reservation demand, which is towards the goods that are (already) in their possession).

reservation demands for the financial asset, which increases the total demand and the price of the financial asset (4, 5, 2 and 1 in Fig. 20).

The budget constraint means that there are only three possible sources of this shift: a) an increase in the stock of money, b) a decrease in the reservation demand for money and c) a decrease in the expenditure on the other goods (decrease in the exchange demands of other good(s)). The cases a and b were already analyzed above. Since currently we deal with preferences for financial assets *versus other goods*, we will assume that the source of the increased exchange demand for financial assets is the case c – a decrease in the exchange demands for other goods. Therefore, as the total demand for financial assets increases, the exchange demand, the reservation demand and the sum of exchange demands (expenditure) for other goods decrease (11, 12 and 7 in Fig. 20).

The reasons why people may shift their preferences from other goods to financial assets are numerous. They are subject to our analysis only to the extent that they are related to monetary policy and will be discussed below.

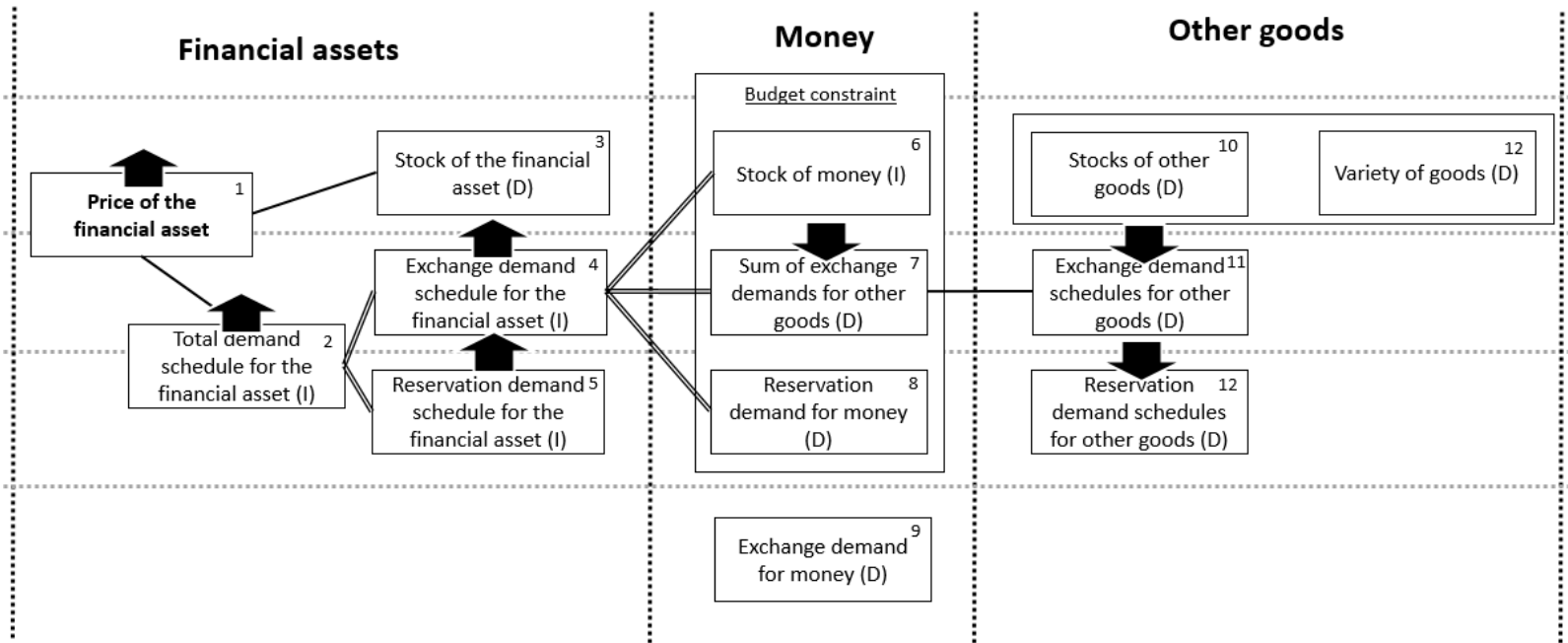


Fig. 20. Shift in the price determinants in the case of a changing (increasing) demand for financial assets. I – factor of increase, D – factor of decrease.



### ***A special case of financial assets as a medium of exchange***

There is one particular reason which is particular to financial assets (for a possible shift in the preference towards financial assets. Good are usually goods bought and sold for money (Fig. 21, 1<sup>st</sup> type of transaction). The exchange and reservation demand for goods come from either the value in their direct use (as consumer or producer goods) or from speculation and an anticipated price increase in the future. Therefore, the price of a good originates from (a) its subjective value in direct use and future sale (sources for total demand) and (b) its stock.

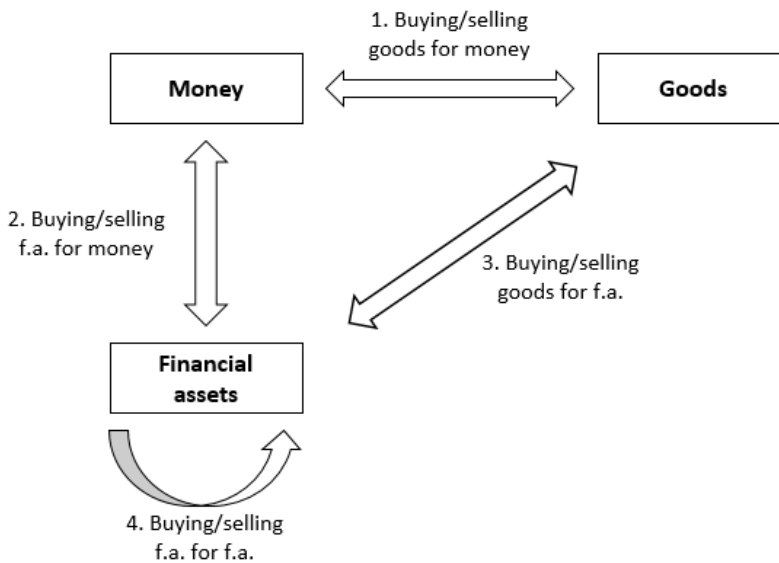


Fig. 21. Exchange between money, goods and financial assets

The case of financial assets is more complicated because financial assets are sometimes used as a medium of exchange. Financial assets can be bought and sold for money (Fig. 21, 2<sup>nd</sup> type of transaction). However, there are two more types of transactions. Firstly, other goods can be exchanged for financial assets (Fig. 21, 3<sup>rd</sup> type of transaction). Secondly, financial assets can be bought and sold for other financial assets (Fig. 21, 4<sup>th</sup> type of transaction).

This means that the demand for financial assets comes not only from their claim value or exchange value, but also from their value in being a medium of exchange. This is

special for financial assets, since in most cases other goods are not used as a medium of exchange. Importantly, an additional demand for financial assets as a medium of exchange makes the total<sup>65</sup> demand for financial assets higher than it would be otherwise.

For commodities, in so far as they are used as media, have an additional component in the demand for them—not only the demand for their direct use, but also a demand for their use as a medium of indirect exchange. This demand for their use as a medium is superimposed on the demand for their direct use, and this increase in the composite demand for the selected media *greatly increases their marketability*. (Rothbard, 1962/2009, p. 191)

Due to the demand for financial assets as a medium of exchange, there are interconnections between different determinants of prices of financial assets. As an additional demand for financial assets as a medium of exchange emerges, demand for money (medium of exchange) may decline, unless people want to expand their total holdings of different mediums of exchange. Thus, there are two distinctive cases that have different effects on the prices of financial assets:

- Demand for a medium of exchange increases without a decrease in the demand for money (demand for medium of exchange expands). The demand for financial assets and their prices will increase. In this case, only one price determinant will be affected.
- Demand for a medium of exchange shifts from money to financial assets. In this case, the demand for financial assets as a medium of exchange increases and the demand for money as a medium of exchange decreases. Prices of financial assets will increase more than in the first case. This is because the shift will influence two price determinants of financial assets at the same time: an increase in the total demand for financial assets (a factor of increase) and a decrease in the total demand for money (a factor of decrease).
- There can be a mix of the case one and case two. The impact that an increase in the total demand for financial assets has because of their use as a medium

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<sup>65</sup> An additional demand for financial assets coming from their use as a medium of exchange can be part of the reservation demand (people willing to hold more financial assets for the sake of using them as a medium of exchange) as well as the exchange demand (people willing to buy more financial assets for the sake of using them as a medium of exchange).

of exchange will vary accordingly. Section 2.4.5. will further discuss the shift from money to financial assets as a store of value in connection to monetary policy.

### **Demand for money**

We have discussed the demand for financial assets and now we will turn to the demand for money as the price determinant of financial assets. As explained above, the value of money comes from its purchasing power. The demand for money is a demand for cash balances (Žukauskas & Hülsmann, 2019, p. 128). It is subjective and it is determined by value judgements. Cash holdings are not accidental; they are a result of conscious behavior.

[...] cash holding is not merely a residuum, an unspent margin of their wealth. It is not an unintentional remainder left over after all intentional acts of buying and selling have been consummated. Its amount is determined by a deliberate demand for cash. And as with all other goods it is the changes in the relation between demand for and supply of money that bring about changes in the exchange ratio between money and the vendible goods. (Mises, 1949/1998, p. 402)

Some economists, predominantly those in the Austrian school of economic thought, clearly identify that the demand for and value of money is subjective and stems from its ability to fulfil its functions in the market as a medium of exchange, a store of value or a unit of account). Money as a good must have certain characteristics for it to be properly used as money. Classically, these are divisibility, fungibility (or universal want), durability, stability of value, etc. The price of money is its purchasing power and it emerges in the market as a *result* of the demand for and the supply of money (the so-called money relation). Economics can reason about the advantages of holding money and factors that may influence the demand for money. But it can never be reduced to a specific function.<sup>66</sup>

The various actors make up their minds about what they believe the adequate height of their cash holding should be. They carry out their resolution by

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<sup>66</sup> More on the subjectivity of the demand for money in section 2.4.5 on “The subjectivist nature of the demand for money”.

renouncing the purchase of commodities, securities, and interest-bearing claims, and by selling such assets or conversely by increasing their purchases. With money, things are not different from what they are with regard to all other goods and services. The demand for money is determined by the conduct of people intent upon acquiring it for their cash holding. (Mises, 1949/1998, p. 401)

The services that an owner receives from holding money are related to the uncertainty in the market economy. Rothbard (1962/2009) recognizes that the demand for money emerges from the uncertainty that economic agents face, *“Its [monies] uses are based precisely on the fact that the individual is not certain on what he will spend his money or of the precise time that he will spend it in the future.”* (p. 767) Although these uses are objective in the sense that every economic agent faces uncertainty, the demand for money is still subjective:

Economists have attempted mechanically to reduce the demand for money to various sources. There is no such mechanical determination, however. Each individual decides for himself by his own standards his whole demand for cash balances, and we can only trace various influences which different catallactic events may have had on demand. (Rothbard, 1962/2009, p. 768)

The purchasing power of money is one of the determinants of the demand for money. Changes in the purchasing power of money induce changes in the quantity of money demanded (via reservation and exchange demands). An increase in the purchasing power of money (a decrease in the prices of goods) causes the reservation and exchange demands for money to decrease (not that here the change is not a shift in the demand schedule, but a shift in the quantity demanded). The reasons here are twofold. First, higher purchasing power of money means that holders of money can fulfil the function of dealing with uncertainty with fewer units of money (the amount of the reservation demand decreases). Second, a higher purchasing power of money means that in the value scales of sellers of goods the relative position of money increases against the position of these goods, which means that they are willing to trade a lower amount of money for the same amount of goods (the amount of the exchange demand for money decreases).

Peoples' preferences towards money also influence the prices of financial assets. Changing preferences towards money versus other goods (some of the reasons of

changing preferences towards money is discussed later in this section and in section 2.4.5) will manifest in the shift of two schedules: the reservation demand for money and the exchange demand for money (8 and 9 in Fig. 23). A decrease in preferences towards money will cause the reservation demand schedule and the exchange demand schedule for money to decrease (shift leftwards). That is, for each price of money in terms of other goods (the purchasing power of money) people will be willing to hold a lesser amount of money (spending the rest on other goods) and will want to demand more money for other goods (which means they will only accept to exchange their goods and services at higher money prices). These two shifts will influence the exchange and reservation demands for goods, including financial assets.

Due to a decreased reservation demand for money, market participants will find themselves holding excess balances of money. This will induce them to increase their expenditure on non-monetary goods (financial assets and other goods), which means increasing (shifting rightwards) schedules of the exchange demand for financial assets and for other goods (4 and 11 in Fig. 23 and Fig. 22, left hand side).

Secondly, a decreased exchange demand for money (the exchange demand for money represents sellers of goods and services) means that sellers are willing to part with their goods only for higher amounts of money (because non-monetary goods in their value scales become more scarce and valuable than money). This means that they are willing to sell only for higher prices, which is equivalent to the supply of goods and services decreasing (shifting leftwards), or the reservation demand for goods or services increasing (shifting rightwards). This is relevant for both financial assets and other goods (5 and 12 in Fig. 23 and Fig. 22, left hand side).

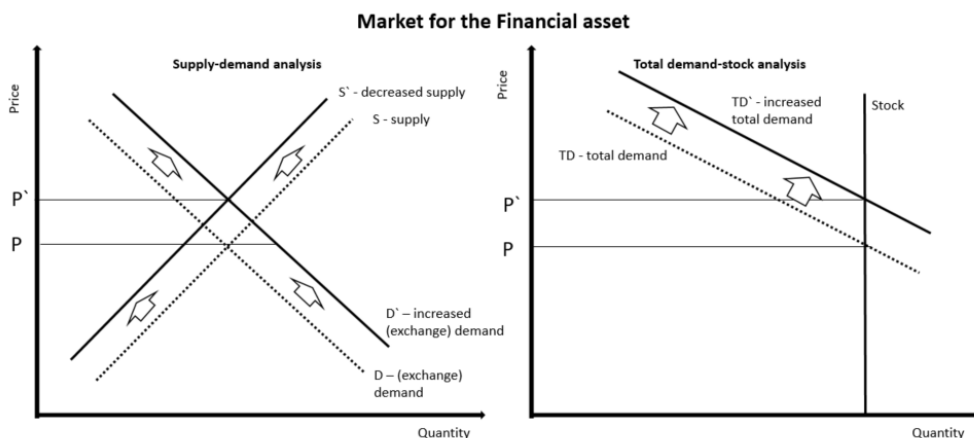


Fig. 22. Change in the price due to a decreased preference for money

We thus see that a decreased preference for money will reduce the supply of financial assets (this is equivalent to an increase in the reservation demand for financial assets) and increase their exchange demand for financial assets. This means that the total demand for financial assets and their price will increase (4, 5, 2 and 1 in Fig. 23).

There are many reasons why peoples' preference towards money may change. Anticipations of future prices and the purchasing power of money is one of the most common reasons. People's demand for money has an important speculative component. Anticipation of price increases in the future will induce higher spending and a lower demand for money, which will tend to increase prices in the present and *vice versa*. Thus, the anticipation of a fall of the purchasing power of money will reduce demand for money and will reduce the current purchasing power of money. Alternatively, expectations in the rise of the purchasing power of money will increase demand for money and will increase the current purchasing power of money (Murphy, 2006, p. 139).

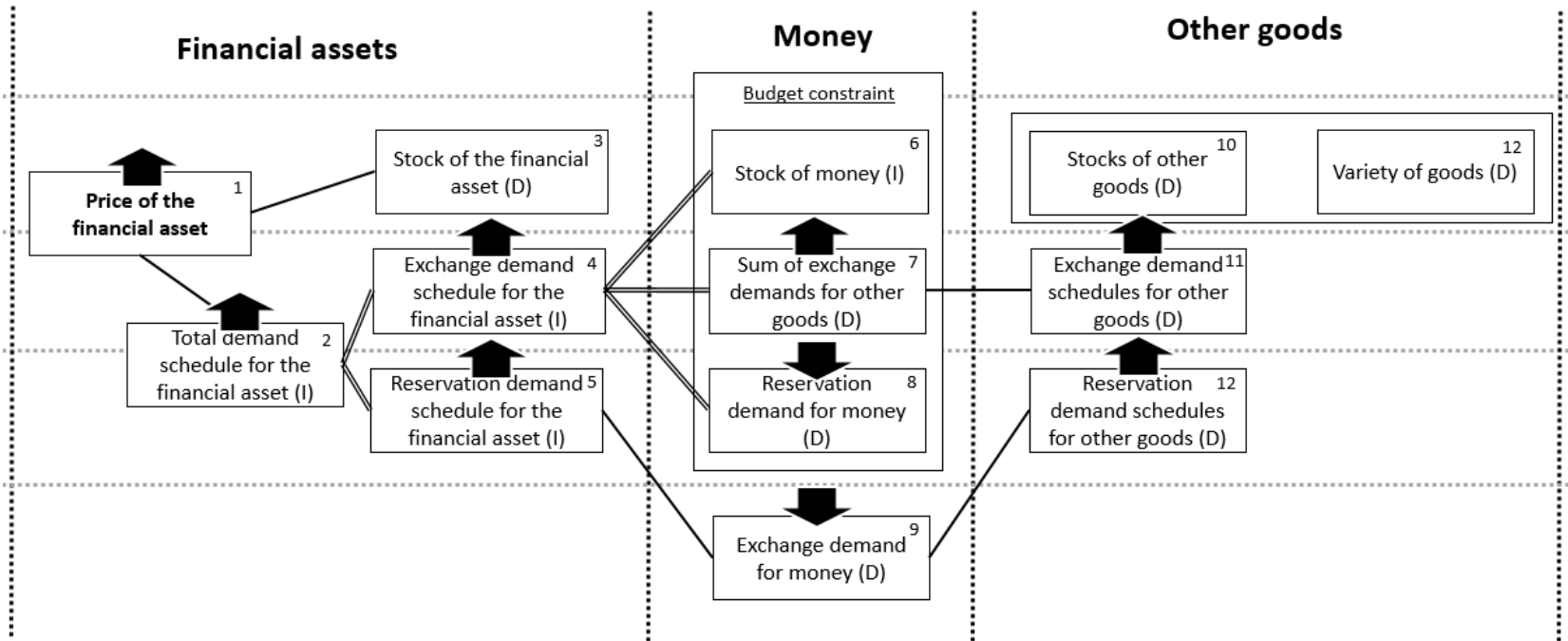


Fig. 23. Shift in the price determinants in the case of a changing (decreasing) demand for money. I – factor of increase, D – factor of decrease.

As in other cases analyzed before, the extent to which a lower preference towards money will increase the exchange and reservation demands for financial assets *versus* the exchange and reservation demands for other goods (and therefore the extent to which the prices of financial assets will be impacted) will depend on people's preference of financial assets *versus* other goods. Particular motivations that prompt changes in the preference towards money in some cases may influence a specific shift of preferences towards money vs. other goods. Below we will discuss motivations that are related to monetary policy.

### **Demand for other goods**

Lastly, we want to look at the preference and demand for other goods as a determinant of the prices of financial assets. An increase in the preference for other goods means a higher reservation and exchange demand for them. The instances (sources) of this change may be twofold, and each affects the prices of financial assets differently:

- An increase in the preference and demand for other goods due to a decrease in the preference and demand for money;
- An increase in the preference and demand for other goods due to a decrease in the preference and demand for financial assets.

The first instance is when the reservation and exchange demands for other goods increase because the reservation and exchange demands for money fall (this has been discussed in section "Demand for money" above). The result of this change is an increase in the demand and prices of non-monetary goods. Non-monetary goods also include financial assets, which means that if the preference to acquire and hold money falls, this increases the demand for and prices of financial assets too. There is a special case when a decrease in the demand for money is associated with a simultaneous decrease in the demand for financial assets (e.g. when the trust in money and all the assets which are nominated in money falls). In this case, there is a simultaneous fall in the demand for money and financial assets, which leads to simultaneous fall in the prices of financial assets, the purchasing power of money and an increase in the demand and prices of other goods.

The second case is when the reservation and exchange demands for other goods increase because there is a decrease in the preference and demand for financial assets (this has been discussed in section "This, in turn, depends on the preferences



of market participants towards financial assets vs. other goods. If market participants prefer financial assets relatively more to other goods, then the reduction of the expenditure on financial assets (in the case of the elastic demand of the good A.) will be relatively smaller, and the price of financial assets will decrease to a lesser degree. Or, an increase in the expenditure on financial assets (in the case of the inelastic demand of the good A) will be relatively higher, and the price of financial assets will increase more.

**Demand for financial assets**" above). In this case, the exchange and reservation demands for financial assets fall and shift to the reservation and exchange demands for other goods (without there being any change in the reservation and exchange demand for money). Consequently, the demand and prices of financial assets fall, and the demand and prices for other goods increase.

## **2.4. Influence of monetary policy on the prices of financial assets**

We have discussed the price formation of financial assets and using the total demand approach we have seen that the prices of financial assets are determined by the stock and the demand for financial assets, money and other goods. Now we turn to the second question – how monetary policy influences the value and prices of financial assets. It follows from our previous analysis that any factor in the economy can affect the prices of financial assets if it influences the stock or demand for financial assets, money and other goods.

Therefore, we will now analyze how monetary policy can influence the stock and the demand for financial assets, money or other goods. We have already discussed that, according to the theory of subjective value, the demand for a good (to hold or to acquire) is the result of a relative valuation of different amounts of two economic goods - the good in question (e.g. a financial asset) and money (other goods are evaluated indirectly through money). We have also discussed the sources of value of financial assets (claim value and exchange value) and money (the purchasing power of money) and that value can never be objectively determined – it is always a product of subjective valuation, which depends on the individual and the circumstances in which the valuation is made.

The value of financial assets and money depend on the degree to which people see financial assets and money fulfilling their needs (being means to their ends). According to the subjective value theory, it is beyond economic analysis to describe all the factors that determine why a particular individual valued a good and exchanged it for some amount of money in particular circumstances. However, economic analysis allows us to theorize and discuss the properties<sup>67</sup> of goods which enable these goods to be functional, that is, to be used in attaining the desired ends. In our particular context, we can discuss how monetary policy may influence the demand for financial assets and money by influencing the properties of financial assets and money, which are important for the value of financial assets and value of money (different properties of financial assets were briefly discussed in section 2.2.1).

First, we will analyze the impact of monetary policy on the stock of financial assets, money and other goods. Then we will turn to the influence on the demand for financial assets, money and other goods.

#### **2.4.1. Influence on the stock of financial assets**

A central bank does not issue or create financial assets (unlike money). Financial assets that a central bank sells to the market are assets that were originally created by other institutions and bought by the central bank. Therefore, a central bank does not have a direct control over the stock of financial assets in the market. However, there are indirect ways how a central bank influences the issuance of financial assets by other market participants.

Hülsmann (2014b) argues that financial markets are a special case of the economics of law, and monetary policy impacts the quantity of financial assets produced in the market. The argument goes as follows. Leoni (1961/1991) famously claimed that to solve conflicting legal claims in the society we do not necessarily need a monopolized legislative process and society can rely on competitive law making processes, relying on custom, contract, and jurisprudence, rather than statutory law, which is the monopoly legislative power of the government. Importantly, "*<...> he went on to*

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<sup>67</sup> Stanford Encyclopedia of Philosophy (2020):

Properties (also called "*attributes*", "*qualities*", "*features*", "*characteristics*" or "*types*") are qualities that can be predicated of things or, in other words, attributed to them. Moreover, properties are qualities that things are said to bear, possess or exemplify.

*demonstrate that the monopolized legislative process was likely to produce results contrary to the very purpose of the law, especially in creating greater uncertainty about the future law than would prevail without legislation.”* (Hülsmann, 2014b, pp. 2-3)

Using this argumentation, we can analyze the impact of government interventions on the production of financial assets (or claims), financial markets being as a special case of the economics of law in the spirit of the analysis of Bruno Leoni. Following this path of reasoning Hülsmann (2014b, p. 8) concludes that the implication of the monetary policy (and fiat money system) on financial markets is that the quantity of financial assets increases beyond the quantity that would be created in the absence of monetary policy:

The starting point for our analysis is the fact that fiat money greatly boosts the development of financial markets, through at least four distinct channels. Central banks may create fiat money to purchase financial claims, thus increasing both the demand for those claims and their prices (monetization channel). Central banks may create fiat money in order to lend it to other market participants. Such lending is usually “collateralized” or secured by the temporary transfer of already-existing financial claims to the central banks. Thus the demand for such claims increases because they may serve as collateral in central bank lending operations (collateral channel). The permanent increase of the fiat money supply typically creates a positive price-inflation rate. In this case, savings in the form of cash hoarding are no longer a suitable way to preserve wealth, and thus savers and investors increasingly turn to financial markets (price-inflation channel). Finally, central banks usually try to stabilize the purchasing power of money, which involves a stabilization of the commercial banking system. Because the commercial banks know that they can count on support from the central bank, they have an incentive to increase their financial exchanges beyond what would otherwise be their precautionary limits (moral-hazard channel). (Hülsmann, 2014b, p. 11)

How do these channels incentivize market participants to issue more financial assets? As a general law, the amount of the production of a particular good depends on the profitability of production – the higher the profit opportunity is, the more producers of a good there tend to emerge, increasing the quantity of the good produced. Since profit

is the difference between revenues and costs (output and input), there are two ways to increase profitability of production, either by increasing revenues or by decreasing costs.

Similarly, the issuance of financial assets depends on its profit for the institutions issuing financial assets. By issuing financial assets (stocks and bonds), companies receive present good (money) by assuming the obligation to pay future financial flows (dividends, coupons and principle payments) to the holder of the financial assets. Money raised through the issuance is invested in a venture which is expected to bring a return for the company.

The profitability of issuance of a financial asset depends on revenues and costs. Roughly, *revenues* depend on a) a return on the additional capital that is raised and invested by issuing a financial asset which is determined by the profitability of the venture that the capital is invested in; b) the level of risk and uncertainty related to this project. *Costs* depend on a) the size of future cash flows that the company has to pay for present money (interest or a yield of the financial asset) and b) others costs of issuance (e.g. underwriting fees).

The higher the return on investment is, the lower the risk and uncertainty associated with it, the lower the interest (cash flows) that the company has to pay for the holders of the financial asset, and the lower other costs of issuance are, the higher the quantity of financial assets issued (created) in the market will be.

It follows then that monetary policy can impact the issuance (and stock) of financial assets by influencing:

- a) The return of investment projects;
- b) The risk and uncertainty of these projects;
- c) The rate of interest that companies have to pay on issued financial assets;
- d) The other costs of issuance.

Let us look at particular ways how monetary policy can impact these factors of production (issuance) of financial assets. The list of these factors and ways of how monetary policy may influence them cannot be exhaustive, since we deal with subjective motivations of individuals. There may be other factors that motivate companies to issue financial assets, and there may be other ways on how monetary

policy influences these factors. However, for the purpose of our analysis, we will cover the most important factors and channels of monetary policy that influence them.

The *return and risk of investment*\_projects can be influenced by monetary policy through its impact on the economic growth and business cycles. This will be analyzed in section 2.4.4 “Impact on the economy.”

It is important to clarify here what we mean by the *risk* of investment projects. Risk here is the risk of investment projects that are started within a firm. We do not mean the risk of holding financial assets issued by the firm. In market conditions the risk of investment projects is related to the risk of financial assets (a riskier investment project means greater probability of bankruptcy and default on the securities issued by the firm). However, monetary policy can weaken this link by assuming (reducing) some of the risks of the financial markets. This will be discussed in section 2.4.4 “Impact through risk.”

The *rate of interest* on issued financial assets is influenced by monetary policy in several ways. Firstly, by buying and selling financial assets, accepting them as collateral, a central bank creates demand for financial assets and thus influences the yield on financial assets and market interest rates in general. This will be discussed in section 2.4.4 “Financial markets as a vehicle of monetary transmission” and “Impact through interest rates.”

Moreover, monetary policy transforms risk and other characteristics of financial assets, making them more attractive for market participants than they would be otherwise. This increases market participants’ preferences towards them, increasing their demand, and prices, and decreasing the yield and interest rates on them. Because of the safety net created by monetary policies (discussed in chapter 1.2, section “Guarantees and the safety net”), financial markets and companies that issue financial assets receive a subsidy of trust. Monetary policy reduces the costs of production of trust in the issuance of financial assets – due to the guarantees for financial institutions the level of trust is higher than it would be otherwise.<sup>68</sup> The subsidy of trust lowers the costs of

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<sup>68</sup> Hülsmann (2014b, p. 12):

Then *even if* the citizens are unable to meet their fiat financial obligations, and *even if* the government is unable to do anything about this by wielding sheer force, the central bank still has the technical possibility to simply create the money necessary to buy and hold indefinitely all FFCs [fiat financial claims], respectively to redeem all financial

issuance of financial assets and incentivizes firms to issue more of them. The impact of regulation of financial markets and the impact of monetary policy on the risk of financial assets will be further analyzed in section 2.4.4 “Impact of regulation” and “Impact through risk.”

Moreover, preferences towards financial assets can be shifted by monetary policy through its impact on the willingness of people to hold money. This will be discussed in section 2.4.5 “ Influence on the properties of money.”

Therefore, different ways how monetary policy influences the production financial assets will be analyzed in more detail below in the following sections, 2.4.4 and 2.4.5. The reason why we must mention them here is that they indirectly affect the stock of financial assets by incentivizing market participants to produce (issue) financial claims. We will see that monetary policy transforms certain properties of financial assets and money which (a) increase the demand for financial assets and (b) induce higher production of financial assets. Thus, monetary policy simultaneously influences the demand and the stock of financial assets.

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obligations. The central bank itself does not need to trust whomsoever. It does not need to believe that the obliged parties are objectively able and willing to make the future payment. It can provide them with any amount of fresh credits out of the printing press, at zero or negative interest rates, and for unlimited time. *In short, under a fiat money system “trust” tends to be severed from the objective ability to make payments. In extremis, trust under a fiat system means trust in the central bank’s willingness to buy this or that financial claim, respectively to bail out the counterparties of these claims.* [Emphasis added.]

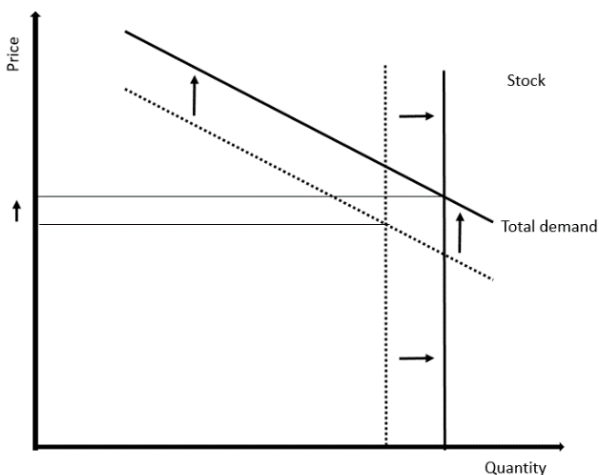


Fig. 24. Effects on the price of a simultaneous increase in the preference and stock of financial assets

It follows then that monetary policy increases the total demand for financial assets (which is a factor of increase of the equilibrium price), but at the same time it indirectly increases the stock of financial assets (which is a factor of decrease of equilibrium price). Both, the total demand and stock increase (a shift rightwards, see Fig. 24). Hence, some of the effects of the increased demand for financial assets are neutralized (from the point of view of equilibrium price) by the increase in the stock of financial assets. Increasing preferences and demand for financial assets are met by an increase in the stock and availability of financial assets.<sup>69</sup> This means that the prices of financial assets increase to a lower extent than they would if the stock of financial assets remained constant. This also suggests that a simultaneous increase of the stock and demand for financial assets means the expansion of the financial sector relative to other sectors.

### 2.4.2. Influence on the stock of money

As discussed previously, asset purchases, loans issued by the central bank and mandatory reserves influence the monetary base, reserves of commercial banks and eventually the money supply (stock) in the economy. Money supply depends on four

<sup>69</sup> One of the reasons why the stock of financial assets can easily react to an increased preference is the relative ease with which financial titles can be created. Their creation does not require a lot of material resources and is based on trust.

factors: monetary base (factor of increase), required reserve ratio (factor of decrease), currency holdings (factor of decrease) and excess reserves (factor of decrease).

The monetary base and the required reserve ratio are directly determined by a central bank and monetary policy. Currency holdings and excess reserves are determined by market participants: financial institutions, businesses and individuals. So despite the fact that central banks do not have a direct total control over the money supply (stock), they directly control two of the four factors which determine the money supply.

Changing the stock of money influences the price level and therefore the prices of all goods, including financial assets. Newly created money enters the market, increases money balances in the hands of market participants and creates new demand for goods and services. This changes the preferences of market participants towards goods (including financial assets) *vis-à-vis* money.

If there is an addition to the total quantity of money held in the market, the result will be a general increase in the eagerness to buy, a rise in market schedules, and a rise in the price of the commodity. If there is a decrease in the total quantity of money held in the market, there will be a fall in the price of commodity. (Boulding, 1941, p. 79)

Machlup (1940) attributed continually rising prices of the stock market to the inflationary credit supply. The expansion of bank credit is always accompanied by a lowering of interest rates and a rise in prices, because the price level is dependent on the absolute level of circulating media.

Whereas a rise in security prices is no proof that an increased amount of money capital is being employed on the stock exchange, an increased flow of money capital on to the stock exchange always leads, other things being equal, to higher security prices. (Machlup, 1940, p. 48)

Also:

The creation of bank money (i.e., the granting of new loans or the purchasing of securities by a bank) exerts its effect, like all additions to the supply of money capital, on the rate of interest and on the structure of production. The continued existence of bank money that was created previously (and, of course, has had its short-run effects) is neutral towards the credit market and the structure of



production. The creation and continued existence of this money has, however, a lasting effect on the supply of circulating media and the price level. The causal sequence (or rather the sequence of probable tendencies) may be roughly described as follows: *The expansion of bank credit will be accompanied by a lowering of interest rates and will lead to a rise in prices and money incomes.* When the credit expansion ceases and if the volume of bank money can be maintained at the higher level, prices and money interest rates, incomes may remain at an elevated level, whereas interest rates will rise again. *While the price level is dependent on the absolute volume of circulating media, the rate of interest hinges on changes in the volume of circulating media.* [Emphasis added.] (Machlup, 1940, pp. 175-176)

And:

A continual rise of stock prices cannot be explained by improved conditions of production or by increased voluntary savings, but only by an inflationary credit supply. (Machlup, 1940, p. 290)

It is noteworthy that the total demand approach and derived price determinants of financial assets allow us to distinguish between the stock of money and preference (and hence total demand) for financial assets (either by a central bank or by other market participants) as separate price determinants. A change in the stock of money and a shift in preferences towards and demand for financial assets are different forces influencing prices of financial assets. An increase in the stock of money decreases the relative scarcity of money vis-à-vis non-monetary goods and causes the general price level to decrease. However, the prices of financial assets may increase faster or slower relative to other goods, depending on other factors which influence market participants' preferences and demand for financial assets. Some of these factors that are connected to monetary policy will be discussed in sections 2.4.4 and 2.4.5.

### **2.4.3. Influence on the stock of other goods**

Employment and economic growth, next to the price stability, are usually defined among the goals of monetary policy. Treaty on the Functioning of the European Union (2012), Article 127 (1) states that "*Without prejudice to the objective of price stability*", the European central bank and the Eurosystem shall "*support the general economic policies in the Union with a view to contributing to the achievement of the objectives of*

*the Union.*" These include inter alia "*full employment*" and "*balanced economic growth*."

The impact of monetary policy on the economy and economic growth is a theoretically and empirically complex issue. For the purposes of this dissertation, this question is relevant to the extent that it is related to two price determinants of financial assets.

Firstly, it is relevant to the extent that monetary policy is successful in achieving the goal of economic growth, it contributes to a general increase in the stock of economic goods. As discussed previously (section 2.3.3), an increase in the stock and availability of economic goods reduces the general price level, including the prices of financial assets.

Secondly, economic growth has an effect on the overall productivity, profits and incomes of companies, and thus the value of financial assets (stocks and bonds), which represent these companies. Higher incomes and higher profits increase the claim (and in turn the exchange) value of financial assets, which leads to a higher demand for and higher prices of these financial assets (demand for financial assets as the price determinant was also discussed in section 2.3.3).

The manner in which monetary policy effects the value and prices of financial assets through the first and second determinants depends on many factors. It is not the purpose of this dissertation to give a thorough exposition of them. However, some of the theoretical and empirical research on the impact of monetary policy on the economic growth (and thus value and demand for financial assets) will be presented in section 2.4.4 "Impact on the economy".

#### **2.4.4. Influence on the properties of financial assets**

We have discussed so far how monetary policy influences *stock* determinants of prices of financial assets. Now we will move on to the determinants which reflect the value, preferences and demand for financial assets, money and other goods.

As discussed previously in 2.1 on "Theoretical principles of the **analysis**," the subjective value theory shows that the value of a good for an individual depends on many properties and characteristics of the good. It is impossible to come up with an exhaustive list of the properties which influence individual judgements of its value. The nature of value is subjective, which means that properties and characteristics of goods

that make them valuable for a particular individual in a particular circumstance are chosen subjectively. Therefore, value can never be explained in a deterministic way.

However, we can identify some of the most common properties and characteristics of goods that individuals attach value to. Our approach here will be to analyze how central banks and monetary policy transform some of these characteristics of financial assets and of money and thus change their value, demand and consequently their prices.

### **Financial markets as a vehicle of monetary transmission**

The institutional framework of today's fiat money system is closely interrelated with financial markets and financial assets. Newly created money enters an economy through financial markets. A central bank creates a monetary base through loans to credit institutions with financial assets as collateral or through financial asset purchases in the market. Money created through the fractional reserve system originates from loans granted by credit institutions. This institutional arrangement of a monetary system has a systematic effect on the demand and prices of financial assets.

There is an obvious and direct link between monetary policy and financial assets that a central bank chooses to pursue. ECB and other central banks use two main methods to release newly created money while conducting monetary policy. The first one is through loans to eligible financial counterparties (e.g. main refinancing operations or longer-term refinancing operations at ECB done through repurchase agreements). The other one is through financial asset purchases (e.g. Asset purchase program at ECB). Purchases of particular financial assets by the central bank produces additional demand for them, which would not exist otherwise.<sup>70 71</sup> A similar effect originates from

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<sup>70</sup> Hülsmann (2014b, p. 11):

Central banks may create fiat money to purchase financial claims, thus increasing both the demand for those claims and their prices (monetization channel).

<sup>71</sup> The intrinsic reasons or sources of the demand of a central bank for financial assets are different from the demand of other market participants. In the market the preference towards goods (including financial assets) is usually formed on the basis of marginal utility of the good (in the case of a financial asset it is the claim value or the exchange value of a future sale). Marginal utility of a good is compared with the marginal utility of money (exchange value of money) and then a decision to purchase or sell is made.

However, the sources of the preference of a central bank towards financial assets or money are different. Firstly, the value of a particular unit of money for the central bank does not come into play through the traditional mechanism of scarcity of money. That is, comparing its purchasing power (exchange value of money) against the value of goods that can be purchased with money. As a monopolistic producer of money, a central bank can issue money with virtually no costs. This means that, not bound by scarcity and production costs, the value of money for a central

lending operations in respect to financial assets which credit institutions pledge as collateral when borrowing from the central bank through open market operations. The acceptance of particular financial assets as collateral means that owning these financial assets becomes close to equivalent to owning money, the difference being the target interest rate on open market operations<sup>72</sup> (main refinancing operations at the ECB), which is usually set at zero or close to zero during the periods of expansionary monetary policy. Acceptance of a particular financial asset as collateral at the central bank becomes a valuable property of this financial asset. The existence of this property creates the demand for the financial asset, which would not exist otherwise.

The difference between asset purchases and loans is that additional demand in the case of asset purchases comes from a central bank, and in the case of loans against collateral, it comes from credit institutions. But the effect exists in both cases, and the extent of this effect is decided by the central bank. Higher amounts of asset purchases and higher amounts of lending with lower interest rate generates higher additional demand, and thus have a more extensive impact on the prices of these particular financial assets. Therefore, there is a direct link between monetary policy and financial

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bank is close to zero. Similarly, a central bank is not motivated to purchase (and to sell) a particular amount of particular financial asset due to its value of claim or future sale. A central bank is not bound by financial considerations of profit in the traditional sense, as the money producer it is not motivated by the financial gain from purchase or sale of the financial asset. Institutionally, motivations for monetary policy actions come from the anticipated impact of those actions and their value for the central bank, not by the value considerations of the financial asset vs money. Therefore, the gain and *value of the action* to produce money and purchase particular financial asset (or sell a financial asset for money) stems from the aims of the policy action and its anticipated effects. Similarly (the alternative costs of a monetary policy action, in this case the purchase of a financial asset) originate not from the value of other goods that may be purchased for the money (exchange value of money), but from alternative policy actions and the value of their effects forgone.

The value of the purchase or sale of a financial asset and the demand for it by a central bank originates from it being a tool of monetary policy as opposed to it having the value of claim or future sale, as in the case of other market participants. However, as long as market participants (central banks among them) express their preferences towards financial assets by demanding and supplying them, this will have an impact on prices of financial assets. Preferences for demanding or supplying financial assets are important only to the extent that they influence the quantity demanded and supplied at each price, their sources and motives are not important beyond that when analyzing the formation of prices. Therefore, even if led by different considerations, a central bank still demands and supplies (when previously purchased) financial assets in the market, and these transactions impact the price determinants of financial assets and therefore their prices.

<sup>72</sup> To be able to borrow from the ECB a credit institution needs to be an eligible counterparty of ECB open market operations.

assets, which the central bank chooses as a vehicle in the transmission of monetary policy. The additional demand for these assets generated by their involvement in the mechanism of monetary policy means that their prices are higher than they would be otherwise.

This effect is not homogenous in respect to different financial assets or groups of financial assets. This is because asset purchases and collateral eligibility rules are not homogenous towards different financial assets. Asset purchase programs at collateral eligibility rules at ECB target financial assets based on the criteria of:

- Type of financial asset (e.g. Asset purchase program at ECB targets covered bonds and asset backed securities, so far ECB purchases only debt securities);
- Sector (e.g. the biggest share of the Asset purchase program at ECB purchases public sector debt, a separate part of it targets covered bonds issued by credit institutions, and yet another targets non-bank corporations);
- Risk (ECB's asset purchases and collateral framework has criteria of eligibility based on the credit rating of a financial asset);
- Maturity (ECB's asset purchase programs set criteria for the maturity of financial assets which are eligible for purchase);
- Issuer (ECB's collateral eligibility and asset purchase rules have exceptions for financial assets originating in particular countries, e.g. partial waiver of the credit rating requirement for Greece and Cyprus, moreover, the instrument of Outright monetary transaction is based on direct targeting of sovereign debt of a particular Eurozone country).

These choices done by the central bank regarding the criteria of eligibility for collateral and asset purchases result in a heterogeneous effect of monetary policy on different financial assets and their groups. Financial assets, which are targeted to a higher degree (not only in terms of eligibility, but also in terms of the amount of purchases), receive more additional demand than those that are targeted to a lesser degree, and this affects their relative prices. Moreover, the eligibility criteria and the extent of targeting are subject to change over time. They changed significantly over time as the ECB reacted to financial and economic crises and when unconventional instruments

of monetary policy were introduced. This means that the extent of the heterogeneity of this effect has also been changing.

To sum up, the structure of a monetary system, its institutions, and the resulting mechanism of how money is created and how it enters the market have a systemic effect on the prices of financial assets. This effect generates additional demand for financial assets in general, but especially a higher demand for those assets that are targeted by this mechanism. This means that prices of financial assets are higher in general, and they are even relatively higher for particular financial assets than they would be otherwise.

### **Impact through interest rates**

Central bank controls the liquidity that credit institutions hold at the central bank (mandatory and excess reserves) by increasing or reducing the amount of lending through open market operations or the amount of asset purchases and in this way sets a money market<sup>73</sup> interest rate at the target short-term interest rate (at ECB - main refinancing operations rate<sup>74</sup>). If a money market interest rate is set at the target rate, then by definition the prices of instruments traded in this market (their maturity is up to one year) correspond to the target rate. How does the short-term interest rate influence prices and yields of other financial assets, which are of longer maturity, and which are not subject to demand from a central bank?

Any changes in the prices of financial assets that are not part of the money market, which result from the change in the short-term interest rate, must come about through changes in valuation of (and thus demand for) these assets by market participants. By decreasing or increasing the short-term interest rate, a central bank does not change any properties attached to financial assets which are outside of the money market. Thus, changes in the valuation of them by market participants can only come from a change in relations and arbitrage.

The law of one price in the market is based on the idea of arbitrage. Market forces tend to eliminate differences of prices of any asset across markets through profitable

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<sup>73</sup> Money market is a market of short-term funds - instruments which have an initial maturity of up to one year.

<sup>74</sup> "The main refinancing operations (MRO) rate is the interest rate banks pay when they borrow money from the ECB for one week." (ECB, 2020e)

arbitrage opportunities (e.g. Rashid (2007)). What makes two financial assets equivalent is a subjective notion. All financial assets share the characteristic that they are claims to future financial flows. However, there are many differences between them. Financial assets, like all other goods in the market, have properties which are subjectively important to market participants in judging their value (e.g. the size of expected cash flows, risk, liquidity, maturity and other properties). Different manifestations of these properties among financial assets determine the degree to which they are subjectively equivalent (substitutes) and the degree to which they are different to market participants. Different manifestations of these properties lead to different subjective valuations and different demands for particular financial assets. In this respect, all financial assets in the eyes of market participants fall within a spectrum according to their properties. This spectrum accounts for the differences in their subjective valuation, demand and ultimately their prices.

The prices of financial assets in this spectrum are interlinked to the degree that they are partial substitutes. As mentioned above, arbitrage tends to eliminate different prices of the same asset in the market. The same principle relates the prices of financial assets, which somewhat differ in their properties, but are still close or distant substitutes. Price differences between financial assets account for the differences in their properties, which make them more or less valuable in the eyes of market participants. If the price difference in the eyes of market participants becomes too big or too small, they increase their demand for a financial asset which is in their eyes underpriced, given its properties, and decrease their demand for a financial asset which is overpriced. This mechanism brings the price differential at par with the subjective valuation of the differences in the properties of the two financial assets.

These interlinkages between financial assets also explain how central bank-induced changes of short-term interest rates in the money market affects prices of financial assets outside of the money market (e.g. longer term, riskier assets). A lower short-term interest rate in the money market means higher prices of money market financial assets, which causes market participants to shift their demand to other financial assets (which are seen as substitutes). Thus, a lower short-term interest rate leads to a higher demand for longer-term financial assets and a lower longer-term interest rate.

This mechanism works not only as a transmission from short-term to longer-term financial assets. It is relevant for other properties of financial assets too, e.g. risk. If a central bank increases its demand for a particular risky asset, the prices of other risky assets will react as well. This is particularly important in the context of unconventional instruments of monetary policy, which often target particular financial assets. The general principle is that, if a central bank chooses to increase its demand for a financial asset with a particular property and causes its price to increase, this will lead market participants to shift their demand for financial assets with similar properties and this will increase their prices.

### **Impact of regulation**

Some aspects of the regulatory framework of financial institutions (discussed in chapter 1.2) has an effect of incentivizing financial institutions to prioritize holding particular financial assets over others. The incentive comes from capital and liquidity requirements, which categorize financial assets into particular groups and apply different requirements to financial institutions depending on the category of financial assets they hold. Let us briefly discuss two examples: capital adequacy requirements and liquidity requirements.

Capital requirements are the minimum capital that banks are required to hold. They depend on the assets that banks hold, their risk level. According to Basel III, a set of international banking regulations, banks have to group their assets into different categories. A bank's capital requirement is calculated according to the share of assets in each category. The regulation sets the weights of risk, or the percentages of capital requirement. In principle they depend on the types of assets (e.g. sovereign bonds, covered bonds, corporate bonds) and on their risk rating (Basel Committee on Banking Supervision, 2017a). The risk weighting depends on the credit rating. However, the regulation sets arbitrarily different weights for the same risk category for different asset types (see Table 1 below).



Table 1. Comparison of risk weights for sovereigns and corporate exposures. Source: (Basel Committee on Banking Supervision, 2017b)

<b>External rating</b>	AAA to AA–	A+ to A–	BBB+ to BBB–	BB+ to B–	Below B–	Unrated
Risk weights for sovereigns and central banks	0%	20%	50%	100%	150%	100%
Risk weights for corporate exposures	20%	50%	75%	100%	150%	100%

Another requirement of Basel III regulation is the liquidity coverage ratio, which refers to the requirement to keep a particular proportion of liquid assets held by financial institutions. It is calculated as a ratio of liquid assets to net cash outflows over a 30-day period. Eligible liquid assets are grouped into three categories according to decreasing levels of quality: level 1, level 2A, and level 2B. For level 2 assets haircuts are applied to the current market value of each asset (see Table 2 below). Furthermore, the contribution to the total stock of liquid assets is capped for Level 2 assets at 40% and for Level 2B at 15% (Basel Committee on Banking Supervision, 2013).

Criteria for different groups of financial assets are numerous, including the issuer (central bank, sovereign, private), types of securities, risk rating, issuance size and others. As in the case of risk weighting for capital requirement, liquidity coverage ratio regulation sets arbitrary rules of grouping and shortcuts for different financial assets. Table 2 shows that in case of euro denominated assets only assets issued by the public sector and central bank fall into Level 1.

Categorization of financial assets, which is implied in the two examples discussed above, create an incentive for financial institutions to hold particular financial assets, for which capital and liquidity requirements are lower. Compliance costs of regulation while holding these assets is lower as opposed to holding assets of higher capital and liquidity requirements. Consequently, the demand for and prices of these financial assets become higher than they would be otherwise without these regulations. This type of regulation introduces an element of arbitrary pricing of risk of financial assets where decisions of market participants regarding the composition of assets held are influenced by regulators.

Table 2. Euro-denominated assets that qualify for the liquidity coverage ratio. Source: Grandia, Hänling, Lo Russo, and Åberg (2019).

Asset class	Description	Level	Haircut
Exposures to central banks	Coins and banknotes	1	0%
	Excess reserves held with the Eurosystem		
	ECB debt certificates		
	Fixed-term deposits <sup>1)</sup>		
Public sector bonds	Bonds issued by Member States of the EU or their regional government or local authorities if exposure is treated (for regulatory purposes) as exposure to the respective Member State	1	0%
	Bonds issued by public sector entities (credit institutions, promotional banks) if exposure is treated as exposure to the respective central government, multilateral development bank or international organisation		
	Regional governments and other public sector entities of Member States where exposures are assigned a risk weight of 20% in accordance with the Capital Requirements Regulation (CRR)	2A	15%
Covered bonds	≥ AA- issue size ≥ EUR 500 m Overcollateralisation ≥ 2%	1	7%
	≥ AA- issue size ≥ EUR 250 m Overcollateralisation ≥ 2%	2A	15%
	≥ A- issue size ≥ EUR 250 m Overcollateralisation ≥ 7%	2A	15%
	Other <sup>2)</sup> issue size ≥ EUR 250 m Overcollateralisation ≥ 10%	2B	30%
	Covered bonds where the bank has originated the underlying loans are not eligible		
Corporate bonds	≥ AA- Issue size ≥ EUR 250 million Max. time to maturity at time of issuance: 10 years	2A	15%
	At least investment grade Issue size ≥ EUR 250 million Max. time to maturity at time of issuance: 10 years	2B	50%
Asset-backed securities	At least AA- Most senior tranche	2B	25%
	Backed by a pool of underlying exposures which belong to specific residential loans; commercial loans; auto loans and leases or loans and credit facilities to individuals		(residential and auto loans) 35% (others)
	ABS where the bank has originated the underlying loans are not eligible		
Shares	Part of a major stock index	2B	50%
	Proven record as a reliable source of liquidity (i.e. stock price decline < 40% during a 30-day stress period)		

## Impact on the economy

Through monetary policy, central banks influence economic activity: economic development, expansion and contraction of economic output. This influence may not be uniform across sectors – some sectors may be influenced more than others. Financial assets (stocks and bonds) represent companies whose ability to create value and earn profits is inevitably related to economic conditions. Therefore, monetary policy, through its impact on the economy, has an indirect effect on companies, their

incomes and profits, and thus cash flows generated for the owners of financial assets of these companies. Therefore, the impact on economic activity is another way how monetary policy indirectly influences the value and prices of financial assets.<sup>75</sup> Below we will briefly discuss different theoretical and empirical approaches that analyze the link between monetary policy and economic activity.

### ***Aggregate and structural effects***

Maisel (1968, p. 796) early on noticed that *“At least four major descriptions of the relationships between changes in monetary policy and changes in specific expenditures compete for attention.*

1. *Monetary policy influences interest rates, which affect spending. Interest rates may alter the desire to consume or save. They also determine the cost of borrowing, which influences the profitability of investment. Higher rates may limit the ability to borrow.*
2. *Spending is a function of the wealth or the assets of individual units. Monetary policies have an impact on wealth. [...]*
3. *Expenditures may be influenced through the creation or intermediation of credit. Monetary authorities through their creation of reserves and their impact on relative interest rates influence the amount and type of credit creation, of lending, and of borrowing.[...]*
4. *Shifts in monetary policy cause changes in attitudes and expectations. These in turn may influence the spending of particular units.”*

All four groups (interest rates, wealth, credit and expectations) correspond to the channels of the standard transmission mechanism of monetary policy analyzed in the first part of this dissertation. As discussed there, the standard framework presents numerous possible channels of how central banks transmit monetary policy to the

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<sup>75</sup> Although the influence on economic activity may work through changes in interest rates, this effect is different one from the one discussed above in section “Impact through interest rates”. This is because the interest rate effect worked through the denominator – changing the discount rate in the discounting of future benefits from financial assets. Changes in economic activity, on the other hand, work through influencing the numerator, the size of cash flows. It is important to distinguish between these two effects, because their impact on the prices of financial assets may be very different depending on the circumstances (e.g. depending on the sector of a company). For example, even though the general interest rate (which is one of the determinants of the discount rate) is the same for all financial assets, monetary policy may have very different effects on the economic activity of different sectors and different companies.

economy. All of the channels, at least in theory, impact the aggregate demand in the economy. That is, through these channels, monetary policy influences the ability or willingness of companies and/or households to spend on consumer and investment goods (note that in Fig. 5 all channels eventually affect the aggregate demand).

In section 1.3.2 we discussed those channels of the standard transmission mechanism, which are directly or indirectly related to the financial assets and their prices. There is one more channel not discussed there, which works through changes in the exchange rate. According to the rationale behind this channel, higher domestic interest rates induced by monetary policy attract foreign investors to purchase domestic assets, which raises the demand for domestic currency and its exchange rate. A higher exchange value of the domestic currency makes domestic goods relatively more expensive than foreign goods. This causes a reduction in the net exports and in the aggregate demand. (e.g. Taylor (1995), Obstfeld and Rogoff (1995)).

All channels in the standard transmission mechanism of monetary policy suggest aggregate effects of monetary policy on the economy and economic growth. According to this view, monetary policy affects the economy through the change (increase) in the levels of spending and output. It does not suggest heterogeneous effects for different sectors in the economy. The view of aggregate effects is part of the Keynesian AS-AD framework, also the theory of neutrality of money. The view of aggregate effects claims that monetary policy increases aggregate demand, which means higher revenues and profits of companies, and thus higher cash flows originating from the financial assets of these companies.<sup>76</sup> Higher cash flows lead to an increase in the value, total demand and prices of financial assets.

Not all explanations of the link between monetary policy and economic activity are based on the aggregate effects. Other theories and frameworks stress *structural effects*. Structural effects occur when the impact is heterogeneous and asymmetric in terms of different sectors of the economy or in terms of impact through time.

Monetary policy may have a structural and asymmetric impact on the different parts of the economy (e.g. consumption vs saving, various degrees of expansion of particular

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<sup>76</sup> The impact for owners of fixed income financial assets may come through reduced credit risk rather than higher cash flows.

sectors of the economy depending on their characteristics, unequal shift in the prices of different goods, different effects on the economy in the short and in the long run). Structural effects and aggregate effects are not mutually exclusive – structural effects often accompany aggregate effects. The important difference between them is that according to the logic behind structural effects, the shifts in the composition of the economy are important by themselves in explaining further development of the economy. It cannot be explained just by a change in the aggregate effects of increase in spending.<sup>77</sup>

### ***Cantillon effects***

The Cantillon effects are a good starting point for discussing structural effects of monetary policy. It explains how monetary policy, which results in production of additional money units and money supply, influences prices in the market. These effects are named after Irish-French economist Richard Cantillon (1680s – 1734). In his *Essay on Economic Theory* he addressed the question of how money supply affects prices:

Mr. Locke lays it down as a fundamental maxim that the quantity of goods in proportion to the quantity of money is a regulator of market prices [. . .] he has clearly seen that the abundance of money makes everything more expensive, but he has not considered how this happens. The great difficulty of this question consists in knowing in what way and in what proportion the increase of money raises the price of things (Cantillon, [1755]2015).

Cantillon goes on to point out that newly-created money affects individual prices and revenues neither equally nor simultaneously. This implies that an increased money supply does not only influence the general level of prices, but also relative prices.<sup>78</sup>

The first market participants who receive the newly created money exchange it for goods and acquire them still at old and lower prices and they are able to enjoy higher

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<sup>77</sup> For example, a monetary policy-induced increase in consumption and investment spending increases aggregate demand in the Keynesian framework and this increases the output. This is an aggregate effect. If spending on consumption increases to a higher extent than on investment, in the Austrian business cycle theory, the economy becomes less future oriented and its future productive potential is reduced. This is a structural effect.

<sup>78</sup> The present paragraph and the two subsequent ones have previously been published in Žukauskas and Hülsmann (2019, p. 130).

standards of living. A higher money supply thus translates into a higher demand and higher prices for the goods that the first recipients of new money choose to buy. As a consequence, providers of these goods then also enjoy higher incomes, so they increase their demand and in turn increase prices of the goods that they choose to buy. Eventually an increase in the new money units will ripple through the economy having the effect of increasing demands and raising prices of goods.<sup>79</sup>

It is important that market participants who receive the new money early on and exchange it for goods benefit in comparison with those who get the newly created money later. Therefore, an increase in money supply is never neutral. The original recipients of the new money enjoy higher standards of living at the expense of later recipients. The redistributive effects of the Cantillon effect have been discussed, modelled and empirically tested by Andrei, Herskovic, and Ledoit (2017), Dorobat (2015), Daley and Wagner (2004), Hülsmann (2014a) (with focus on the effects on the structural pattern of economic activity), Agitis and Pitelis (2001) (with focus on interclass income distribution) and others.

Cantillon effects explain how an increase in money supply has a different effect on the prices of different goods through time. This adds an important structural dimension to the impact of monetary policy on the economy. If prices of different goods and different sectors in the economy react differently to increased money supply, this also means that it has different effects for financial assets representing these sectors.

### ***Austrian business cycle theory***

Another, more recent theory which explains structural effects of monetary policy on the economy is the Austrian business cycle theory. Macroeconomics of the Austrian school of economics has a distinct feature which distinguishes it from other schools of economics thought. This feature is the theory of intertemporal capital structure. Capital, according to this theory, is not homogenous. All capital goods belong to different stages of production. Some capital goods are specific to a particular stage of production; others can be shifted from one to another (Garrison, 1991). Every consumer good has to pass through many successive stages of production when it

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<sup>79</sup> Cantillon effects are to be understood in counterfactual and not historical terms. They provide us with insights about the dynamics of relative prices as opposed to what it would have been otherwise without an increase of money supply.

eventually reaches the final consumer. The amount of capital accumulated in the economy is a measure of the length of the production process. In capital rich economies there are many stages of production, because capital enables more productive, but more technically difficult, roundabout production processes. In poor countries there are only a few production stages. When capital is accumulated and invested, new stages of production are added and this creates progress and higher productivity, enabling more consumption in the future (Haberler, 1996). The development of capital theory in the tradition of Böhm-Bawerk is largely attributable to Mises (1949/1998) and Hayek (1967).

The authors of the Austrian business cycle theory reveal structural effects of monetary policy and the fiat money system. This theory is an explanation of regularly occurring booms and busts in the economy originally developed by Ludwig von Mises and then elaborated by Friedrich A. Hayek and other economists in the tradition of Austrian school of economics. According to the Austrian business cycle theory, business cycles are caused by monetary policies of central banks:

In the broadest terms, the Austrian theory is a recognition that an extra market force (the central bank) can initiate an artificial, or unsustainable, economic boom. The money-induced boom contains the seeds of its own undoing: the upturn must, by the logic of the market forces set in motion, be followed by a downturn. (Garrison, 1989, p. 7)

Non-homogeneity of capital according to Austrian capital theory means that capital is most productive only when its allocation at different intertemporal stages is right. A flawed allocation of capital at different stages reduces long-term productivity of the economy. Thus, at the heart of the Austrian business cycle theory are interest rates, which play the role of resource allocation to different stages of production. According to the theory, in a free market, interest rates are determined by the time preference of all individuals in the economy. Time preference is a notion of how much people prefer present goods to future goods (Mises, 1996). It is closely related to the time value of money and means that people tend to postpone their consumption only for a premium. This premium is an interest rate.

It is important that people's time preference also determines the extent to which people save and invest as compared to how much they consume. For example, if people's

time preference declines, they will save more. More saving will reallocate more funds to the loanable funds market and this will lower the interest rate. Lower interest rates will allow entrepreneurs to start more investment projects that will be sustainable in the long run, since resources are being transferred from consumption to investment. So an interest rate which is sustainable with a long-term growth of the economy and which balances saving and investment on one side and consumption on the other is called a natural interest rate.

The natural rate of interest<sup>80</sup> which depends on the balance of saving and consumption and ultimately on the time preference of market participants plays the role of

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<sup>80</sup> The notion of natural interest rates goes back to Knut Wicksell. Wicksell used the notions of a market rate and a natural rate to explain how money and prices move from one equilibrium level to another level in the context of the Quantity Theory of Money.<sup>80</sup> He famously called this process a cumulative process. The market rate in this process is the actual value of the real interest rate, while the natural rate is the equilibrium value of the same variable which represents a neutral monetary system.

In the *Interest and Prices* Knut Wicksell describes natural interest rate:

There is a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them. This is necessarily the same as the rate of interest which would be determined by supply and demand if no use were made of money and all lending were effected in the form of real capital goods. It comes to much the same thing to describe it as the current value of the *natural rate of interest on capital*. (Wicksell, [1898]1936, p. 102)

Also:

It is not a high or low rate of interest in the absolute sense which must be regarded as influencing the demand for raw materials, labour, and land or other productive resources, and so indirectly as determining the movement of prices. The causative factor is the current rate of interest on loans as compared with what I shall be calling the natural rate of interest on capital. This natural rate is roughly the same thing as the real interest of actual business. A more accurate, though rather abstract, criterion is obtained by thinking of it as the rate which would be determined by supply and demand if real capital were lent in kind without the intervention of money. (Wicksell, [1898]1936, p. XXV)

Keynes (1936/2018) and the General theory changed the way in which natural interest rates and saving-investment coordination were analyzed. Before the General Theory, the Wicksellian tradition did not make a distinction between “saving exceeds investment” and “market rate exceeds natural rate,” they were interchangeable. They both described intertemporal disequilibrium. The proposition about disequilibrium could have been defined in terms of *quantities* as well as in terms of *prices*. It was not the case for Keynes. He claimed that if saving and investment were always equal, the interest rate could “not be governed by them, also. Also, that interest rates could not coordinate saving and investment decisions (Eatwell, Milgate, & Newman, 1987, p. 610). This made Keynes to substitute the liquidity preference theory on interest rates for loanable funds theory, and he basically abandoned the concept of a natural interest rate (Leijonhufvud, 1981, p. 169).

In recent works a natural interest rate is defined as an interest rate to which the economy tends to in the medium to long run. “*It is the rate that would prevail in general equilibrium and, according to Wicksellian terminology, the rate that equates the ex-ante supply of savings (by households) with ex-ante demand for investment (by firms).*” (Browne & Everett, 2005, p. 123). There are three basic methods of estimation of a natural interest rate. The first one is the calculation of a natural interest rate by using financial market indicators (e.g. Crespo and Ernest



coordinating capital to different stages of production. This is another distinctive feature of the Austrian capital theory, in that it assigns a very important role to interest rates. Garrison (2002, p. 6) illustrates this point:

Classical economists saw the rate of interest, also known as the rate of profit, as the price of capital. Keynes, who clearly rejected this view, would have us believe that the shadow [interest rate] is actually being cast by money. Keynes's critics, particularly the members of the Austrian school, took the rate of interest to reflect a systematic discounting of future values <...>. The centrality of the interest rate derives from its role in allocating resources – and sometimes in misallocating them – within the economy's capital structure.<sup>81</sup>

The way that the allocation of capital works is that a lower time preference leads to more saving which then leads to lower interest rates and more investment into longer<sup>82</sup> and more productive production processes.

According to the theory, central banks pursuing expansionary monetary policy artificially reduce interest rates and increase the money supply. Thus credit expansion occurs. It is also supported by fractional reserve banking that lets banks expand credit beyond their assets. Additional credit and low interest rates stimulate economic activity. Projects that were not profitable in earlier circumstances become profitable. Malinvestment<sup>83</sup> occurs, which means that artificially low interest rates and additional credit are used to begin projects that are unsustainable in the long run. There are not enough natural resources to finish all the projects that were started due to the low interest rates and credit expansion. Therefore an economic boom eventually turns into

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(2007), Bomfim (2001), Christensen (2002), Browne and Everett (2005). The second is by using statistical methods (e.g. Crespo Cuaresma, Gnan, and Ritzberger-Grünwald (2004)). The third method is modeling (e.g. Giammarioli and Valla (2003), Smets and Wouters (2003), Laubach and Williams (2003), Mesonnier and Renne (2007)).

<sup>81</sup> By "cast by money" Keynes meant that interest rates could and should be influenced by changes in the credit and money supply.

<sup>82</sup> Longer in the number of stages and amount of capital used, not necessarily in terms of time.

<sup>83</sup> Malinvestment is called "An investment in wrong lines which leads to capital losses. Malinvestment results from the inability of investors to foresee correctly, at the time of investment, either (1) the future pattern of consumer demand, or (2) the future availability of more efficient means for satisfying a correctly foreseen consumer demand. <...> Malinvestment is always the result of the inability of human beings to foresee future conditions correctly. However, such human errors and the resulting malinvestments are most frequently compounded by the illusions created by undetected inflation or credit expansion." (Greaves, 1974)

a bust when wrong investments must be liquidated and capital and resources reallocated.

The key aspect of the Austrian business cycle theory is that interest rates fall not because of changes of time preference and more saving, but due to an artificial credit expansion through monetary policy of central banks. Only in this way lower interest rates lead to unsustainable booms. Here, the lowering of the interest rate occurs not because of changes in people's time preference and resources going from consumption to investment and capital creation. Artificially lower interest rates are set by monetary policies despite people's time preference. Therefore artificially low interest rates do not balance saving and investment with consumption. Lower interest rates lead to more investment without people saving more and consuming less. This is the main source of unsustainability of economic activities which evolves from artificially low interest rates.

The Austrian business cycle theory explains how lower interest rates and credit expansion increase the demand for a) consumer goods and b) capital goods at the same time in the initial phase of a credit cycle.

Lower interest rates lower the *costs* of investment projects. An increase in profitability of investment projects depends on their length: the longer the project, the larger the increase due to a higher share of interest costs in the cost structure. This induces more investment in the long-term investment projects and therefore a higher demand for producer goods involved in developing these projects.

Investment projects, that with a higher interest rate would have been unprofitable, now look profitable due to the interest rate reduction. In order to undertake these investment projects, capital goods are needed. Therefore, as new credit is created, capital goods are demanded. However, if savings do not increase, neither does the supply of capital goods. The increase in the demand for capital goods meets a supply of capital goods that has not increased. Consequently, the prices of capital goods will be bid up. Consequently, the price of capital goods titles and the price of their production facilities also increase. Stocks are titles to capital goods and production facilities of capital goods. (Bagus, 2007, p. 62)

At the same time, due to a lower interest rate consumers can get cheaper consumer loans and their saving diminishes. Consequently, alternative costs of consumption (which is saving and investment) go down. Higher borrowing and lesser saving increase demand for consumption goods.

Bagus and Howden (2010) identify another important channel through which monetary policy impacts the capital structure of the economy. Just like capital is not homogeneous, neither are savings. Savings have a different term structure. Therefore, there is not just one market for loanable funds, but there are loanable funds markets for different maturities with different interest rates (Bagus & Howden, 2010, p. 66). Entrepreneurs engaging in investment projects and looking for financing have to make a decision on what maturity of borrowing (and saving) they will rely on. Borrowing for a shorter term than the project itself costs more, but relying on shorter term borrowing increases the risk of refinancing the loan. Bagus and Howden show that miscalculation of the ability to “roll over” the debt (maturity mismatching between the term structure of savings and the term structure of investments) leads to malinvestment. So a natural interest rate (or many interest rates for many loanable funds markets of different maturities) have also a function of coordination between investment durations and the corresponding availability of savings. Bagus and Howden (2010, pp. 81-82) conclude that:

Three phenomena foster excessive (i.e., nonsustainable) maturity mismatching: credit expansion, the existence of a lender of last resort and government bailout guarantees. Excessive mismatching caused by government interventions leads to an unsustainable misalignment of the term structures of savings and investments. As a result, financial institutions unsustainably borrow short and lend long. Long-term interest rates are reduced artificially and more long-term investment projects are undertaken than there will be real savings available to fund them. An unsustainable boom ensues.

To conclude, the Austrian business cycle theory suggests extensive structural effects of monetary policy on the economy across different sectors and across time. The intertemporal capital structure, which is an important part of this theory, explains how monetary policy impacts income and profit of companies in the sectors of consumer goods and producer goods at different stages of the boom-bust cycle. Companies in

consumer and producer goods industries where demand has increased will have higher incomes and higher profits. Financial assets representing these companies will generate higher cash flows (dividends in the case of stocks) and lower risk (e.g. in the case of bonds, where cash flows are fixed). Higher cash flow and lower risk will mean that the capitalized value of these financial assets will increase, which will then also bring an increase in the demand for and prices of these financial assets. Thus, the heterogeneous impact of monetary policy translates into a respective heterogeneous impact on the cash flows, value and prices of corresponding financial assets in different sectors of the economy.

***Empirical studies on the asymmetric impact of monetary policy on the economy***

There are many empirical studies that show the structural effects of monetary policy on the economy. Sterk and Tenreyro (2018) shows how expansionary monetary policy causes a boom in a durable goods sector. Lower interest rates cause a downward revaluation of public debt, which is a negative wealth effect for the private sector.

Households respond to the fall in wealth by increasing saving, which pushes the real interest rate down. Lower interest rates generate a substitution towards durable goods, causing a boom in the durable goods sector. (Sterk & Tenreyro, 2018, p. 136)

In an early paper using US data Bernanke and Gertler (1995) developed a methodology (structural vector auto regressions) and showed that the investment exhibited the most drastic fall following monetary contraction and this explained most of the contraction in the demand. The fall of investment was followed by a decrease in durable and non-durable consumer goods. The authors attributed the difference in the effects to the heterogeneous sensitivity of sectors to the credit channel of monetary policy.

A study by Arnold and Vrugt (2002) revealed that there are big differences in the impact of monetary policy on the production. They investigated production in 11 regions and 12 economic sectors in the Netherlands in the period from 1973 to 1993. Sectors which reacted the most to monetary policy were finance, construction, trade and industry. Differential regional effects of monetary policy were found to be significantly related to industrial composition.

Guiso, Kashyap, Panetta, and Terlizzese (2000) added to the literature on the disaggregated measurement of monetary policy transmission. The paper studied regional differences in the transmission of monetary policy among the European Union states. The authors raised an objection to the use of aggregate data in empirical studies. *"[...] the evidence from studies conducted at the aggregate level should be supplemented by systematic comparisons at the micro level"* (Guiso et al., 2000, p. 57). Regions may react differently to monetary policy depending on the differences in their behavior at the micro level. *"[...] similar firms and individuals in different countries behave differently.[...] Alternatively, similar firms and individuals might act similarly, but the mix of these agents across countries might differ."* (Guiso et al., 2000, p. 57). The study attributes the heterogeneous responses of countries to the factors of structural differences of the markets: the amount of capital stock, the quality of contract enforcement, the size of firms, labor market rigidity, the size of banks, and others.

A comprehensive done study by Dedola and Lippi (2005) gathered monthly disaggregated data from 21 industrial subsectors in five countries (France, Germany, Italy, the United Kingdom and the United States) from 1975 to 1997. It revealed that monetary policy has a weaker impact on food and textiles, and a stronger impact on heavy industries (iron and machinery and equipment, and vehicles). Furthermore, the impact of monetary policy is related to such factors as product durability, borrowing capacity of the firm and its size.

Peersman and Smets (2005) analyzed the effects of monetary policy on the output growth in 11 industrial subsectors in 11 Eurozone countries between 1980 and 1998. Results show that there are significant differences in the impact among industries and that there is a significant asymmetry in the impact during different phases of the economic cycle. Apostolakis, Giannellis, and Papadopoulos (2019) and Dominguez-Torres and Hierro (2019) offer more recent empirical studies on the heterogeneous effects of monetary policy on the countries in the Eurozone.

The discussion on the aggregate and structural effects of monetary policy on the economy shows, that monetary policy also influences the value of prices of financial assets through its impact on economic activity. Higher economic growth in general or of particular sectors means higher cash flows originating from financial assets representing these sectors. Higher cash flows mean higher value, total demand and

prices of these financial assets. Financial assets, which are the object of this effect, may differ according to the circumstances. Some theories and empirical studies suggest homogenous aggregate effects, while others point to asymmetric structural effects.

Moreover, the effect of monetary policy through its impact on economic activity may come not only through the realized economic activities (e.g. higher income and higher profits of companies), but through expectations about the future. Prices of financial assets are forward looking. A capitalized value of future financial flows is driven by expectations, because future financial flows from a particular financial asset are not known, they are uncertain. Changes in the expectations of future benefits from a particular financial asset change its price (Boulding, 1966, p. 157). If expectations of market participants about the future are updated in the way that bonds are seen as less risky, or stocks (of companies) more profitable, this will cause an increase in the total demand for financial assets, and the equilibrium price will increase.<sup>84</sup> Therefore, prices of financial assets may change due to the expectations about the impact of monetary policy on the future economic development. This is true even if these expectations are wrong. In the case when the expectations are wrong and monetary policy does not bring the desired effect on economic growth, prices of financial assets eventually adjust to the updated expectations.<sup>85</sup>

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<sup>84</sup> Boulding (1966, p. 157):

A rise in the price of an ordinary share may therefore mean solely that the market as a whole takes a more cheerful view of the prospects of the issuing company. A change of this kind may be called a change in the quality of a security. In a corresponding way, if the quality of any commodity rises, its price per unit of *quantity* may be expected to rise.

<sup>85</sup> When market expectations are far from the results of the actions of policymakers, central banks have a difficult choice between going against the expectations or risking economic imbalances:

However, if the market's expectations get too far out of alignment with those of the policymaker, the policymaker finds herself in a difficult situation. If financial markets expect easier policy than what the policymaker feels is appropriate and she chooses to accommodate the markets' belief, this suboptimal policy could lead to macroeconomic instability in the future. If, instead, the policymaker chooses to disappoint the markets, she risks increased volatility and an unwanted tightening of financial conditions. Even a policymaker who declares that surprising the markets won't deter her from following appropriate policy might find that this declaration is not time consistent when faced with such a choice. (Mester, 2020, p. 1)

## Impact through risk

Risk is a very important property of financial assets. Modern finance and the asset pricing theory mostly analyze financial asset prices in terms of their return and risk dimensions. In this section, we will analyze how monetary policy can affect risk associated with holding financial assets and thus influence the value and prices of financial assets.

Financial risk is defined as “any event or action that may adversely affect an organization’s ability to achieve its objectives and execute its strategies” or, alternatively, “the quantifiable likelihood of loss or less-than-expected returns” (McNeil, Frey, & Embrechts, 2005, p. 1). Risk is commonly classified into two groups according to the object of its effect. Risk can be either idiosyncratic or systematic (Cecchetti & Schoenholtz, 2015, p. 118).

*Idiosyncratic* (also, specific or unique) risk affects a particular group of people or particular firm(s). Whereas *systemic* (also, common) risk affects the whole system (the economy and market). Systemic risk in finance is usually understood as “failure of a major financial institution” that can “trigger a domino effect and many subsequent organizational failures, threatening the integrity of the financial system” (Horcher, 2005, p. 45).

In finance, the best known types of risks are market risk, credit risk and operational risk.

[...] best known type of risk is probably *market risk*, the risk of a change in the value of a financial position due to changes in the value of the underlying components on which that position depends, such as stock and bond prices, exchange rates, commodity prices, etc. The next important category is *credit risk*, the risk of not receiving promised repayments on outstanding investments such as loans and bonds, because of the “default” of the borrower. A further risk category that has received a lot of recent attention is *operational risk*, the risk of losses resulting from inadequate or failed internal processes, people and systems, or from external events. (McNeil et al., 2005, pp. 2-3)

It is hard to clearly distinguish between different types of risks. “*The boundaries of these three risk categories are not always clearly defined, nor do they form an exhaustive list of the full range of possible risks affecting a financial institution. There*

*are notions of risk which surface in nearly all categories [...] (McNeil et al., 2005, p. 3). One of these notions important for our current topic is liquidity risk, which is “[...] the risk of not being able to immediately liquidate or hedge a position at current market prices.” (Bervas, 2006, p. 64)<sup>86</sup>.*

In general, risk is uncertainty associated with holding financial assets. As discussed above, risk can have different sources and parameters and it is connected to the value of financial assets. In the framework of subjective value, it is reasonable to assume that risk is a negative property in the sense that a lower degree of risk is preferred over a higher degree of risk, other conditions being equal.

In the context of monetary policy and its impact on risks associated with financial assets, we will look at systemic risk as well as at credit and liquidity risks.

### **Systemic risk**

Money, monetary policy and financial markets are deeply interconnected. New money created by the central bank enters the economy through financial markets and financial institutions. Commercial banks also have the power to create money in the form of deposits by issuing loans. Financial markets are a vehicle through which central banks conduct monetary policy. Therefore, it is natural that price stability, which is the most common objective of central banks, is connected with maintaining the stability of financial markets in general, and commercial banks in particular.

The primary objective of the ECB is the maintenance of price stability,<sup>87</sup> as written in the Treaty on the Functioning of the European Union (2012), Article 127, section 1. However, section 2 lists basic tasks to be carried out by the ECB in achieving price stability, and one of them is directly connected to the maintenance of financial stability: *“to promote the smooth operation of payment systems.”* Moreover, section 5 of Article 127 states that ECB shall contribute to *“the prudential supervision of credit institutions and the stability of the financial system.”*

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<sup>86</sup> Also, Horcher (2005, p. 44):

Liquidity impacts all markets. It affects the ability to purchase or sell a security or obligation, either for hedging purposes or trading purposes, or alternatively to close out an existing position. Liquidity can also refer to an organization having the financial capacity to meet its short-term obligations.

<sup>87</sup> ECB's Governing Council has defined it as *“a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%.”*



There are different ways and instruments which are used by central banks in trying to increase the stability of the financial system.

Financial regulation:

- *Required* (also minimum or mandatory) *reserves* – deposits that credit institutions are required to hold on accounts with the central bank, calculated as a percentage of their short-term liabilities. In theory, this instrument limits the amount of loans that credit institutions can issue on top of the monetary base (the required reserve ratio determines the size of the money multiplier) and reduces the fragility of the banking system, which is inherent in the fractional reserve banking (e.g. Rothbard (1990)). However, this instrument currently performs only a limited role, since required reserve ratios are usually very low (in 2012 the required reserve ratio was lowered from 2 to 1 percent).
- *Mandatory requirements* applied for capital, leverage and assets held in the balance sheet and liquidity of the commercial banks (e.g. Basel III regulation, macro prudential regulation) with the aim to increase the ability of commercial banks to withstand financial stress.

Guarantees and financial help:

- *Deposit insurance* is an instrument which ensures that depositors of commercial banks will receive the money in their accounts up to some maximum amount if their bank fails. This instrument is aimed to reduce the possibility of the domino effect of bank runs when banks operate under fractional reserves.
- Instruments of *lender of last resort* are special lending programs or instruments for banks that face sudden deposit outflows. The idea is that the best way to stop a failure of a particular bank turning into financial panic is to make sure that all solvent commercial banks can meet withdrawal requests of their depositors.
- *Too big to fail* policies. Some financial institutions are treated as *too big to fail* or *too interconnected* to fail (Cecchetti & Schoenholtz, 2015, p. 371). In case of financial troubles, these institutions may receive direct financial help and guarantees or may be bailed out.

In addition to other risk, holders of financial assets face systemic risk, that is a risk that the value of financial assets will substantially decline because of the breakdown or collapse of the financial system. Financial stability, as one of the objectives of central banks and monetary policy, works like an insurance policy against systemic risk for the holders of financial assets. By reducing it, central banks reduce the overall risk of holding financial assets, which makes them more valuable than they would be otherwise.

### ***Credit risk***

Idiosyncratic (also, specific or unique) risks are risks that are specific to particular financial assets. We will discuss two types of idiosyncratic risks which may be influenced by monetary policy and central banks, namely credit risk and liquidity risk.

As discussed above, in order to maintain stability of the financial system, central banks implement measures which may target particular financial institutions. Instruments of *lending of last resort* and *too big to fail* policies lead to financial help for particular credit institutions in financial distress. These policies and instruments create a safety net which reduces the probability of bankruptcy of institutions eligible to participate in this safety net.<sup>88</sup> Thus, their credit risk, and specific risk associated with holding their financial assets, is reduced. Unlike in the case of systematic risk, this effect works only for particular financial assets, not financial assets in general.

### ***Liquidity risk***

Central banks and monetary policy have an impact on the liquidity and thus on the liquidity risk of particular financial assets. Let us first discuss the notion of liquidity (or marketability, saleableness) in the context of money, and then see how monetary policy influences liquidity of financial assets.

Analysis of the natural emergence of money in the economy explains that, as a commodity transitions to being money (a universally accepted medium of exchange),

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<sup>88</sup> Bernanke (2013, p. 11):

Through extending loans to commercial banks, central banks fulfil the function of a lender of last resort. This function is created to prevent bank failures and to provide necessary reserves to banks when no other market participants are willing to do that. So, the lender-of-last-resort function is carried when the central bank uses its power to provide liquidity to ease market conditions during periods of financial distress or panic

its liquidity or marketability greatly increases. Market participants start increasingly demanding it not for its direct use, but for being able to exchange it for other goods (given that it has the property of being a medium of exchange). In this case, the property of liquidity or marketability emerges naturally, and it creates additional preference and demand for commodity. In a commodity money system, the demand for money for its direct use as a commodity is negligible compared to the demand for money as a medium of exchange. The emergence of commodity money shows how a gradual increase in liquidity and marketability of a commodity creates additional preference and demand for it.

Emergence of money demonstrates different degrees of saleableness of goods. It also shows that the degree of saleableness is a very important property of a good. Goods are regarded as more or less saleable according to the degree to which they can be disposed of in the market at any convenient time at the current price. It is clear that some goods or commodities generate a bigger and more constant demand than other goods. They are universally wanted and they are scarce, so their supply is never perfectly satisfied. Menger discusses the saleableness as a property of an economic good, which makes it superior in trade:

And further, that the person who wishes to acquire certain definite goods in exchange for his own is in a more favourable position, if he brings commodities of this kind [saleable] to market, than if he visits the markets with goods which cannot display such advantages, or at least not in the same degree. Thus equipped he has the prospect of acquiring such goods as he finally wishes to obtain, not only with greater ease and security, but also, by reason of the steadier and more prevailing demand for his own commodities, at prices corresponding to the general economic situation—at economic prices. (Menger, 1892/2009, pp. 33-34)

*“[...] unlimited saleableness of money is only a special case — presenting a difference of degree—of a generic phenomenon of economic life, namely, the difference in the saleableness of commodities in general.”* (Menger, 1892/2009, p. 21). This connection between value and saleableness or liquidity can also be applied to financial assets. We have already discussed how financial assets, by being a part of the monetary

transmission mechanism<sup>89</sup>, create additional demand from the central bank or market participants. The demand for a particular financial asset by the central bank through direct purchases means that this financial asset becomes more liquid (saleable in the market) than it would be otherwise (without being a target of open market operations by the central bank). Similarly, a financial asset becomes more liquid if it can be pledged as collateral to the central bank. The property of being eligible as collateral creates additional demand for it from other market participants:

Central banks may create fiat money in order to lend it to other market participants. Such lending is usually “collateralized” or secured by the temporary transfer of already-existing financial claims to the central banks. Thus the demand for such claims increases because they may serve as collateral in central bank lending operations (collateral channel). (Hülsmann, 2014b)

The size of the collateral effect depends on the difference between market conditions for borrowing using a particular financial asset as collateral and the conditions of borrowing offered by the central bank. The more favorable borrowing conditions (e.g. interest rates, ratio of a loan to collateral (*shortcut*)) market participants can obtain at the central bank using a particular financial asset as a collateral, and the less favorable the borrowing conditions in the market, the more valuable the property of the financial asset accepted as a collateral at the central bank will be.

The reduction of liquidity risk of financial assets by them serving as part of the transmission mechanism of monetary policy is reinforced even more with the emergence of asset purchases as unconventional instruments of monetary policy. Asset purchases have two important characteristics which increase the liquidity effect (compared to the regular open market operations). First, they are bigger in size. Second, they target particular financial assets or asset groups.<sup>90</sup> Asset purchase programs are often implemented in response to financial stress in particular markets of financial assets (e.g. falling prices of particular financial assets or increasing yield spreads) and are aimed at increasing liquidity and prop up prices. In 2012 the ECB introduced outright monetary operations in response to the sovereign debt crisis in

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<sup>89</sup> Either by being purchased directly, or by being used as collateral to borrow from the central bank.

<sup>90</sup> The extent of targeting in open market operations depends on the broadness of the collateral framework.

Europe. Asset purchase programs were introduced by ECB in 2014, and one of their aims was to prop up prices of financial assets in particular markets.

Both ways of increasing liquidity of a financial asset (as a target of open market operations and being eligible as collateral) are similar in the way that they bring a financial asset closer to being a substitute for money. Increased liquidity enhances a financial asset's ability to be turned into (exchanged for) money at relatively low costs. Thus, its characteristics become more money-like. This diminishes the liquidity risk of financial assets and adds to their exchange (future sale) value, which is one of the sources of marginal utility in acquiring or holding a financial asset (the other being value derived from the claim, as discussed in section 2.2.1).

Reduction in the liquidity risk due to monetary policy (as in the case of credit risk) is first of all targeted at financial assets which are part of the transmission mechanism of monetary policy (either being accepted as collateral or purchased by the central bank). However, as discussed previously in this chapter, changes in the properties of financial assets that occur due to them being part of the monetary policy transmission mechanism spread to other financial assets to the degree that they are partial substitutes.

To sum up, monetary policy and central banks reduce the systemic risk of holding financial assets. Moreover, they reduce idiosyncratic risk (credit and liquidity risks) of holding particular (targeted) financial assets. A lower systemic risk means a higher value of financial assets *vis-à-vis* other goods, and a lower idiosyncratic risk means a higher value of particular financial assets *vis-à-vis* other financial assets and other goods. A higher value manifests itself as increased exchange and reservation demands for financial assets (which means a higher total demand) and consequently a higher price of the financial assets *vis-à-vis* other goods and other financial assets.

Increased exchange demand can come from two sources. First, market participants increase their preference towards a particular financial asset as opposed to other goods (other financial assets and other goods). In this case, exchange demands for them decrease. Second, market participants increase their preference towards a particular financial asset as opposed to money, since the financial asset gains in properties that allow it to be a less costly money substitute. In this case, the

reservation demand for money decreases. The combination of these two sources is possible.

### 2.4.5. Influence on the properties of money

We have analyzed how monetary policy can change properties and characteristics of financial assets and thus influence preferences of market participants towards them and their prices. Central banks as institutions holding monopoly on money can also influence properties of money and change preferences towards money. Here we will analyze what properties and characteristics of money central banks can influence and how this affects preferences of market participants towards money and financial assets (and ultimately the prices of financial assets).

The value of money and preference towards money depends solely<sup>91</sup> on the expectation of future prices and a future purchasing power of money.<sup>92</sup> Because of this future orientation, market participants' trust in the monetary system and monetary institutions (e.g. commercial banks) plays an important role. Central banks are certainly trust-producing institutions when it comes to money.

Much of what governments and central banks do has an influence on people's expectations and perceptions of the future exchange value of money. For example, legal tender means that debtors cannot legally refuse the money as payment and

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<sup>91</sup> Klein (1974, p. footnote on p. 446)

This property [the importance of money's resale value as a determinant of its service flow] may be considered unique to money. Although the current cost of other durable goods may be related to their future resale value, the real (non-liquidity) service flow from other goods is independent of their exchange value. The service flow from a money, on the contrary, is related solely to its market exchange value. *An individual may, for example, consider a refrigerator to be of very high quality and be correct independent of how anyone else values the refrigerator, while an individual's estimate of the quality of a money that completely disagrees with the market estimate must be incorrect* [emphasis added]. If everyone thinks a money is worthless, it necessarily is and therefore yields no monetary services. Increased future supply of other durable goods will decrease the value, but not the quantity, of the service flow yielded by goods currently purchased. [Emphasis added]

<sup>92</sup>Klein (1974, pp. 446-447)

Money differs from other durable consumer goods in the importance of its resale value as a determinant of its service flow. As a result, future supply and demand significantly affects the quality of money an individual purchases now. This characteristic of money plus the fact that fraud (unanticipated changes in the quantity of a firm's money) is costly to detect and react to in the money industry implies that consumer confidence and therefore firm brand names are of exceptional value relative to other inputs in the money industry.

amounts to the assertion by the government that individuals may use government courts and police to force acceptance of its money in discharge of debts (Klein, 1974, p. 448). Also, only legal tender can be used to pay taxes. Therefore, legal tender laws increase trust in money provided by the central bank. Klein (1974, p. 444) discusses the reasons why central banks are in an advantageous position of producing trust and confidence in money:

To explain the existence of a dominant monetary arrangement we must more carefully consider the nature of the production function for consumer confidence. Significant economies of scale probably exist in the production of information about reliability of a money. In addition, the costs of disseminating information about a particular industry are smaller the smaller the number of independent firms in the industry. The greater the homogeneity of products in an industry, the smaller the variance of the anticipated quality distribution in the industry. Since information about anticipated quality (predictability of prices) is a major determinant of the monetary-service flow from a money, we can therefore expect these considerations to be paramount and the value of a single quality product in the industry to be substantial. (Klein, 1974, p. 444)

In fact, the current monetary system where a central bank issues the monetary base (or base money) on top of which commercial banks can create money too (in the form of deposits supplied by different commercial banks) can be seen as a trust generating mechanism. By implicitly guaranteeing the solvency and liquidity of commercial banks, a central bank produces trust in the money created by different commercial banks. All deposit money created by the central bank are treated the same and exchanged at 1 for 1 ratio against base money.<sup>93</sup>

If central banks are trust producing institutions, how is trust exactly related to the purchasing power of money, and how does trust in money influence prices of financial

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<sup>93</sup> Klein (1974, pp. 441-442) claims that:

Present U.S. domestic monetary arrangements can usefully be described in terms of this model of multiple monies convertible into a single dominant money at fixed exchange rates. There is one dominant money (currency supplied by a government monopoly) and many privately produced nondominant monies (deposits supplied by different commercial banks). All the private monies are denominated in the same units as the government's money and legally convertible into the government's money by the private money issuers.

assets? In order to answer these questions, we first need to explore the quantity theory of money and to introduce the notion of the quality theory of money.

### **Factors in the demand for money**

*“The relation between the demand for money balances and its determinants is a fundamental building block in most theories of macroeconomic behaviour and is a critical component in the formulation of monetary policy.”* (Goldfeld, 1994, p. 131). Especially because economic depressions and inflationary booms can be interpreted as caused by the disequilibrium between the supply<sup>94</sup> of and demand for money (Yeager, 1956/1997)<sup>95</sup>.

Alternative theories propose various factors which determine the demand for money. E.g. Yeager (1956/1997, pp. 5-6) claims that the demand for money essentially depends on the volume of transactions and on the price level, with interest rates and expectations and business conditions also playing a role:

Households and businesses demand cash balances for what are usually classified as transactions, precautionary, speculative, and investment motives. Consideration of these motives shows that the total of cash balances demanded tends to be positively associated with the physical volume of transactions paid for in money (which depends in turn on payment practices and other institutional conditions, on the human and business population, and on the level of production or real income) and with the level of prices and wages. Interest rates and expectations of future price levels and business conditions also presumably have some effect on the demand for money.

Yeager (1956/1997, p. 7) compares money to any other commodity by saying that the number of money units that people demand varies inversely with the purchasing power as the value of the unit: we want to hold more units of any good if its value is higher.

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<sup>94</sup> Throughout this dissertation the “supply” of money will mean the available total stock of money. In cases when the argument will revolve around the effects of the production of new money, it will be indicated accordingly (e.g. “increase” or “change” in the supply of money).

<sup>95</sup> Yeager (1956/1997) views the equality between the demand for money and supply of money as the equilibrium condition and identifies disequilibrium in the money market as the primary cause of depression and inflationary boom. Depressions occur when there is an excess demand for money, in the sense that people want to hold more money than there is in existence. Inflationary booms occur when there is an excess supply of money, in the sense that more money exists than people want to hold.



And, as with other goods, there is some value or purchasing power of a money unit that equilibrates the amounts demanded and supplied.

According to Laidler (1971), a stable demand function is a characteristic monetarist belief and it is also supported by empirical evidence. By “stable” Laidler means that money holdings “*can be explained [...] by functional relationships which include a relatively small number of arguments*” (Laidler, 1982, p. 39).

In practice a “small” number of arguments has meant three or four – typically including a scale variable such as income, permanent income or wealth, an opportunity cost variable such as nominal interest rate or some measure of the expected inflation rate, and, if nominal balances have been the dependent variable, the general price level. (Laidler, 1982, pp. 39-40)

The liquidity preference framework emphasized the opportunity cost as a factor of money demand. The demand for money depends on the tradeoff between the liquidity of holding money and the opportunity cost of holding money which is the interest rate earned on holding less liquid but interest-earning alternatives.<sup>96</sup> To this day authors name different factors of the demand for money balances, but the most prominent variables include the interest rate, the level of income, the price level, the number of transactions, transaction costs, and preferences of money holders.<sup>97</sup>

In the traditional framework, monetary policy works through changes in the supply of money. One of the defining features of monetarism is a ‘quantity theory’ approach to macroeconomics which is “*a view that fluctuations in the quantity of money are the dominant cause of fluctuations in money income*” (Laidler, 1982, p. 3). Since the money demand curve is downward sloping,<sup>98</sup> an increase in the supply of money equilibrates the money market at a lower interest rate and a higher quantity of money demanded.<sup>99</sup> Shifts in the supply of money, interest rate and amounts financial assets

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<sup>96</sup> See e.g. Modigliani (1944), Tobin (1958).

<sup>97</sup> See e.g. Goldfeld (1994), Serletis (2007).

<sup>98</sup> Lower interest rate means lower opportunity cost of holding money which increases the quantity of money demanded.

<sup>99</sup> Modern monetary economics often uses the quantity theory of money and exchange in explaining the purchasing power of money. The quantity theory of money is expressed with the Fisherian equation of exchange,  $MV = PY$ , where  $M$  is the quantity of money,  $V$  is its velocity (i. e., rate of circulation),  $Y$  is real output and  $P$  is the price index of the output.

held in the hands of market participants in turn affect the economy (and ultimately the aggregate demand) through different transmission channels.<sup>100</sup>

It is important that, according to the traditional view, the supply of money is essentially the key element through which central banks conduct monetary policy. Monetary policy-induced changes in the supply of money are part of the transmission mechanism of monetary policy, and the shifts in the demand for money are not.

### **The subjectivist nature of the demand for money**

The theory behind monetarism and stable money demand function tends to overlook the subjectivist nature of the demand for money. The quantity theory of money which was formulated by Fisher (1911) and restated by Friedman (1956) still dominates the way economists look at the purchasing power of money. This theory focuses on the supply of money and it does not explicitly suggest a role for subjective factors, which determine the demand for money. *“While such an analysis is not obviously incorrect, the attention the equation affords to past quantities, both of money and nominal transactions, obscures the real problem at hand regarding the value of and demand for the monetary unit.”* (Bagus & Howden, 2016, p. 110). Historically the qualitative (or demand-side) approach precedes the modern focus on the quantitative (supply-side) factors in the analysis of the value of money:

A long history of qualitative and demand-side analysis predates the modern attention to supply-side factors determining money’s value. Early authors such as Mariana ([1609] 1994) and Petty (1662) illustrate this long tradition of the quality theory of money. Smith ([1776] 1863) explains the origin of money by pointing to the importance of certain qualities such as a commodity’s divisibility and durability. Similar discussions of the qualities of a “good” medium of exchange are found in the classic works of Say ([1803] 1843), Mill ([1848] 1909), and Senior ([1850] 1854). Menger (1871/2007) explained the origin of money as a market process whereby commodities with certain marketable qualities prevail at becoming generally accepted exchange media. By the time Jevons ([1875] 1876) wrote his treatise *Money and the Mechanism of Exchange*,

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<sup>100</sup> See Mishkin (1995), Taylor (1995), Bernanke and Gertler (1995) on the channels of conventional instruments and Gagnon et al. (2011a), Campbell et al. (2012), Bauer and Rudebusch (2013), Kuttner (2018, p. 126) on the unconventional instruments.

the characteristics or qualities of “good” money were generally known (and are still today summarily detailed in most introductory monetary economics texts). (Bagus & Howden, 2016, pp. 111-112)

Half a century ago Hendershott (1969) claimed that the emphasis on the quantity of money in judging the impact of monetary policy on the economy was misplaced. He claimed that the emphasis on the quantity of money was due to two factors: (1) an attractive simplicity of the naive quantity theory of money, and (2) historical correlations between money supply ( $M$ ) and output ( $Y$ ). He continued to show how, instead of a growth in money supply causing an increase in output, the causal link was the opposite.

As mentioned before, some economists, predominantly those in the Austrian school of economic thought, clearly identify that the demand and value of money is subjective and that prices in the market do not emerge in a deterministic fashion as a result of just the supply of money.

There are factors that may increase or decrease the demand for money, e.g. changes in the population size, in the division of labor, in the rhythm of payments during various seasons of the year, in the efficiency of settlement and claims institutions, etc.. These might be considered objective factors. But these objective factors influence the demand for money always and everywhere through the subjective value judgements of market participants. (Žukauskas & Hülsmann, 2019, p. 129)

Also:

All these factors indeed influence the demand for money and the height of the various individuals' and firms' cash holding. But they influence them only indirectly by the role they playing the considerations of people concerning the determination of the amount of cash balances they deem appropriate. What decides the matter is always the value judgments of the men concerned. The various actors make up their minds about what they believe the adequate height of their cash holding should be. They carry out their resolution by renouncing the purchase of commodities, securities, and interest-bearing claims, and by selling such assets or conversely by increasing their purchases. With money, things are not different from what they are with regard to all other goods and

services. The demand for money is determined by the conduct of people intent upon acquiring it for their cash holding. (Mises, 1949/1998, p. 404)

The subjective demand for money is closely linked to the recognition that money is a good. Like any other good, market participants demand money for its valuable services. According to Hutt (1956), money is productive in exactly the same sense as other goods in the economy. Money held provide valuable services, and thus they derive their value from their power to provide these services. The amount of money, which market participants decide to hold, is determined by the marginal utility of its services. In fact, this means that money has a “*prospective yield (of “utilities”), which invites the holding of money, as the normal return to investment*” (Hutt, 1956, p. 198). The demand for money is effectively the demand to hold. It stems from the value of being in a position to acquire other things at “*the most profitable time, or at the most convenient time*” (Hutt, 1956, p. 206). Thus, holding money is not forgoing the yield which could be earned by holding other interest-bearing assets. By holding money, one earns a non-pecuniary yield in the form of money services.<sup>101</sup>

Horwitz (1990) applies subjectivist principles to the demand for money as well and criticizes “*neoclassical and Keynesian models that portray the only opportunity cost of money held as interest-bearing securities*” as over-simplified. His approach claims that the choice to hold money depends on the utility of the most valuable alternative forgone:

When an actor is facing a decision to hold wealth in the form of money, she is deciding between a number of prospective utility streams. We can broadly categorize those streams as the utility from non-financial assets and the utility from both the availability and interest returns from non-money financial assets. (Horwitz, 1990, p. 465)

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<sup>101</sup> Also Hutt (1956, p. 207):

The fact that we hold money assets for any period at all indicates that, although we do not want to use these assets *in any other way*, their services *do* occupy a place on our scale of preferences, just like the services of all the other capital resources which we refrain from exchanging.

Most importantly, the demand for money is subjective, since only the chooser can determine the utility that this choice provides. Moreover, the cost of holding money is subjective because it is never objectively realized.

What is given up in a choice is by definition what was not chosen, so the "measure" of that cost must necessarily be the expected utility of the sacrificed alternative. Such expectations can be definitively described only by the chooser." (Horwitz, 1990, p. 465)

The subjectivity of the demand for money brings us back to monetary policy. If the demand for money balances has an important subjective element to it, the demand for money can be influenced, but it is not mechanically determined by such factors as income, the price level, interest rates or others. Then central banks and monetary policy may influence the amount of money that people are willing to hold not just through the manipulation of the money supply and interest rates. The subjectivist approach to the demand for money allows us to recognize that the impact of central banks on money (and prices) may be much broader. And this is exactly what recent literature claims on the quality of money.

### **The quality of money and its dimensions**

The recognition of the subjective nature of the demand for money leads us to the notion of the quality of money. The theory of the quality of money maintains that the demand for money depends on the quality of money. The quality of money can be defined as *"the capacity of money, as perceived by actors, to fulfil all its main functions, namely to serve as a medium of exchange, as a store of wealth, and as an accounting unit"* (Bagus, 2009, pp. 22-23). *"[...] the quality of money is one of the important factors, along with uncertainty, financial innovations (credit cards, ATM machines, MMMFs), frequency of payment, etc. that affect the reservation or cash-balance demand for money."* (Žukauskas & Hülsmann, 2019, p. 129).

Money supply, according to this view, is just one of the factors of the quality of money. The total supply of money at any time does not matter in the sense that money can be used as a universal medium of exchange despite the amount of monetary units available (a lower amount simply means a lower price level). Money supply matters for the quality of money if we add the dimensions of time and changes in the supply of money. Changes in the supply of money influence the extent of the stability of the

purchasing power of money. However, there are a lot more factors or dimensions influencing the quality of money: *“As the purchasing power of money may change due only to a shift in the demand for money, the subjective valuation of money can change even with the expectation of a constant money supply.”* (Bagus & Howden, 2016, p. 111).

The idea behind the quality of money is that central banks, through monetary policy, influence other (besides money supply) characteristics of money that are relevant for money users. Shifts in these characteristics impact the quality and subjective value of money, and *“[...] changes in money’s quality affect the demand for money and, consequently, its purchasing power.”* (Bagus (2015, p. 19).

According to Bagus (2015), there are *“objective qualities of “good” monetary systems”* (p. 20). The quality of money is closely linked to the quality of a monetary regime, which can be defined as *“the capacity of a monetary system to provide an institutional framework for a good medium of exchange, store of wealth, and accounting unit.”* (pp. 19-20).

According to Bagus (2015), the *“[...] unit of account function is fulfilled by nearly all monetary systems equally well and it is impaired only in extreme situations.”* (p. 22). Thus, it is meaningful to concentrate on the characteristics of a good medium of exchange and a good store of value.<sup>102</sup> The main requirements for money as a medium of exchange are *“[...] low storage and transportation costs [...] easy handling, durability, divisibility, resistance to tarnish, homogeneity, and ease in recognition.”* (p. 23). However, *“[...] these properties hardly change today as paper-based fiat standards have eased the physical usability of the monetary unit, as well as the costs to provide it.”* (p. 23). Another *“[...] relevant property of a medium of exchange is the number of users. More users imply more demand for a medium of exchange. As more people accept it in trade, the medium of exchange is more useful.”* (p. 23). *“existence of ample non-monetary demand for money as either a consumer good or a factor of production”* (p. 23) is yet another important characteristic of a medium of exchange.

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<sup>102</sup> According to Röpke (1954), money’s functions often disappear in a certain order. First, money ceases to be a storage of wealth. Then, money loses its function as a unit of account. The last function that is lost is the a medium of exchange, and this usually happens during a hyperinflation.

However, in fiat-money systems, where money is not redeemable, it does not have this property altogether.

One of the most important characteristics of money in the function of its store of value is the possibility of increases in its quantity. "*Different monetary regimes allow for different mechanisms to increase the quantity of money, thereby influencing money's quality. Thus, monetary systems may set strict and less strict limits for increases in the money supply.*" (Bagus, 2015, p. 24). The stability of a financial system is also an important property of money and a factor of the store of value function of money.

There are monetary regimes that are more prone to generate business cycles, over-indebtedness and illiquidity than other regimes. Business cycles, over-indebtedness and illiquidity may provoke interventions and bailouts on part of the government or monetary authorities. In the wake of the bailouts the quantity of money is often increased, or even the quality of the monetary system is diluted (Bagus, 2015, p. 24).

Independence of a monetary regime from the government and restrictions set by the regime to eliminate or limit the manipulations by the government directed towards money are also important for money as a store of value. "*Interventions by the government often decrease the quality of money in its own favor by increases in money's quantity or through a deterioration in the reserves backing it.*" (Bagus, 2015, p. 25)

To sum up, According to Bagus and Howden (2016, p. 113), the quality of money in its functions as a store of value and a medium of exchange can essentially change in five ways:

1. Evolution of the quantity of money – the supply of money in existence today and in the future;
2. Redemption ratio and its changes (in the case of commodity money systems) – the amount of and value of assets or other goods that back the currency (that money can be redeemed into);
3. Conditions and stability of the banking system – a financially troubled, illiquid banking system increases risks of bail-outs, which may lead to a higher quantity of money (if financed through debt monetization);
4. Organization of the monetary authority – which can mean:

- a) Independence of a central bank (if a central bank follows directives from the government, this increases the risk of debt monetization to finance spending);
  - b) Accountability and transparency - if central bankers are accountable and responsible for their policies, and if there is transparency, this will improve the quality of money;
  - c) A central bank's constitution, that is its philosophy or doctrine (e.g. objectives and mandate of a central bank (price stability vs. ancillary aims of full employment, asset prices, stability of the financial system maintenance of a currency), the benchmark of price inflation, rule-based monetary policy vs. targeting of asset prices;
  - d) Staff and decision makers at the central bank who influence monetary policy.
5. Quality of a central bank's balance sheet – the quality of reserves and assets that money is backed with in the balance sheet of a central bank determines the central bank's ability to retain and defend the value of currency in the future.

Therefore, if we incorporate the quality of money in our analysis, we can understand how the purchasing power of money can vary with a constant money stock, namely, when the perceived quality of money changes. The quality of money affects the purchasing power of money first by altering the demand for money, which reflects the changed valuation of a fixed quantity of money on each person's value scales. When the quality of money improves, the demand for money and, consequently, its purchasing power will be higher than without this quality improvement. If a subjective valuation of money falls, people will reduce their cash balances and prices will increase.<sup>103</sup> Subjectivity of valuation and demand for money also means that changes in the perceived quality of money can be very abrupt (which would lead to a strong and quick change in the purchasing power of money), whereas changes in the quantity of money are usually gradual.

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<sup>103</sup> Parts of the present paragraph have previously been published in Žukauskas and Hülsmann (2019, p. 129).



## **Balance sheet of a central bank as a vehicle of monetary policy**

Balance sheet analysis plays a special role in the analysis of quality of money. Most factors influencing the quality of money are difficult to quantify. However, assets in the balance sheet of a central bank can be directly observed and assessed. The idea is that the quality of money can be analyzed indirectly vis-a-vis assets that back the monetary base and money supply (stock).

Moreover, analysis of the balance sheet becomes even more relevant in the context of unconventional monetary policy. Bernanke and Reinhart (2004) summarize the possibilities of unconventional monetary policy, when the short-term interest rate regulated by a central bank is zero and close to zero. The authors mention three possibilities that a central bank can effectively use to stimulate the economy when a reduction of interest rates is not an option anymore.

[...] (i) providing assurance to investors that short rates will be kept lower in the future than they currently expect, (ii) changing the relative supplies of securities in the marketplace by altering the composition of the central bank's balance sheet, and (iii) increasing the size of the central bank's balance sheet beyond the level needed to set the short-term policy rate at zero ("quantitative easing").  
(p. 85)

Notice that, in the first and second cases, the suggestion is that central banks can conduct monetary policy and influence financial-asset prices without actually expanding their balance sheet or increasing the money supply. Therefore, there is a reason to think that central banks can influence the economy and prices of financial assets without changing the supply of money.<sup>104</sup>

The central bank's assets enable it to pursue its monetary policy goals effectively through various instruments including open market operations, the discount rate and reserve requirements. The analysis of a central bank's balance sheet has become especially fruitful as central bankers have started to use compositional shifts of their assets directly for money policy. Zero interest rate policies test the limits of conventional monetary policies. In response, changes in the composition and size of central banks' balance sheets have been

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<sup>104</sup> The present paragraph have previously been published in Žukauskas and Hülsmann (2019, p. 129).

pursued. [...] Increased attention directed at central bank asset holdings has become a larger issue than in the past when central bank assets were more homogenous, i. e., primarily comprised of short-term government bonds. (Bagus & Howden, 2016, pp. 109-110)

Authors even suggest using the term “qualitative easing<sup>105</sup>” in cases when policy is directed towards changing the composition of a central bank’s balance sheet without changing the size of the balance sheet:

The average quality of the backing assets increases when newly bought assets are of a higher quality than the average of the existing assets. The average quality of the backing assets decreases when newly bought assets are of a lower quality than the average existing assets, a process known as “qualitative easing.” (Bagus & Howden, 2016, p. 115)

The connection between the quality of the assets in the balance sheet and the demand for money work through a) expectations about future monetary policy and the future purchasing power of money,<sup>106</sup> and b) capacity of a central bank to back the currency and banking system in case of financial and monetary trouble. A central bank’s balance sheet can be seen as a source of indirect redemption of the currency as well as a source of support of the banking system.

### **Expectations as a vehicle of monetary policy**

Preference towards money (and hence today’s purchasing power of money) is established by incorporating today’s information about different characteristics of (the quality of) money and expectations how these characteristics will influence the future purchasing power of money. So changes in relevant characteristics of money alter the

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<sup>105</sup>Bagus and Howden (2016, p. 115):

Quantitative changes to the monetary base adversely affect the quality of money as its backing reserves may be diluted. However, the quality of the assets of a central bank can change even with a constant money supply as the central bank substitutes its high quality assets by purchasing lower quality assets.

<sup>106</sup>Bagus and Howden (2016, p. 110):

While the value of a monetary unit is predicated on its usefulness in performing transactions, its demand will be based upon expected future prices that it will be used to purchase. Since future prices are determined by the interaction between the demand for money and its future supply, balance sheet analysis can give insight into what the investor can reasonably expect the central bank to be able to target for the quantity of money.

perceived quality of money, because they change people's expectations about the future value of money.

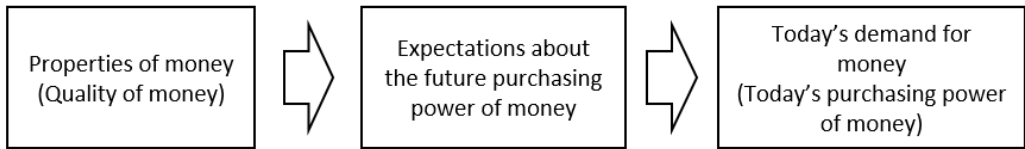


Fig. 25. The relationship between properties of money, expectations and purchasing power of money

These expectations can also be altered through a central bank's communication about future monetary policy. By *signaling* the future direction of monetary policy a central bank can change the preference of market participants towards money. E.g. signaling about a central bank's future commitment to low interest rates and inflationary monetary policy can influence market participants' preference and lower their demand for money as opposed to all other goods.

Subjective valuation of money and its qualitative parameters are very clear here. Just by signaling market participants about future monetary policy, a central bank can have an effect on current perceptions of market participants on the value of money (also on the demand for money and hence its purchasing power) without changing any parameters of the current monetary stance and policy. Market participants figuratively discount future monetary policy and its perceived impact on the future value and purchasing power of money, and by doing so they arrive at a subjective value of money today. This process is quite similar to asset valuation (where current value depends on discounted future financial flows).

Subjectivity plays a big role here, because market participants also have an individual understanding of how monetary policies influence the purchasing power of money. There is no agreement on this even in theory, therefore in reality market participants have different perceptions.

If market participants judge the central bank's signaling and commitments to future monetary policies to be good for economic growth and the value and purchasing power of money, this will increase their preference towards money and contribute to the current increase in the purchasing power of money. However, if the reasoning of a particular market participant is different (e.g. because they have a different

understanding of the connection between monetary policy and future economic growth and value of money), then their preference for money will shift to the opposite way. In a way the current purchasing value of money is a consensus by market participants as to how current and future monetary policy will influence the future value of money.

### **Financial repression and the demand for financial assets**

Another mechanism, which is partly related to the demand for money and financial assets, is financial repression. Financial repression is defined as a “*government’s strategy – supported by monetary and financial policies – to gain privileged access to capital markets at preferential credit conditions and divert resources to the state with the aim to secure and, if necessary, enforce public debt sustainability*” Riet (2018, p. 14). “*Financial repression occurs when governments implement policies to channel to themselves funds that in a deregulated market environment would go elsewhere.*” (Reinhart, Kirkegaard, & Sbrancia, 2011, p. 22).

The term “financial repression” was introduced by McKinnon (1973) and Shaw (1973) when they were criticizing policies conducted in emerging markets that inhibited economic growth. The term was later used to describe financial systems in emerging markets before the financial liberalization which started in the 1980s (e.g. Easterly (1989), Giovannini and Melo (1993), Age´nor and Montiel (2008)). Reinhart and Sbrancia (2015, p. 296) document that “[...] *financial repression was also a norm for advanced economies during the post-WWII period and in varying degrees up through the 1980s.*”

Financial repression manifests itself in different forms (Reinhart & Sbrancia, 2015):

- Explicit or indirect reduction of interest rates (through explicit regulation or a cap on lending rates or low interest rates maintained through monetary policy);
- Direct ownership of banks and other financial institutions by government (e.g. in China or India) or extensive government management thereof (e.g. in Japan);
- Creation and maintenance of a captive domestic market for government debt, which is achieved by mandating banks to hold government debt via capital requirements, or by disincentivising or even prohibiting to hold alternative assets (e.g. through capital account and exchange control, regulatory

measures requiring that institutions (e.g. banks or pension funds) hold government debt in their portfolios, transaction taxes on equities (see Campbell and Froot (1994)), prohibitions on gold transactions);

- Restricting competition and entry into the financial industry or by directing credit to certain industries (see Beim and Calomiris (2001));
- Capital controls and restrictions on the transfer of assets abroad.

Reinhart (2012) argues that a modern return of financial repression has been taking place since 2008 in the form of “*massive purchases of government debt by central banks around the world*” and “*low nominal and real interest rates*” (p. 43), regulation of financial institutions (e.g. “[...] *Basle III provides for the preferential treatment of government debt in bank balance sheets via substantial differentiation (in favor of government debt) in capital requirements.*” (p. 43)), requirements for banks and other financial institutions to hold domestic debt, reemerging capital controls, and other.

In a recent extensive study focused on the European Union, Riet (2018) argues that the tools of financial repression have been applied in Europe to address the global financial crisis of 2008 in order to alleviate the serious challenges for fiscal policy in euro area countries. He argues that “[...] *national public debt management, EU financial regulation, EMU crisis management as well as ECB monetary policy have significantly supported euro area governments in dealing with their fiscal predicament.*” (p. 16). The governments and central banks have applied the tools of financial repression to relieve the sovereign liquidity and solvency problems.<sup>107</sup>

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<sup>107</sup> Riet (2018, pp. 293-299) discusses measures of public debt management, financial regulation and monetary policy that have the nature of financial repression:

Apart from taking austerity measures, they [euro area countries] actively persuaded domestic investors (retail savers, banks, pension funds and insurance companies) to maintain and increase their sovereign credit exposure while some governments used forceful measures to overcome their budget constraint. This financial repression to increase the domestic demand for government debt also exploited the ECB's exceptional liquidity operations and was further assisted by supervisory pressure on banks to keep capital in the country and to repatriate capital held abroad. Greece and Cyprus temporarily restricted capital outflows in turbulent market conditions when savers and investors feared for expropriation of their assets. [...]

They [European authorities] set out to limit the scope for excessive risk-taking, tighten prudential supervision and raise the size of required cushions in the financial sector. Conditional EU/EMU official assistance and ECB market support facilities for struggling euro area sovereigns were set up and major steps towards a European Banking Union were taken. The extensive overhaul of European financial governance was accompanied by special privileges for government funding and debt resolution, which were maintained

The theory behind financial repression and empirical studies have shown that the results of financial repression are lower saving levels (which means lower investment and thus a lower rate of economic growth) and capital misallocation, since savings are rechanneled outside of the organized financial sector (e.g. Fry (1978), Fry (1980), McKinnon and Grassman (1981), Jafarov, Maino, and Pani (2019)). This means that financial repression results in a lower demand for financial assets. Moreover, financial repression also leads to a diminished demand for money. Work or other non-monetary goods cannot be directly exchanged for financial assets. Money is always a medium of exchange through which non-monetary goods are traded for financial assets. Thus, if financial repression reduces the demand for financial assets, it also reduces the demand for money. Therefore, according to the theory, financial repression and the quality of money are related in the sense that they both reduce the demand for money.

Financial repression and the reduction of interest rates may also change the preferences of market participants for different types of financial assets. If interest rates are reduced, market participants may shift from fixed income financial instruments to financial assets which are more risky but offer higher returns, e.g. equities.

The quality of money and financial repression are connected not only because they both reduce the demand for money, but also because they both partly originate from the same policies. Riet (2018, p. 34) distinguishes between three categories of policies

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or newly introduced on prudential grounds and to preserve financial and monetary stability in the euro area as a whole.

The associated government favors are apparent in the captive sovereign credit markets created by prudential legislation for financial institutions which disregards the risks from large sovereign exposures; the reduced market pressure associated with new restrictions placed on short-selling of government bonds, buying sovereign default protection and issuing sovereign credit ratings; the proposed common financial transactions tax if it would exempt trading in government bonds; the availability of official rescue funds and market support facilities that might be exploited to excessively suppress sovereign bond yields in times of fiscal stress; the exceptional possibility for euro area countries to initiate a 'voluntary' debt restructuring while subordinating private creditors; and the apparent ease with which even insured savers might be expropriated when resolving a troubled systemic bank while introducing capital controls to prevent them from shifting their assets abroad. [...]

Following the global financial crisis, monetary policy rates reached the zero lower bound, which constrained the ability to respond to very low inflation with conventional interest rate cuts in a situation marked by a negative neutral real interest rate and in most cases a missing fiscal expansion. Central banks then applied forward guidance as well as credit and quantitative easing to directly push down the sovereign yield curve. These unconventional measures responded to secular stagnation and were in economic terms equivalent to financial repression for the benefit of governments.

which resulted in financial repression in the euro zone since 2008. These are public debt management (minimizing debt-servicing costs, maximizing fiscal stability), financial regulation (protection from market pressure, preferred treatment of public debt) and monetary policy (low policy rates, repair of sovereign bond markets, quantitative easing). Since the third category, namely, monetary policy, is also the one which determines the quality of money, financial repression is inevitably linked to the quality of money. Financial repression influences the conditions of saving through financial markets, and the quality of money determines the conditions of holding money (as a store of value and a medium of exchange). However, they both are influenced by monetary policy. Low current and future interest rates, a rapidly increasing money demand and high amounts of quantitative easing are manifestations of financial repression, and they result in a lower quality of money.

If financial repression is correlated through time with the quality of money, there might be competing effects on the demand for financial assets working at the same time. A reduction in the quality of money, as discussed above, suggests the substitution effect of a store of value from money to financial assets, which results in an increased demand for financial assets. At the same time, financial repression suggests a diminished demand for money and financial assets. Thus, the total effect is not *a priori* clear and is up to an empirical investigation of particular circumstances.

### **The quality of money and the demand for financial assets**

Finally, it is time to discuss how shifts in the perceived quality of money and preference towards money impact prices of financial assets. Firstly, we will look at a general case, and then we will turn to a special case when financial assets are seen as a substitute for money.

In section 2.3.3 on “Demand for money” we analyzed a general case about what happens to the price of financial assets when the preference and demand for money changes. We identified one of the possible reasons of changes in the demand for money related to monetary policy – a perceived change in the quality of money. Reduction in the quality of money diminishes both the exchange demand and the reservation demand for money (Fig. 23). Market participants are less willing to acquire money in exchange (a reduced exchange demand for money) and current holders of money are more willing to sell (exchange) more of money units they already own in

exchange for other goods (a reduced reservation demand for money). A reduced reservation demand for money means an increase in the exchange demand for non-monetary goods (including financial assets). A reduced exchange demand for money means an increase in the reservation demand for non-monetary goods (including financial assets). This implies that the total demand for and prices of non-monetary goods (including financial assets) increase, because the total demand for money (exchange demand plus reservation demand) decreases.

A special case of a reduction of the quality of money and reduction in the total demand for money is when financial assets are sought as a substitute for money (Žukauskas & Hülsmann, 2019). In this case, a reduced quality of money tends to diminish the total demand for money and to increase the total demand for financial assets (more than in the general case above). Let us discuss possible reasons and circumstances in which financial assets can be seen as a substitute in case of the reduction in the quality of money.

As discussed above, price stability is one of the most common and important objectives of central banks and monetary policy. Price stability is usually understood as a constant and low price inflation.

In section 2.3.3 on “Stocks of other goods” we analyzed how an increase in the stock of goods, which is a result of a developing economy, causes the general price level to go down in the case of a constant money supply (in the sense of stock). This is due to the demand-for-money effect. Thus, if a central bank wants to have a constant price inflation, what it has to do is to increase the money supply (stock) by a rate which would a) offset an increase in the demand for money stemming from an increased stock and diversity of goods *plus* b) increase money balances to the extent that will result in a surplus in money balances and an increase in the spending, demand and prices of goods by the desired rate. Therefore, central banks cause price inflation through a constant increase in the money supply (stock). In the case of a relatively constant money supply (stock), the general price level would decrease.

Different environments of price inflation has an effect on the instruments of saving that market participants prefer. The environment of a decreasing price level offers a reasonably simple option to save in cash. This is because money in a price deflationary environment increases in value in time, due to a constant decrease in prices the



purchasing power of money grows. Then the easiest way to save is to hoard cash. It does not require any specific knowledge and is easily available to anyone who acquires money.

However, in an environment of constantly increasing prices, saving by hoarding cash is detrimental, since the cash saved decreases in its purchasing power every year and is therefore worth less in the exchange value. Therefore, the only sensible way to save is to invest into interest or return bearing assets. Rather than hoarding their savings in cash, one way to protect savings is to turn to financial assets hoping that dividends and interest payments will compensate for the shrinking purchasing power of money:

The permanent increase of the fiat money supply typically creates a positive price-inflation rate. In this case, savings in the form of cash hoarding are no longer a suitable way to preserve wealth, and thus savers and investors increasingly turn to financial markets (price-inflation channel). (Hülsmann, 2014b, p. 11)

This way of saving is less accessible since it requires specific knowledge of investment and it requires engagement with market participants (investment firms, banks etc.). This produces two effects.

First, since a profitable way to save in an inflationary environment is more difficult, the level of saving decreases. “<...> *the permanent price-inflation that typically results from fiat-money production destroys one major alternative to financial investments, namely, cash hoarding and thus discourages savings.*” (Hülsmann, 2014b, p. 13).

The other effect is directly related to our analysis – in an inflationary environments interest and return bearing assets become more demanding than they would be in the deflationary or constant price level environments. Some interest and return bearing assets are financial assets. Hence, a constant increase of the general price level encourages savers to invest into financial assets and increases the preference of savers towards financial assets.

It is important that price inflation is not the only reason why people may shift from holding money to holding financial assets. Other dimensions of the quality of money discussed above (e.g. changes in the institutional framework of the monetary system, changes in the conditions and the stability of the financial system, financial repression)

may also incentivize shifts. The key take away is that financial assets are a reasonable store of value in case of a decrease in the quality of money, so there is a theoretical reason to assume that the demand for money and the demand for financial assets are negatively related. Let us apply the total demand approach in spelling out the link.

Decreased willingness to hold money manifests itself as a reduction in the reservation demand and the exchange demand for money. The surplus of money balances that occur due to a decreased reservation demand for money will be spent on financial assets, which will subsequently increase the exchange demand for financial assets. A lower exchange demand for money increases the reservation demand for financial assets because people will be more willing to hold on to their financial assets - not only because their exchange demand for money has decreased (as in the general case above), but also because their preference for financial assets as substitutes for money has increased. Therefore, the result of a shift from money to financial assets as a means of saving increases the total demand for financial assets and their prices.

*A priori* it is impossible to say which part of the surplus in money balances will be spent on financial assets and which part on other goods (including investment goods). The share of surplus money balances which will be directed towards financial assets depends on what the alternatives of saving and investment are besides financial assets (e.g. real estate, precious metals, antiques, etc.) The more alternatives there are, and the more attractive they are, the less of the surplus money balances will be directed towards financial assets, and the more will be directed towards alternative means of saving.

#### **2.4.6. Influence on the properties of other goods**

Monetary policy and central banks do not usually target the preferences of market participants towards other goods (non-monetary and non-financial goods). However, some authors claim that long-term implications of monetary policy and fiat-money systems include not only economic, but also cultural considerations.

Newman (1984) relates postmodernism to the prevalence of inflation in the twentieth century. He makes a serious attempt to discuss cultural implications of price inflation. Cantor (1994) analyzes psychological ramifications of an inflationary environment through analysis and interpretation of short story by Thomas Mann. Hülsmann (2008)

claims that a fiat money system, which produces constant and unavoidable price inflation, creates inflation-specific institutions and habits and exerts a cultural and spiritual impact on society. Hülsmann (2016) highlights some of the cultural implications of a continuous and permanent expansion of the money supply and price-inflation. He argues that “[...] *the debt economy promotes short-termism and haste, insatiability, ugliness especially in architecture, and rationality traps. It also creates strong tendencies for willing political dependence and for a politicisation of society.*” (p. 23).

To the extent that monetary policy has cultural implications, it also impacts people’s preferences towards other goods, not only money or financial assets. However, cultural implications of monetary policy fall beyond the scope of this work. Therefore we will not investigate this question further, even if it is related to the price determinant of financial assets (demand for other goods).

#### **2.4.7. Summary of the impacts**

Using the total demand approach and price determinants, we were able to identify nine channels through which monetary policy impacts the prices of financial assets.

Impact through the influence on the stocks of goods:

1. Incentives to produce financial assets;
2. Money supply (stock);
3. Economic growth and the supply (stock) of goods and services;

Impact through the influence on the preferences for financial assets:

4. Direct demand for financial assets by the central bank and indirect demand through the collateral system;
5. Interest rate;
6. Demand for particular financial assets created through the regulation of financial markets;
7. Impact on the economy and the dimension of return of financial assets;
8. Changes in the dimension or risk of financial assets;

Impact through the influence on the preferences for money:

9. Quality of money and financial assets as a store of value.

The total demand approach incorporates all the channels of impact present in the standard transmission mechanism of monetary policy (these are threefold: money stock, direct demand for financial assets by the central bank and interest rates). Moreover, the combination of the subjective value theory and the total demand approach allowed us to identify more channels of impact. The main reason why the chosen theoretical approach was fruitful in understanding the connection between monetary policy and prices of financial assets was that it incorporated subjective valuations and preferences of market participants in the pricing of financial assets. This is an important contribution which allows us to identify those channels of impact that work not just through the additional flows of money into the market or changes in the interest rate. Additional channels manifest themselves in changes of subjective preferences of market participants towards financial assets and towards money.

Fig. 26 below shows the theoretical framework of the influence of monetary policy on the prices of financial assets developed in the second part of this dissertation. The dotted lines in the graph show that central banks have a direct influence on the stock of money and on the stock of and demand for financial assets. These impacts primarily originate from open market operations. Purchases of financial assets by central banks: a) increase the money stock, b) increase the exchange demand for financial assets by central banks, and c) reduce the stock of financial assets available in the market.

More importantly for this dissertation, monetary policy has an influence on the prices of financial assets by changing the properties of financial assets and money. The causal chain of the impact is the following. Monetary policy transforms some of the properties of financial assets and of money. The affected properties of financial assets are risk, return, liquidity, eligibility to be used as collateral, compliance costs related to capital and liquidity requirements. (These properties of financial assets were discussed in section 2.4.4). Moreover, monetary policy changes various properties of money which are important for the quality of money, e.g. the balance sheet of the central bank, evolution of the quantity of money, conditions and stability of the banking system, and organization of the monetary authority. (They were discussed in section 2.4.5 and will be developed further in 4.1.). Changes in all these properties in turn shift the value of financial assets and money, which manifests itself in the changes of the demand (exchange demand and reservation demand). Lastly, changes in the relative demand

for financial assets versus money cause changes in the prices of financial assets in the market.

This theoretical framework of the impact of monetary policy on the value and prices of financial assets will serve as the basis for empirical investigation, which will follow.

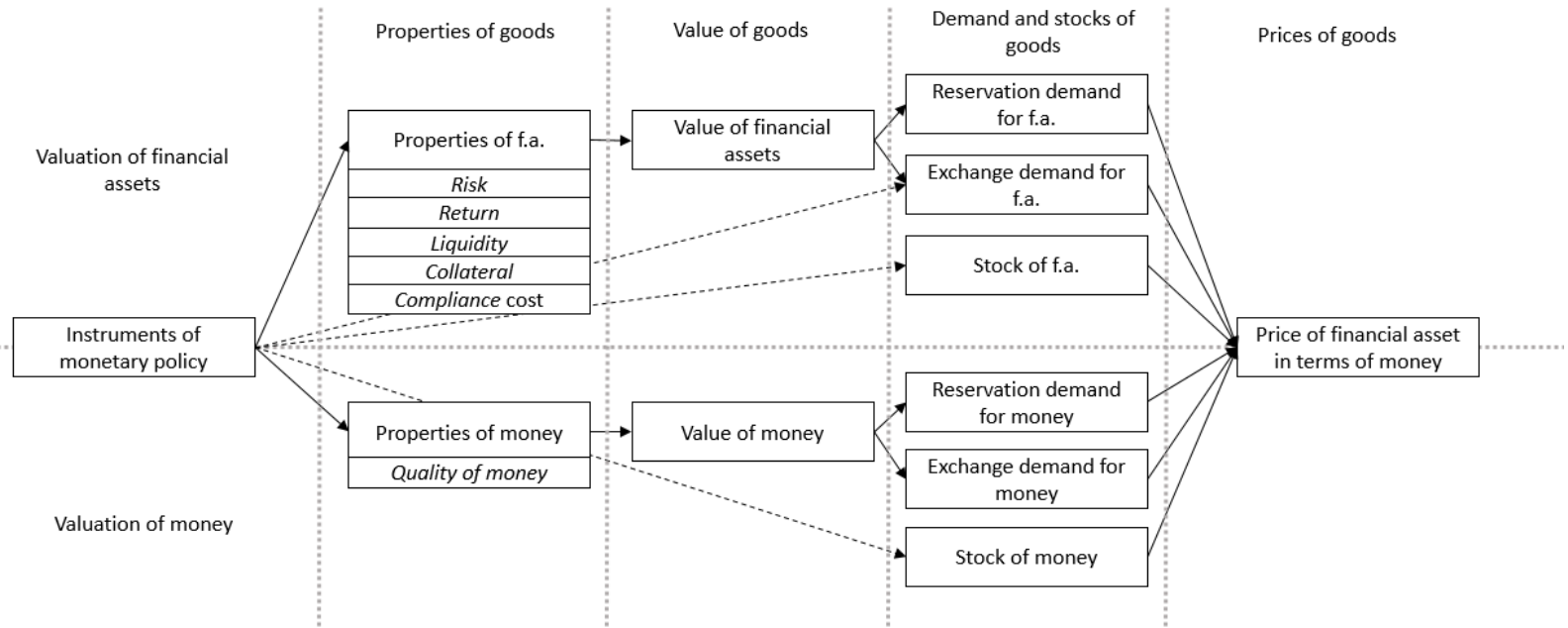


Fig. 26. Theoretical framework of the influence of monetary policy on the value and prices of financial assets

### **3. Methodology of the empirical research**

Previous parts of this dissertation focused on the theoretical aspects of financial asset pricing. A flexible conceptual framework of asset pricing was developed, which was based on the subjective value theory and the total demand approach. This framework allowed us to identify different channels through which monetary policy influences different price determinants and thus the prices of financial assets. Moreover, the analysis has identified some channels which were mostly overlooked in the standard view of the transmission mechanism of monetary policy as well as is in the standard models of asset pricing. The fifth objective of the dissertation is to apply the theoretical framework to empirically investigate the link between the monetary policy and prices of financial assets. This part of the dissertation will formulate the methodology of empirical research.

#### **3.1. The channel of the quality of money**

The theoretical framework of financial asset pricing developed previously allows to analyze different channels of impact of monetary policy. We have discussed how this framework can be used in conceptualizing the channels which are already well discussed in the literature, as well as some of the channels which are less prevalent in the literature.

Monetary policy influences financial asset prices through a number of channels. When that is the case, in a scientific inquiry it is common to focus on one of the variables. Given that it is not feasible to investigate all the channels into one empirical study, one channel should be selected for investigation. In this case, quality of money is viewed as the most appropriate channel for investigation. The primary reasons why this channel was chosen for the empirical investigation are:

- Identification of the quality of money channel is a novel theoretical contribution of this dissertation;
- The effects of this channel on financial asset pricing have not been previously investigated empirically;
- Žukauskas and Hülsmann (2019) show that prices in the financial sector grow faster relatively to prices in the non-financial sector of the economy. The traditional transmission mechanism of monetary policy does not offer an

explanation for this finding. While the study's authors attribute this finding to the decreasing quality of money, this hypothesis has not been tested empirically.

Therefore, the objective of the empirical analysis (which corresponds to the fifth objective of the dissertation) is to use the developed theoretical framework to empirically investigate if and to what extent the *quality of money* channel has an impact on the development of prices of financial assets.

Fig. 27 below presents the theoretical model of the analysis, showing the relationships between monetary policy and prices of financial assets that constitute the quality of money channel. As evident from the figure, in theory, central banks through monetary policy influence the quality of money, which in turn has an effect on how market participants perceive the value and future purchasing power of money. Monetary policy induced changes in the perception of value of money are manifested in the change in the total demand (reservation plus exchange demand) for money. This change in the demand for money inevitably influences spending and selling decisions of market participants and thus changes the exchange and the reservation demands of non-monetary goods and their prices (this is relevant for all non-monetary goods, including financial assets). Lower quality of money means lower exchange and reservation demands for money and higher exchange and reservation demands for non-monetary goods (including financial assets), and higher prices of them, and *vice versa*.

Moreover, if a fall in the quality of money leads to a decrease in the demand for money as a store of value, financial assets can be seen as a substitute for money. In this case, the reservation and exchange demand for financial assets will increase relatively more than for other non-monetary goods (which do not have the properties to be a store of value or have them to a lesser extent).

The bottom half of the Fig. 27 shows the empirical model which is based on the relationships discussed in the theoretical model. Since the value of financial assets or money is not directly observable or measurable, the empirical model will test the relationship between the quality of money and prices of financial assets.



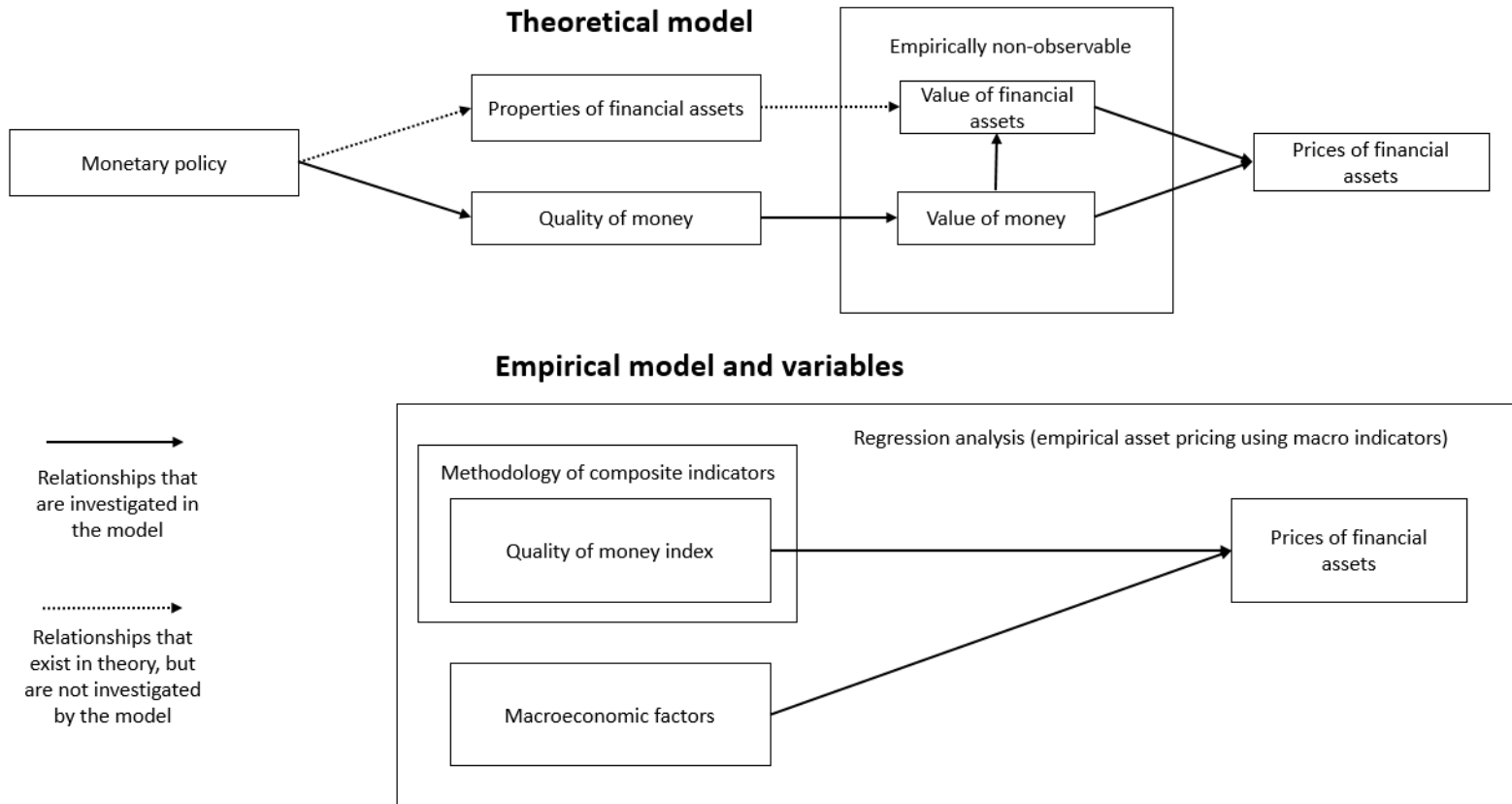


Fig. 27. Explication of the model - theoretical model and its parametrization

In order to test this relationship the model needs to have a measure of the quality of money. This measure will be created using the methodology of composite indicators (discussed below in chapters 3.2 and 4.1 below). The relationship will be tested using the regression analysis in the framework of empirical asset pricing using macroeconomic indicators (discussed in chapters 3.3 and 4.2 below).

### 3.2. Composite indicator of the money quality

In order to empirically investigate the quality of money channel and its impact on the prices of financial assets, an empirical measure of the quality of money is necessary. The quality of money is a quite novel concept and even though there were attempts to quantify some aspects of the quality of money (e.g. Bagus and Schiml (2010), Bagus and Howden (2016)), it has not been thoroughly measured, suggesting a need for such a measurement to be created in this dissertation.

One of the ways to measure the quality of money is to create a composite indicator. A composite indicator reflects a '*complex system*' that consists of numerous '*components*', making it easier to understand in full rather than reducing it back to its '*spare parts*' (Greco, Ishizaka, Tasiou, & Torrisi, 2019). This approach is therefore suitable to measuring the quality of money. The concept of the quality of money has different dimensions that can be identified in the literature, and it needs to be measured as a single characteristic of money.

'*Composite*', also known as '*synthetic*' indicators are:

- "*synthetic indices of multiple individual indicators*" (Freudenberg, 2003, p. 5)
- "*formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured*" (Nardo et al., 2005, p. 8)
- "*based on sub-indicators that have no common meaningful unit of measurement and there is no obvious way of weighting these sub-indicators*" (Saisana & Tarantola, 2002, p. 5)

The literature on composite indicators (e.g. Nardo et al. (2005), OECD (2008), Greco et al. (2019)) suggests a particular procedure and steps, which are required in order to compile a composite indicator. We will briefly discuss these steps here, and will apply them to the concept of quality of money in the 4<sup>th</sup> part of this dissertation.

## **Theoretical framework**

The first step in the creation of a composite indicator is a theoretical framework and the definition of what is being measured as well as the list of indicators that constitute the composite indicator. Theoretical framework reveals the dimensions of the object, which is being measured and thus plays an important role as the basis of selection of the components (indicators). Theoretical framework also allows to decide what are the different dimensions of the phenomenon, if any, which may result in sub-groups of the composite indicator. The strength of the theoretical framework determines and defends the meaningfulness of the composite indicator.

Selected indicators must carry relevant information about the core components of the phenomenon being measured. Practitioners use proxy variables when direct indicators or data are not available. The selection of indicators should include the discussion of their strengths and weaknesses as well as a brief discussion of data characteristics (European Commission, 2020a). Although the selection of indicators is grounded in the theoretical framework, practitioners admit that this process inevitably involves subjective judgments of the researcher.<sup>108</sup>

## **Normalization**

Normalization transforms the indicators' raw data onto a common scale. This is crucial for the comparability of different indicators and their aggregation into a composite. Normalization involves two steps. First, the indicators are adjusted in terms of their direction, so that higher values would correspond to better performance in all indicators. Next, a suitable normalization method is applied (e.g. min-max, z-scores, distance to best performer; see OECD (2008) for a description of these methods). Normalization needs to respect the conceptual framework and the purpose of indicator, the data properties, and should be easily interpreted by users of the composite indicator (European Commission, 2020a).

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<sup>108</sup> European Commission (2020a):

Because there is no single definitive set of indicators for any given purpose, the selection of data to incorporate in a composite can be quite subjective. Different indicators of varying quality could be chosen to monitor progress in the same performance or policy area.

## **Ponderation**

Composite indicators are usually composed of sub-indicators (sometimes called dimensions, they represent the different aspects of the concept being measured) and individual indicators, which have specific weights. There are different ponderation methods. They all fall into two categories: expert/public opinion based methods and statistical methods. The selected procedure of ponderation needs to reflect the object and at the same time it needs to be relatively simple in order for the users to be able to understand the ponderation scheme.

The weights and the ponderation scheme are essentially value judgments which reflect the objectives underlying the construction of the composite indicator (European Commission, 2020a). No ponderation system is above criticism and it is up to the developer to choose the ponderation system that is best fitted for the purpose of the construction of the composite indicator (OECD, 2008, p. 22).

Equal weighting is the most common scheme in the development of composite indicators (Bandura (2008), OECD (2008)). The strengths of this type of ponderation are: it is often seen as more objective, it is relative simple to construct, it can be used when there is a lack of theoretical structure to justify a differential ponderation scheme, when there is no agreement between decision makers, when there is inadequate statistical and/or empirical knowledge (see Freudenberg (2003), OECD (2008), Maggino and Ruvigioni (2009), Decancq and Lugo (2013), Greco et al. (2019)).

Importantly, equal weighting does not necessarily mean equal weights for all the indicators. If the individual indicators are grouped into sub-indicators (or dimensions) and the weights are distributed equally dimension-wise, then individual indicators will not be equally weighted unless all dimensions have the same number of indicators.

However, literature on composite indicators considers ponderation based on statistical methods to be more 'objective', as they are not based on any subjective valuation of researcher (e.g. see Booyesen (2002), Zhou, Ang, and Poh (2007), Decancq and Lugo (2013)). Two statistical tools that are often used in ponderation are correlation and multiple linear regression analysis.

In most cases, there is a positive correlation between different indicators in a composite indicator. When equal weighting is chosen, high correlation between the indicators introduces an element of double counting. The rule of thumb used in

compiling composite indicators is to decide on the threshold beyond which correlation entails double counting (European Commission, 2020a). For instance, if a very high correlation is detected between two indicators within a dimension, it may be moderated by accounting for it in the ponderation step (e.g. Saisana, Saltelli, and Tarantola (2005), OECD (2008), Maggino and Ruvigliani (2009)). Pearson correlation coefficient is often used as the criteria. Then either only those indicators which have low correlation are chosen, or less weight is given to the correlated indicators.<sup>109</sup>

Moreover, by moving beyond the simple statistical correlation, researcher can explore the causal link between the sub-indicators and the composite indicator using regression analysis. Norlén (2017) suggests adjusting the weights of the sub-indicators (dimensions of the composite indicator) according to their coefficients of determination to achieve a more balanced contribution of the components to the composite indicator.

## **Aggregation**

The aggregation process combines values of a set of indicators into one composite indicator. Important categorization of the aggregation methods in the literature is the choice between 'compensatory' and 'non-compensatory' aggregation approaches (e.g. Munda (2005), Greco et al. (2019)). According to Bouyssou (1986, p. 151), aggregation is non-compensatory if no trade-offs between high and low values in the individual indicators can occur and is compensatory otherwise. Compensatory aggregation assumes that "[...] *poor performance in some indicators can be compensated by sufficiently high values of other indicators.*" (European Commission, 2020a).

Linear and geometric<sup>110</sup> approaches belong to the category of 'compensatory' aggregations (Greco et al., 2019). 'Non-compensatory' aggregation methods are

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<sup>109</sup> European Commission (2020a):

Depending on a school of thought, one may see a high correlation among indicators as something to correct for, e.g. by making the weight for a given indicator inversely proportional to the arithmetic mean of the coefficients of determination for each correlation that includes the given indicator. On the other hand, practitioners of multi-criteria decision analysis would tend to consider the existence of correlations as a feature of the problem, not to be corrected for, as correlated indicators may indeed reflect non-compensable different aspects of the problem.

<sup>110</sup> Greco et al. (2019, p. 75):

*“multi-criteria approaches, considering preferential relationships from the pairwise comparisons of the indicators”* (OECD, 2008, pp. 112-113). Similar to the issues of normalization and ponderation, there is no ‘perfect aggregation’ scheme (Arrow, 1963), because each scheme is useful for different purposes and has its own strengths and weaknesses (Greco et al., 2019). Linear compensatory aggregation is the most common method used in the creation of composite indicators (Gan et al., 2017).

### **Sensitivity analysis**

The last step in the creation of a composite indicator is the sensitivity analysis, which is the study of the variation in the output of a composite indicator depending on the different assumptions made in the model (Saltelli, Tarantola, Campolongo, & Ratto, 2004). Sensitivity analysis is an important step, because the overall procedure involves quite a few assumptions, which are based on value judgment and subjective considerations of the researcher.

In the 4<sup>th</sup> part of this work we will apply all these steps while creating a quantitative, empirical measure of the quality of money. This will allow us to measure the impact of the changes in the quality of money on the prices of financial assets, which was predicted by the theoretical framework.

### **3.3. Arbitrage pricing model using macro indicators**

The goal of our empirical investigation is to analyze if and to what extent monetary policy influences the prices of financial assets through the quality of money channel. The first step of the empirical framework is to develop a composite indicator of the quality of money. The second step is to test the relationship between the composite indicator and the prices of financial assets. The second step requires an empirical approach, which would link the quality of money to prices.

The nature of economic reality entails that any empirical investigation of the relationship between two economic phenomena (or objects) are always bound by the

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Linear aggregation is when the composite index is formed through an additive utility function, in which the composite equals the sum of the products of weights and indicators. Geometric aggregation is when the composite index is formed through a Cobb–Douglas type function (multiplicative function), in which the composite equals the product of the indicators, each raised to the power of the weight assigned.

multitude of factors. When we hypothesize that a particular factor influences movements of prices (in our case the factor is the quality of money) we must take into account that there are other factors, which simultaneously influence our dependent variable as well. Unless the factor is overwhelmingly more important than others, it would be problematic to investigate and capture the empirical link between it and price movements without including other factors into the analysis. Otherwise, it is likely that the impact of the other factors would disguise or counteract the impact of the particular factor under investigation. Therefore, a simple test of the relationship between one factor and prices would be distorted, it would not account for the other factors. For this reason, our investigation of monetary policy on the prices of financial assets through the quality of money channel needs to incorporate other factors, which influence prices of financial assets.

An arbitrage pricing model (APT) is an empirical model capable of capturing multiple factors and flexible enough to be able to include the measure of the quality of money. Arbitrage pricing theory was formulated by Ross (1976) and was presented as an alternative to the capital asset pricing model (CAPM), originally introduced by Sharpe (1964), Lintner (1965) and Mossin (1966). The main motivation behind the development of the APT was increasing evidence that the CAPM was unable to empirically explain market asset returns.

There are several strengths of the arbitrage pricing model which are important for the purposes of our research compared to its most common alternative – CAPM. The CAPM assumes “[...] a single factor which, with a random disturbance, generates returns for each individual asset via some (linear) functional relationship.” (Roll & Ross, 1980, p. 1073). APT agrees with the intuition behind the CAPM that asset returns are driven by particular factor(s) related to financial assets. However, there are two important differences between the CAPM and the APT. First, APT is more flexible, since it allows for more than just one factor. This is an important feature, because the purpose of our empirical framework is to incorporate and test the relationship between the quality of money (among other factors) and returns on financial assets. Secondly, APT works under fewer assumptions than CAPM. According to Roll and Ross (1980, p. 1074):

[...] since any market equilibrium must be consistent with no arbitrage profits, every equilibrium will be characterized by a linear relationship between each asset's expected return and its return's response amplitudes, or loadings, on the common factors. With minor caveats, given the factor generating model, the absence of riskless arbitrage profits – an easy enough condition to accept a priori – leads immediately to the APT. Its modest assumptions and its pleasing implications surely render the APT worthy of being the object of empirical testing.

The basic assumption of the APT is that there are no riskless arbitrage opportunities and it allows for several return generating factors. Arbitrage pricing model itself does not speak of particular factors of asset returns. It is up to the researcher to come up with the algorithm to decide upon the factors and their number (Trzcinka (1986), Fama (1991)). Some authors utilize the APT using numerous micro, or company specific variables to explain asset returns, others use economic variables (macro approach). The APT model is the most frequently used in tackling “[...] *the relationship between stock prices and several economic variables*” (Peiró, 2016, p. 288), which is exactly what our model needs to achieve.

There are three important reasons why the APT was chosen as the model to empirically investigate the link between monetary policy and prices of financial assets through the quality of money channel.

- APT is very flexible in the choice of the factors/variables. The flexibility of the model fits the theoretical reasoning and the subjectivist total-demand approach for financial asset pricing, developed in this dissertation. According to this framework, asset pricing factors are ultimately subjective and they manifest in the decisions of market participants to purchase or/and to hold financial assets, money and other goods.
- APT can be used with macro variables/factors (as opposed to variables that describe properties of a particular company or financial asset). The APT is often used to determine which macroeconomic indicators (e.g. output, price level, interest rate etc.) influence price developments of financial assets. The quality of money as a factor of prices is closer to a macro variable than a company-specific variable. In theory, the quality of money describes a



macroeconomic aspect of the economy (money) which is relevant for the prices of financial assets.<sup>111</sup>

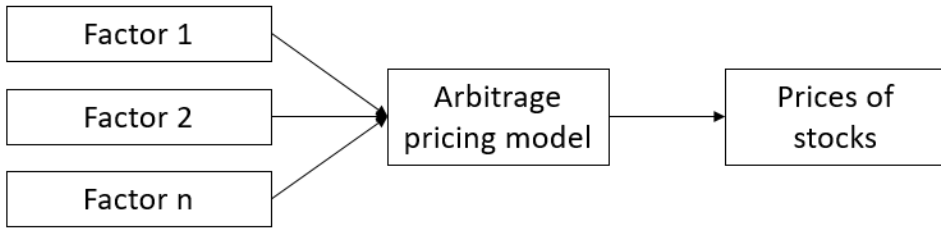
- The application of APT requires less assumptions about the market that are potentially problematic while investigating empirical data (e.g. APT does not require the assumption about the efficiency of the market).

Therefore, utilizing APT, we will conduct an empirical test capturing the impact of monetary policy on the prices of financial assets through the quality of money channel. While choosing the independent indicators we will rely on the work of other researchers, who have used the APT to investigate the links between macro indicators and the prices of financial assets. These indicators will represent all the other factors that are relevant for the analysis of dynamics of prices of financial assets (a. in Fig. 28). We will also introduce the quality of money as one more factor in the model (b. in Fig. 28). This procedure is guided by the objective of our empirical research and by the principle that our aim is not to create the most comprehensive model of empirical asset pricing, but to test the statistical significance of the quality of money factor.

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<sup>111</sup> The way we reason about the link between the prices of financial assets and macroeconomic variables (e.g. output, prices) is similar to the way we theorize about the connection between the quality of money and prices of financial assets. Similarly to macro indicators, quality of money does not directly describe the aspects of a particular company or financial asset, but we establish the link between these variables and prices through theorizing of relevant factors in the price formation of financial assets. E.g. output is relevant because it reflects cash flows of companies. Similarly, the quality of money is relevant because it reflects the value of a good (money) in which the valuation happens and prices are expressed.

a. APT with macroeconomic variables



b. APT with macroeconomic variables and a measure of money quality

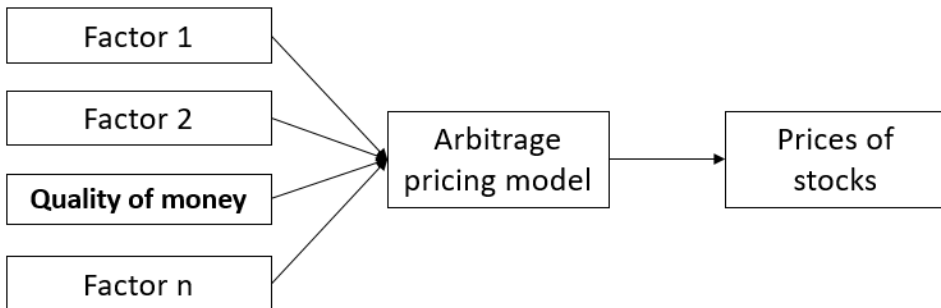


Fig. 28. The principle scheme of the model

The combination of the empirical framework of APT and the composite indicator of money quality will be able to test if the quality of money is statistically significant in explaining the price developments of financial assets, and thus to empirically test our theoretical framework.

### 3.4. Empirical links between stock prices and economic variables

In this chapter we will review the literature on the empirical links between macroeconomic variables and prices of financial assets in order to come up with the relevant macro indicators for our model. From a theoretical point of view, prices of financial assets have a quite close and well-understood relationship with some of these macroeconomic variables, but the relationship with other variables is less clear – it is more complex and ambiguous. A lot of research has been done on the ambiguity and state-dependency of the stock market reactions to economic news (e.g. by McQueen and Roley (1993) or Boyd, Hu, and Jagannathan (2005)).

Present value model, where stock prices are seen as the present value of expected future cash flows assumes three factors of stock prices, namely, future cash flows (e.g.

dividends), risk-free discount rate and risk premium (Boyd et al., 2005). There is a clear connection between some of macroeconomic variables and these factors. Changes in output and production influence expected future cash-flows and higher stock prices. Increases in the interest rates means higher discount factor and this lower stock prices. In addition, there is a relationship between interest rates and production: increases in interest rates could lead to a decrease in investment and, thus, in future production. *“Hence, interest rates may affect stock prices in two different ways: i) directly, through changes in discount rates; ii) indirectly, through changes in future production.”* (Peiró, 2016, p. 288).

Bernanke and Kuttner (2005, pp. 1244-1245) outline the connection between the short-term interest rate and stock prices:

There are three broad reasons why an unexpected funds rate increase may lead to a decline in stock prices: it may be associated with a decrease in expected future dividends, a rise in the future expected real interest rates used to discount those dividends, or an increase in the expected excess returns (i.e., the equity premiums) associated with holding stocks.

This means that the interest rate, which is the variable of monetary policy, affects prices of financial assets through several channels. First, as a discount factor, second, as an influencer of economic activity (and the cash flows of firms), and third, as a factor of the relative preference of market participants for the different types of financial assets.

Some researchers do not find any significant relationship between macroeconomic factors and equity returns (e.g. Louis, Karceski, and Lakonishok (1998), Flannery and Protopapadakis (2002), Maio and Philip (2015)). Others do find statistically significant relationships.

A lot of research has been undertaken to trace the statistically significant relationships between the returns of stocks and economic variables in US. Fama (1981, 1990), demonstrated that stock returns have a strong relationship with growth rates of output. Fischer and Merton (1984) showed that stock returns forecast future production. Schwert (1990) showed that future production growth rates explain the variation in stock returns.

Fama (1981) also found that the relationship between stock returns and inflation is negative. Geske and Roll (1983) and Kaul (1987) explained this by stressing the response of the monetary policy to the expected inflation: stock returns increase if there is a reduction in the expected inflation because this signals a chain of events which lead to a lower interest rate and a higher rate of monetary expansion.

Ang and Bekaert (2006) found that the best predictive factor for future returns of stocks is the short interest rate. Humpe and Macmillan (2009) determined that US stock prices are positively influenced by industrial production and negatively influenced by long-term interest rates. Alam and Uddin (2009) observed that short-term interest rate has a mixed impact on stock returns. They studied 15 developed and developing countries and found that in all of them stock prices are negatively related with the interest rates.

There has been a few empirical studies that have been focused on the European financial markets. Wasserfallen (1989) analyzed a response of stock markets in Europe to the unexpected components of several economic variables (output, wages, unemployment, money supply, consumer prices, import prices, exports, interest rate, exchange rate), finding that statistical relationships between these macro variables and stock market returns are very weak. Canova and De Nicolo (1995) found statistically significant relationships between stock returns and industrial production growth rates.

Hamilton and Lin (1996) analyzed monthly stock returns and growth of industrial production. They conclude that economic recessions drive the volatility of stock returns. Peiro (1996) observed a positive relationship between industrial production and stock returns and negative relationship between current changes in interest rates and stock returns. Nasseh and Strauss (2000) found statistically significant relationships between industrial production, interest rates and stock prices in six European countries.

Errunza and Hogan (1998) examined if variability of a set of monetary and real macroeconomic factors can explain the variation of stock market volatility in several European countries. They found that monetary instability is a significant factor for France and Germany, while industrial production is significant for Italy and the Netherlands. Nasseh and Strauss (2000) investigated the period of 1962 to 1995 in

Germany, UK, Holland, France, Italy and Switzerland, concluding that consumer prices and production have a positive relationship and long-term interest rates have a negative relationship with the stock market.

Brooks, Tsolacos, and Lee (2000) examined the cyclical regularities of financial, macroeconomic and property market aggregates. They conclude that cycles of consumer expenditure, per capita total consumption, dividend yield and the long-term bond yield are correlated and related to the property prices.

Morelli (2002) analyzed the relationship between macroeconomic volatility and stock price volatility. This study considered such macroeconomic variables, namely, industrial production, money supply, exchange rate, inflation and real retail sales. *"[...] a significant relationship was found between stock market and macroeconomic volatility with respect to the ability of macroeconomic volatility in predicting stock market volatility. Tests of the joint and simultaneous explanatory power of macroeconomic volatility were found to be disappointing since no significant relationship was found."* (p. 109).

According to the study of Rapach, Wohar, and Rangvid (2005), which focused on several European countries, the most consistent and reliable predictors of stock returns in several is the interest rate. Barro and Ursúa (2009) claims that crashes in stock market have some predictive power for economic depressions.

Hasan and Nasir (2008) examined the relationships between equity price and different economic variables (inflation, industrial production, oil prices, short-term interest rate, exchange rates, foreign portfolio investment, money supply). The study revealed that interest rates, exchange rates and money supply had statistically significant effect of equity price. While industrial production, oil prices and inflation were not statistically significant.

Díaz and Jareño (2009) claimed that inflation influences stock indices. When inflation rate is higher than expected it has a significant negative impact on stock returns in Spanish stock market. Jareño and Navarro (2010) found a significant negative relationship between stock returns and interest rates in Spain. Fernandez-Perez, Fernández-Rodríguez, and Sosvilla-Rivero (2014) suggested that the slopes of US and Europe yield curves have some information content that helps to better forecast the probability of bear markets.

Kuosmanen, Nabulsi, and Vataja (2015) investigated the relationship between financial markets and the real economy in four Nordic countries. They found that “*The relationship between financial variables and economic activity is found to be stronger in Finland and Sweden than in Denmark and particularly in Norway.*” (p. 378). This study suggests a breakdown in the relationship between stock returns and growth rates of economic activity in the early 1980s.

The review of the empirical studies that investigate the relationship between macroeconomic variables and prices of financial assets allowed us to identify the most commonly used and at least in some cases statistically significant macroeconomic variables. They are: GDP, industrial production, consumer prices, unemployment, short and long-term interest rates, money supply and exchange rate. These variables, together with the quality of money indicator, will be used as independent variables in our empirical study.

### **3.5. Hypotheses and other specifications of the empirical research**

The empirical model will focus on the Eurozone, and the composite indicator of the quality of money will be constructed for the Euro currency from its introduction in 1999 to the end of 2019. The composite indicator of the quality of money applied to the Eurozone will be the exogenous variable in the model. To capture movements in the prices of financial assets, broad index of stocks of the Eurozone will be used (Dow Jones Euro Stoxx Price Index). Moreover, the regressions will also be run for 10 countries of the Eurozone separately. Original members of the Eurozone have been selected as countries for this analysis: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, and Spain. The endogenous variables in the country-based regressions will be the broad stock price indices ((MSCI Standard Large and Mid Cap indices). The regressions will also include the macroeconomic variables as control variables (exogenous). The selected macroeconomic variables are the most commonly used in previous studies (as reviewed in chapter 3.4): GDP, industrial production, consumer prices, unemployment, short and long-term interest rates, money supply and exchange rate. The regressions will be run separately for monthly, quarterly and yearly data.

The regression analysis will use multiple regression model with the following specification:

$$Y_i = \beta_0 + \beta_q Q_i + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + \varepsilon_i$$

where:

$Y_i$  –  $i$  th observation of the dependent variable (stock price index),  $i = 1, 2, \dots, n$ ;

$\beta_0$  – intercept (constant term)

$\beta_q$  – slope coefficient for the main independent variable (quality of money);

$Q_i$  –  $i$  th observation of the main independent variable (quality of money);

$\beta_j$  – slope coefficient of the  $j$  th independent control variable (macro variable),  $j = 1, 2, \dots, k$ ;

$x_{ji}$  –  $i$  th observation of the  $j$  th independent control variable (macro variable),  $j = 1, 2, \dots, k$ ;

$\varepsilon_i$  - error term for the  $i$  th observation;

$n$  – number of observations;

$k$  – number of independent control variables (macro variables).

The hypotheses of the empirical research are the following:

**H1.** The quality of money in the Eurozone over the long-term has decreased to correspond to the growth of prices of financial assets versus the general price level;

**H2.** There is a statistically significant relationship between the medium-term (yearly) changes in the quality of money and the changes in the stock price indices;

**H3.** There is a statistically significant relationship between the short-term (monthly and quarterly) changes in the quality of money and the changes in the stock price indices;

**H4.** The medium and short-term relationships between the changes in the quality of money and changes in the stock price indices are negative.

## 4. Connection between quality of money and financial asset prices: empirical results

### 4.1. Composite indicator of the money quality

#### **Theoretical framework and indicators**

*Quality of money* is defined as “[...] the capacity of money, as perceived by actors, to fulfil its main functions, namely to serve as a medium of exchange, as a store of wealth, and as an accounting unit.” (Bagus, 2009, p. 29). Value of money and preference towards money depends solely on the expectation of future prices and future purchasing power of money. Section 2.4.5 on “The quality of money and its dimensions” discussed five ways how the quality of money in its functions as a store of value and a medium of exchange can change.

As discussed in the 3<sup>rd</sup> part on the methodology above, in order to empirically test the channel of the quality of money, we need to have a measure, which quantifies the quality of money. This empirical exercise is based on the assumption that a measure of quality of money can be created by identifying and quantifying different parameters and dimensions of the quality of money, identified in the literature. If theoretical reasoning is correct, there should be a statistically significant link between the measure of the quality of money and the price movements of financial assets, which would demonstrate the existence of the quality of money channel. The index of money quality is constructed as a composite indicator in such a way that it would quantify the areas and results of the monetary policy, which were recognized to be relevant for the perception of the quality of money by other authors discussed in the 2<sup>nd</sup> part of the dissertation in section “The quality of money and the demand for financial assets”.

As shown in the Table 3, the proposed index consists of six dimensions and 22 indicators. All six indicators in the Balance sheet of the central banks dimension are taken as suggested by Bagus and Howden (2016). Other indicators in the index were selected by the author to reflect the other significant dimensions and aspects of the quality of money. The choice of dimensions and indicators will be discussed below.

#### **Balance sheet of the central bank**

*“The quality of money can be analyzed indirectly by the assets that back the monetary base.”* (Bagus & Howden, 2016, p. 115). Central bank assets serve as collateral that



“back” the currency and represent the capability of the central bank to defend the value of the currency domestically and internationally. The balance sheet will be assessed by three liquidity ratios, two international strength ratios and one equity ratio (see Table 3).

### **Money supply**

Changes in the supply of money supply is one of the factors affecting the quality of money. Existing total stock of money at any time does not matter in the sense that money can be used as a medium of exchange irrespective of the amount of monetary units available. However, changes in the money supply influence the long-term stability of the purchasing power of money. The index contains four indicators which represent different definitions of money supply: monetary base, balance sheet of the central bank, monetary aggregates M1 and M3.

### **Interest rates**

There is a link between money supply and interest rates. ECB communicates its monetary policy stance by setting an interest rate target. This target is achieved primarily through open market operations by purchasing or selling financial assets in the market and thus increasing or decreasing the monetary base. Thus, changes in the interest rates set by the central bank show how inflationary monetary policy is. The decrease in the interest rates are achieved through the increase in the money supply, which in the long-term means lower purchasing power of money. The index of money quality contains five indicators measuring interest rates. Three of them represent three key interest rates set by the ECB: interest rates on deposit facility, main refinancing operations and marginal lending facility. The fourth indicator is based on spread between the main refinancing operations rate and Taylor's<sup>112</sup> rule interest rate. The

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<sup>112</sup> Taylor's rule is a guideline for how central banks should change interest rates in response to changes in economic conditions. It was established to set the interest rate aiming for the short-term stabilization of the economy, while maintaining long-term growth (Taylor, 1993). Machaj (2016) admits that Taylor “[...] convincingly demonstrates that low interest rates contributed to the housing bubble and mortgage-market expansion.” (p. 12). However, Machaj criticizes Taylor rule from the Austrian perspective by saying that “any rule recommended for interest rates higher than the actual ones would have been better than that actually followed (even a rule based on astrology). Apart from that, there may be nothing specific about the Taylor rule that makes it a panacea for macroeconomic problems” (p. 12). The technical problem with the Taylor rule is that it has many variants that cannot be precise (e.g. “potential output”). The fundamental problem is that following this rule does not ensure economic stability, “targeting [...] macroeconomic variables is not a recipe for intertemporal coordination understood in the Hayekian sense: as

fifth is the spread between the main refinancing operations rate and natural interest rate.

### ***Stability of the financial system***

Conditions and stability of the financial system matter for the quality of money, because financially troubled, illiquid banking system increases risks of bail-outs, which may lead to higher quantity of money (if financed through debt monetization). The stability of the financial system is measured by two indicators: the composite Indicator of Systemic Stress, and Euribor – OIS spread (for more detailed explanation of each of the indicators see Table 3).

### ***Forward guidance***

Forward guidance is central bank's communication - announcements, speeches, press conferences - which aim to provide information about the likely path of future policy and interest rates (Kuttner, 2018, p. 126). Forward guidance is an unconventional instrument of monetary policy that ECB uses to guide the expectations of market participants about the future stance of monetary policy. Forward guidance is related to the quality of money since expectations for prolonged periods of inflationary monetary policy mean that market participants expect the interest rates to stay low and money supply to increase faster than otherwise. The index uses one indicator (the spread between current rate of main refinancing operations and OIS rate) which captures the extent to which market participants expect the future monetary policy to be stay or become inflationary (see more in Table 3).

### ***Price inflation***

Current and expected levels of price inflation is an indication of the quality of money in its ability to preserve the purchasing power of monetary units. Current prices and future prices and purchasing power of money are related through so-called regression theorem, proposed by Mises (1912/2012). This theorem states that the subjective value and demand for money today emerges not by assessing prices of all non-

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*coordination between successive stages of production"* (Machaj, 2014). Nevertheless, in this indicator we will use the Taylor rule as a rough guide and the basis for the evaluation of the interest rate set by the monetary authority. Following the Taylor rule does not ensure macroeconomic balance, but it is quite clear that strong deviations from it are related to the macroeconomic imbalances.

monetary goods in terms of money in the present, but by employing past prices as a reference. The index has four indicators related to price inflation: current yearly price inflation according to the Harmonized Index of Consumer Prices (HICP), and three forecasts: HICP forecasts for current year, one year ahead and two years ahead .

The dimensions and the indicators of the index are flexible and can be applied to any currency and central bank. In this article, we will focus on the Euro area and European Central Bank. To ensure maximum flexibility in using the index it will be calculated on the highest possible frequency using monthly data<sup>113</sup>. The period for the index is the end of 1999 until the end of 2019.

One aspect not captured by the index is the institutional framework (independence of the central bank, accountability and transparency, central bank’s constitution, staff and decisions makers at the central bank) due to the lack of publicly available and quantifiable indicators. Although there are quantitative indicators of the independence of the central bank (e.g. Garriga (2016), Masciandaro and Romelli (2019)), they are only available on an annual basis.<sup>114</sup> Quantitative indicators on other issues of the institutional framework are not available, since they are heavily subjective and depend on value judgements.

Table 3. Indicators of the index of money quality

Indicator	Reasoning and explanation	Source
<b>Dimension: Balance sheet of the central bank</b>		
Ratio of gold to monetary base	Liquidity I ratio. <i>“Gold has traditionally held the coveted position as a highly liquid asset. Gold can be sold in high quantities without adverse bid-ask spreads crisis. In contrast to other non-money financial assets, gold has no credit risk as it does not represent a debt.”</i> (Bagus & Howden, 2016, p. 119).	ECB (2020a)

<sup>113</sup> Once the index is available on a monthly basis, the data can be easily used to calculate quarterly or yearly changes.

<sup>114</sup> Moreover, since the evaluation of the independence of the central banks does not change much over the years, it is more useful as a tool of comparing the level of independence between different central banks, rather than tracking the change of a particular central bank’s independence.

Ratio of reserve assets (including gold) to monetary base	Liquidity II ratio. <i>“Foreign-exchange reserves are normally very liquid as they are traded daily in large volumes. Their value is less assured than gold since credit risk implies that their value can theoretically be reduced to zero in extreme cases”</i> (Bagus & Howden, 2016, p. 119).	ECB (2020a)
Ratio of reserve assets (including gold) and government debt to monetary base	Liquidity III ratio. <i>“The share of government bonds is important when assets are viewed in terms of credit risk. High quality government bonds (e.g. U.S. Treasury bills) enjoy a very large and liquid market enabling them to be sold en masse without losses through increased bid-ask spreads. Credit risk is also low. The value of such bonds is backed by the government’s taxing power and ultimately by the productivity of the economy”</i> (Bagus & Howden, 2016, pp. 119-120).	ECB (2020a)
Ratio of foreign reserves to monetary base	Defense potential ratio. Selling foreign reserves <sup>115</sup> <i>“on the open market and purchasing domestic currency can support the value of the currency in times of crisis or speculative attacks.”</i> (Bagus & Howden, 2016, p. 117).	ECB (2020a)
Ratio of foreign reserves to total world foreign reserves	External strength ratio. <i>“The higher the share of total world foreign-exchange reserves that a central bank owns the greater will be the potential to defend the currency internationally. It may also indicate the previous strength of a currency area to generate exports, benefiting the quality of money through increased trade-based demand.”</i> (Bagus & Howden, 2016, p. 118).	ECB (2020a), IMF (2020)
Ratio of capital to total assets	Equity ratio. <i>“Potential losses on the asset side of the balance sheet can be cushioned by available equity and thus prevent a government initiated recapitalization which may potentially increase the quantity of money.”</i> (Bagus & Howden, 2016, p. 120).	ECB (2020a)
<b>Dimension: Money supply</b>		
Growth of monetary base	Monetary base (currency in circulation and credit institutions’ deposits held with the Eurosystem) is a measure of money supply. The growth is calculated as an annual growth rate.	ECB (2020a)

<sup>115</sup> Foreign reserve assets are assets denominated in foreign currency and include reserve position in the International Monetary Fund (IMF), special drawing rights (an international reserve asset) created by the IMF, financial derivatives, loans to non-resident non-banks, long-term loans to an IMF Trust account and other assets that meet the reserve assets definition.

Growth of the balance sheet (total assets)	The size of the balance sheet of the central bank is a measure of money supply which is important in the circumstances of quantitative easing. Quantitative easing expands the balance sheet of the central bank beyond the level which is required to hold the interest rate at the target (Bernanke & Reinhart, 2004). The growth is calculated as an annual growth rate.	ECB (2020a)
Growth of monetary aggregate M1	Monetary aggregate M1 is the sum of currency in circulation and overnight deposits. The growth is calculated as an annual growth rate.	ECB (2020a)
Growth of monetary aggregate M3	Monetary aggregate M3 is the broad monetary aggregate and it is the sum of M1, deposits with an agreed maturity of up to two years, deposits redeemable at notice of up to three months, repurchase agreements, money market fund shares/units and debt securities with a maturity of up to two years. The growth is calculated as an annual growth rate.	ECB (2020a)
<b>Dimension: Interest rate</b>		
ECB Deposit facility interest rate	The rate on the deposit facility, which banks may use to make overnight deposits with the Eurosystem.	ECB (2020a)
ECB main refinancing operations interest rate	The interest rate on the main refinancing operations (MRO), which provide the bulk of liquidity to the banking system.	ECB (2020a)
ECB marginal lending facility interest rate	The rate on the marginal lending facility, which offers overnight credit to banks from the Eurosystem.	ECB (2020a)
Spread between main refinancing operations rate and Taylor's rule interest rate	The spread between ECB target rate of main refinancing operations and rate suggested by the Taylor rule indicates the stance of monetary policy from the point of view of the interest rate.	ECB (2020a), Bloomberg (2020)
Spread between main refinancing operations rate and natural interest rate	In recent works natural interest rate is defined as the interest rate to which the economy tends to in the medium to long run. It is the " <i>rate that would prevail in general equilibrium, the rate that equates the ex-ante supply of savings (by households) with ex-ante demand for investment (by firms)</i> " (Browne & Everett, 2005, p. 123). The spread between the rate of main refinancing operations and the natural interest rate for the Euro zone indicates the stance of monetary policy interest-rate wise.	ECB, Bloomberg (2020)
<b>Dimension: Stability of the financial system</b>		
Composite Indicator of Systemic Stress	Composite Indicator of Systemic Stress (Hollo, Kremer, and Lo Duca (2012) is an indicator of	ECB (2020a)

	<p>contemporaneous stress in the financial system. <i>“Its specific statistical design is shaped according to standard definitions of systemic risk.”</i> (p. 1). <i>“Index incorporates five market-specific sub-indices created from a total of 15 individual financial stress measures. The main general goal of using stress indices such as the CISS is to measure the current state of instability, i.e. the current level of frictions, stresses and strains (or their absence) in the financial system and to condense that state of financial instability into a single statistic. The specific aim of the CISS is to emphasize the systemic nature of existing stresses in the financial system, where systemic stress is interpreted as an ex post measure of systemic risk, i.e. risk which has materialized already.”</i> (Hollo et al., 2012, p. 2).</p>	
Euribor – OIS rate spread	<p>Euribor<sup>116</sup> reflects bank credit risk, and OIS<sup>117</sup> is considered risk-free, thus, the Euribor – OIS spread can be seen as a measure of the financial stability and creditworthiness of the banking system. <i>“In times of stress, the Euribor, referencing a cash instrument, reflects both credit and liquidity risk, but the OIS has little exposure to default risk because these contracts do not involve any initial cash flows. The OIS rate is therefore an accurate measure of investor expectations of the effective rate set by the central bank over the term of the swap, whereas Euribor reflects credit risk and the expectation on future overnight rates.”</i> (Sengupta &amp; Tam, 2008, p. 1).</p>	<p>ECB (2020a), Bloomberg (2020)</p>
<b>Dimension: Forward guidance</b>		
Main refinancing operations rate and minus 2 year OIS rate spread	<p>The OIS rate reflects the expectations of future short-term interest rates plus a term premium (Hubert &amp; Labondance, 2018), which also shows expectations of given country’s central bank rate over the course of a certain period. The spread between current rate of main refinancing operations and OIS rate shows to what extent</p>	<p>ECB (2020a), Bloomberg (2020)</p>

<sup>116</sup> *Euribor* is short for Euro Interbank Offered Rate. The Euribor rates are based on the average interest rates at which a large panel of European banks borrow funds from one another.

<sup>117</sup> *OIS* is the overnight index swap rate, which represents a given country’s central bank rate over the course of a certain period.

	market participants expect the interest rate policy of the central bank to continue into the future.	
<b>Dimension: Price inflation</b>		
Yearly inflation according to the HICP	Current price inflation is measured by the yearly percentage changes in the Harmonized Index of Consumer prices.	ECB (2020a)
Current calendar year HICP forecast	The forecast of the changes in the HICP during current calendar year represents short-term expectations of the price inflation.	ECB (2020c)
One year ahead HICP forecast	The forecast of the changes in the HICP one year ahead represents medium-term expectations of the price inflation.	ECB (2020c)
Two years ahead HICP forecast	The forecast of the changes in the HICP two years ahead represents long-term expectations of the price inflation.	ECB (2020c)

Once the list of indicators is available, further steps in compiling the composite indicator are normalization of the data, ponderation of the indicators and aggregating them into a composite indicator. We will go through these steps now.

### Normalization

The normalization method used for the index of money quality was the min-max transformation. The min-max transformation brings all the values of all the indicators on a scale of 0 to 100, where 0 represents the lowest value and 100 represents the highest value. The formulas of min-max transformation used in the calculation are presented below.

In cases where higher values of the indicator represent higher values in the index:

$$I_a^t = \frac{x_a^t - \min(x_a)}{\max(x_a) - \min(x_a)} * 100,$$

in cases where higher values of the indicator represent higher values in the index:

$$I_a^t = \frac{\max(x_a) - x_a^t}{\max(x_a) - \min(x_a)} * 100, \text{ where:}$$

$I_a^t$  is the transformed value of an indicator a at time t;

$x_a^t$  is the data point of an indicator a at time t;

$\min(x_a)$  is the minimum of all data points of an indicator a;

$\max(x_a)$  is the maximum of all data points of an indicator a.

The reasons why the min-max transformation was chosen over the other methods were primarily:

- The data used in the index are time series of variables which do not have high variability and no extreme values (in the cases of extreme values normalization methods based on the distance from the mean or standard deviation are preferred);
- According to the theoretical framework, changes in the indicator's value are important in the same way, regardless of the level (if this were not the case, the transformation should instead be concave (log, root, exponential or power));
- The transformation is intuitive and relatively easy to understand, which is an important feature for easier interpretation of the composite indicator.

### **Ponderation**

The ponderation of the composite indicator was decided separately on two levels: the level of dimensions and the level of indicators. The first step applied regression analysis and decided the weights of the six dimensions of the index. The second step applied correlation analysis and decided the weights of individual indicators in each of the dimensions.

- *Ponderation of dimensions (or sub-indices).* The composite index of quality of money contains five sub-indices, which contain various amounts of indicators. The weight of the sub-indices is decided through the regression analysis of particular sub-index and the composite index. The deciding factor is the coefficients of determination ( $R^2$ ) of single-variate regressions for each sub-index. The aim is for the coefficients of determination of each sub-index to be as close as possible to each other, which means that the proportion of the variance in the dependent variable (the index) that is predicted by the independent variable (the sub-index) should be more or less equal or at least not dominated by any one sub-index. The procedure starts with equal weighting of sub-indices, and the weights of sub-indices with the lowest coefficients of determination are increased (at the expense of sub-indices with high coefficients of determination) until the level of the highest possible



equality is reached. There are several restrictions to this procedure. First, for the reasons of simplicity and aesthetics, the step of adjustment (up and down) is 5 percentage points. Second, each sub-index must have no less than 5% weight. This is for theoretical integrity to keep at least minimum representation in the composite index. Thirdly, no sub-index should have more than 35% weight (roughly – a third). This is to avoid over-representation of one sub-index.

- *Ponderation of individual indicators in the sub-indices (dimensions).* The ponderation of indicators in the sub-indices correspond to the weights of the sub-indices, which are decided in the first step. Therefore, the general rule is that the weights of indicators are equal to the weight of the sub-index divided by the number of indicators in it. There are two rules according to which the weights of individual indicators can be adjusted.
  - Some sub-indices have several groups of indicators, which refer to different topics or types of indicators/measurements. E.g. the sub-index of Balance sheet contains indicators referring to the Liquidity, International strength and Equity position in the balance sheet of the central bank. Thus the first rule is that irrespective of the quantity of indicators in these topics, each one of them is weighted equally in the topic (which means that different indicators may have different weights in the sub-index depending on the number of them in the topic).
  - The second rule of ponderation of the individual indicators in the sub-indices is based on the correlation analysis. When indicators have high and statistically significant correlation between them (judged by Pearson's coefficient of correlation, if it is higher than 0.6), they are treated as one indicator (their weights are reduced to jointly equal the weight of other indicators).

Table 4 shows the results of the first step, which used linear regression analysis with indicator weights. After two steps of adjustment, the coefficients of determination are not equal, but they are more balanced than in the case of equal weighting. The intermediary steps of adjustment are presented in the Appendix III.

Table 4. Weight adjustments in the 1st step (dimensions)

Dimensions	R2 with equal weights	R2 after adjustment	Weights
Balance sheet of the central bank	15%	29%	20%
Money supply	34%	23%	10%
Interest rate	0%	15%	35% (max)
Stability of the financial system	54%	24%	5% (min)
Forward guidance	62%	9%	5%
Price inflation	6%	19%	25%

In the second step, the equal weighting of indicators in each dimension was adjusted to avoid double counting using the correlation analysis. As explained above, the weights were distributed equally to all indicators in each dimension, unless there were high levels of correlation (higher than 0.6). Following the correlation analysis the adjustment for four indicators was made in the dimension of interest rate (a, b, c and e) and two indicators in the dimension of price inflation (c and d). The correlation table can be found in the Appendix II and a detailed table of all weights of indicators can be found in the Appendix III.

### Aggregation

Linear compensatory aggregation was chosen as the most suitable method for aggregating the index of money quality. The value of the composite index was the arithmetic average of all the indicators weighted by their respective weights (explained in the section on ponderation above). The following aggregation formula was used:

$$Y_i = w_1x_{1i} + w_2x_{2i} + \dots + w_kx_{ki}$$

where:

$Y_i$  –  $i$  th value of the composite indicator,  $i = 1, 2, \dots, n$ ;

$w_j$  – weight of the  $j$  th indicator,  $j = 1, 2, \dots, k$ ;

$x_{ji}$  –  $i$  th observation of the  $j$  th indicator (macro variables),  $j = 1, 2, \dots, k$ ;

$n$  – number of observations (periods) of the composite indicator;

$k$  – number of indicators in the composite indicator.

The primary reason for this choice is that the theoretical framework, which is the source of the different dimensions of the index, implicitly assumes the possibility of

compensation (bad performance in one of the dimensions of quality of money can be compensated with the good performance in the others)<sup>118</sup>. The linear aggregation was preferred over the geometrical aggregation because some values of the indicators are equal to zero<sup>119</sup>. Moreover, linear compensatory aggregation is the most common method used in the creation of composite indicators (Gan et al., 2017).

## Results of the index

The results of the index of money quality are presented in the Fig. 29 below. The index demonstrates that since its introduction, the overall quality of Euro has declined by 38 points (on a scale of 0 to 100), from 68 in December 1999 to 30 in August 2019. The rate of decline on average is 0.16 points per month, or 2.0 points per year.

We can distinguish four different periods in the quality of the Euro. The dynamics of the quality of money during these periods were different and they represent distinctive economic conditions and policy of the ECB.

The first period lasted from the 1999 to the middle of 2005. It marks the initial decline in the quality of money in the Eurozone. The two most important drivers of the decline are the balance sheet of the ECB and the interest rate policy (see Fig. 30 and Fig. 31 below for the dynamics in the dimensions of the index). The quality of the balance sheet of the ECB declined during this period quite significantly. This was caused by the declined in liquidity (the amount of monetary base was growing faster than the value of gold or gold receivables, the value of reserve assets in general were declining). Moreover, there was a drop in the value of the foreign reserves and decline in the equity ratio to total assets of the central bank. In general, the ECB's balance sheet during this period became less liquid and it had less foreign reserves and equity as a ratio to total assets. During the first period the ECB also significantly reduced the

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<sup>118</sup> Quality of money is a subjective notion; it has different dimensions to it. The importance of different dimensions is a subjective matter – it depends on the individual making the evaluation. However, we can identify these dimensions and create a composite indicator, which at least approximates the general trend of the quality of money. It is quite reasonable to assume that bad performance in one of the dimensions can be compensated with the good performance in the others. To claim the opposite, it seems, would be to assume that we know more about the process of subjective evaluation of quality of money, that we actually do.

<sup>119</sup> The quality of geometric means is that when any of the values of the indicator is zero, then the geometric mean also becomes zero, which is not a desirable feature of the aggregation scheme in our particular case.

interest rate. The interest rate of the main refinancing operations were reduced from 4.75 in the 2000 to 2 percent in 2003. Since September 2001, the interest rate was lower than what would have been suggested by the Taylor rule.

The second period lasted from about the middle of 2005 to the middle of 2008, when the quality of money stopped declining and somewhat increased. The quality of the balance sheet of the ECB was still declining during this period, but it was offset by the increased interest rates – the ECB was phasing out of the stimulating monetary policy and gradually increased the interest rate of the main refinancing operations up to 4.25 percent in 2008.

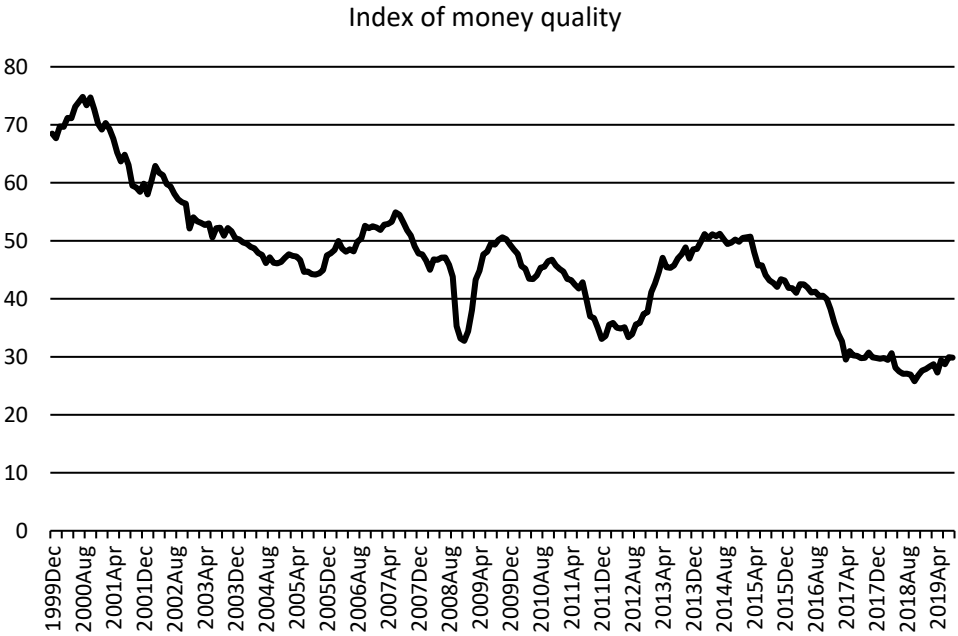
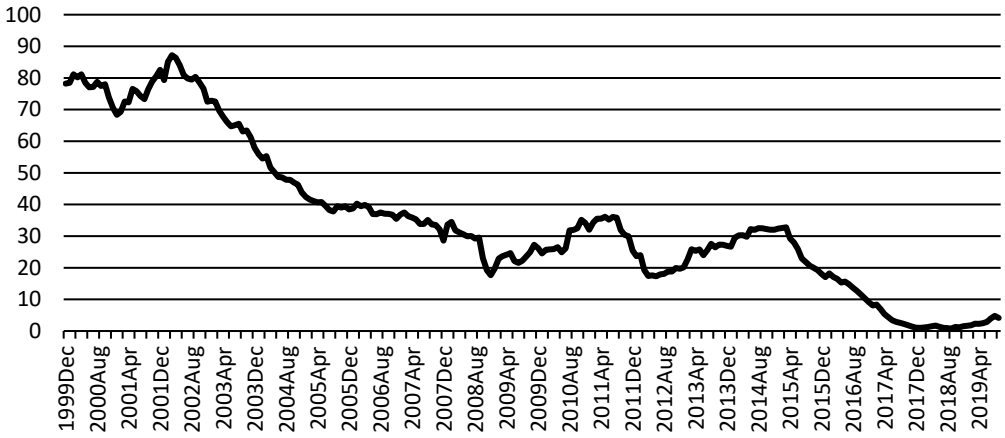


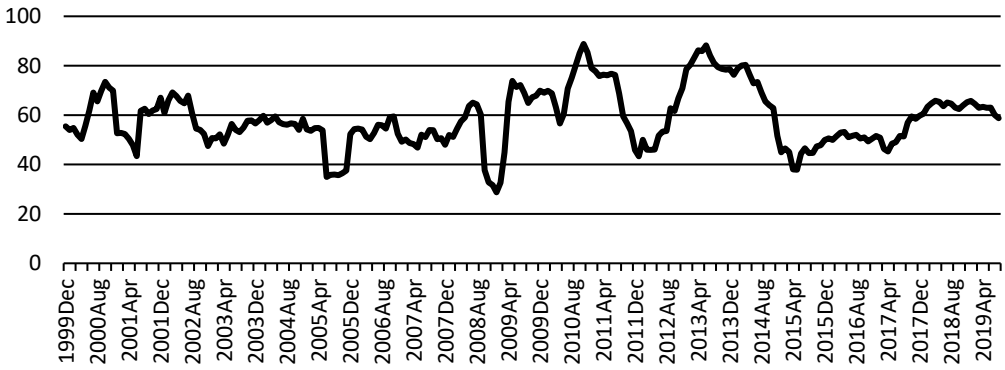
Fig. 29. Index of money quality (scale: 0 to 100)

The third period was that of financial and economic turmoil and it lasted from the middle of 2008 until the beginning of the 2013. This period marks two very significant drops in the quality of money. The first one took place in-between the second half of 2008 and the first half of 2009.

Dimension: Balance sheet



Dimension: Money growth



Dimension: Interest rate

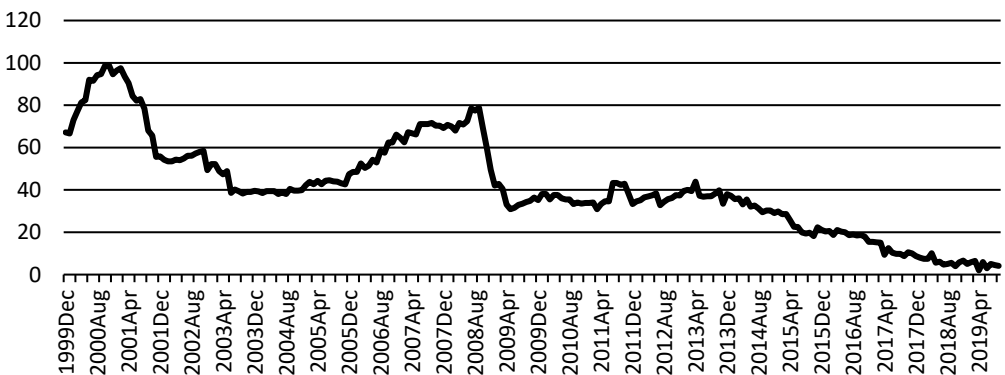
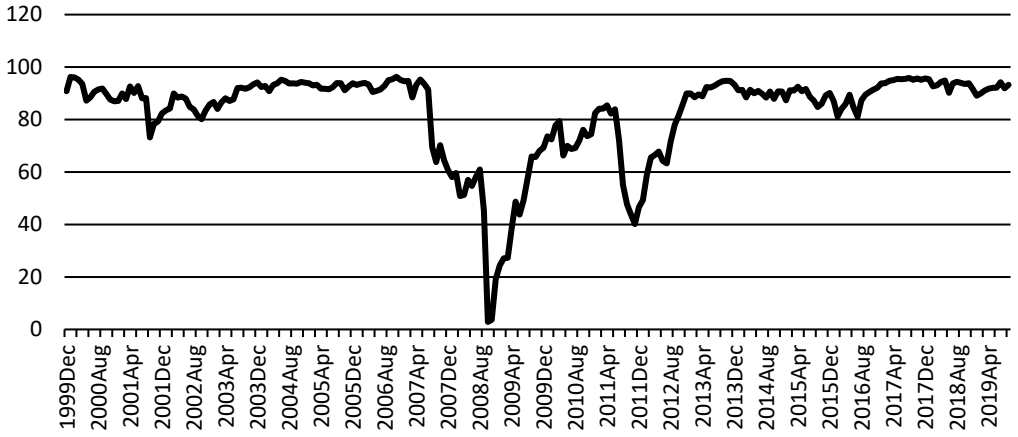
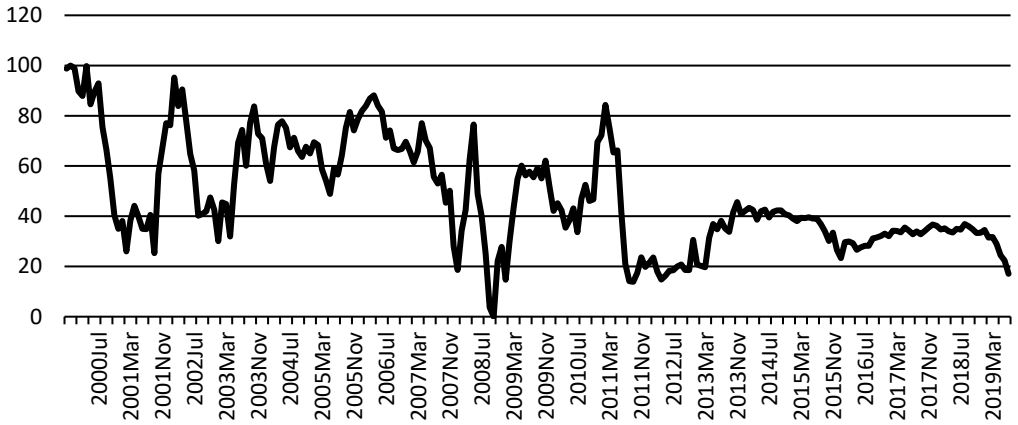


Fig. 30. Dimensions of the index of money quality I

Dimension: Stability



Dimension: Forward guidance



Dimension: Price inflation

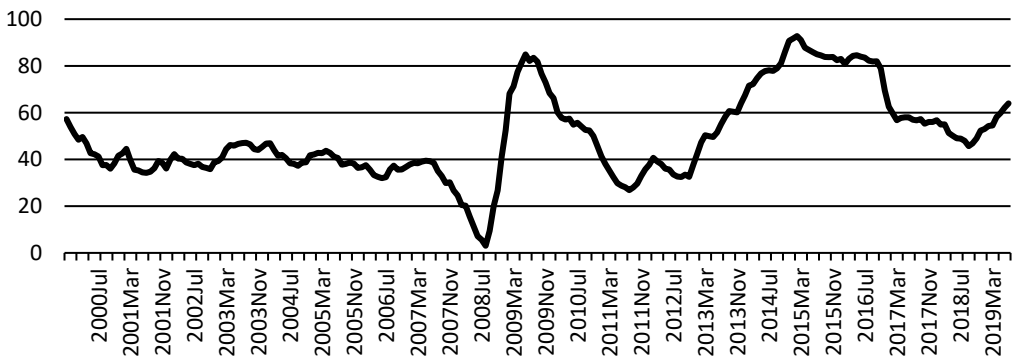


Fig. 31. Dimensions of the index of money quality II

There were many factors that contributed to this drop. Stability of the financial system declined rapidly. Financial turmoil spread to the real economy, which halted economic growth and induced the ECB to try to save the financial sector and prop up the economy by rapidly reducing the interest rates to new record low of 1 percent and quickly increase the growth of money supply. This increased expectations in the market that the central bank will continue with the inflationary monetary policy.

After the first half of 2009 the economic and financial situation in the Eurozone somewhat stabilized and the drop in the quality of money was offset by an increase in the financial stability and reduced growth in the money supply. However, the situation worsened very quickly again in the second half of 2011, when financial markets started panicking again due to the sovereign debt crisis in some of the Euro countries, primarily Greece. The stability of the financial system rapidly declined again, bond yields of weak euro-member governments were soaring. This was the catalyst for ECB president Mario Draghi to give his famous speech, in which he said that *“Within our mandate, the ECB is ready to do whatever it takes to preserve the euro”*. The ECB again lowered the interest rate, increased the money supply, and started conducting quantitative easing and forward guidance. This caused the quality of the balance sheet to decline, since new policies reduced the liquidity, reserves, and equity of the ECB. All this contributed to the significant drop in the quality of money. After these measures, the stability of the financial system increased again and somewhat reversed the drop in the quality of money.

The fourth period started around 2013 and lasted at least until the end of 2019. During this period, the ECB continued conducting the policies of quantitative easing and forward guidance. The interest rates were reduced further until they reached 0 percent in 2016. The growth of money supply has again increased. It was especially high in 2013 and 2014. Quantitative easing led to the vast expansion of the balance sheet of the central bank and the excess reserves of the commercial banks at the ECB. The communication of the ECB has been focused on forward guidance, assuring market participants of the accommodative monetary policy in the future. All these measures have convinced financial markets that the troubles are behind and different measures showed the gradual stabilization of the financial system. During fourth period the quality of money has declined, the stability of the financial system was the only dimension of the index which has increased. This suggests that the policies which

were enacted by the ECB were successful in stabilizing the financial system, but they caused a significant decline in the quality of money in the Eurozone.

### **Sensitivity analysis**

Sensitivity analysis is the study of output variation in models such as a composite indicator depending on the different assumptions made in the model (Saltelli et al., 2004). Sensitivity analysis is quite important in the process of compiling and analysis of composite indicators, since it involves quite a few assumptions, which are based on value driven and non-objective considerations of the researcher. Essentially, there were 4 types of assumptions made in the creation of the index of money quality, which are the subject to the sensitivity analysis:

1. Assumptions coming from the theoretical framework on the dimensions of the index and the choice of the indicators;
2. The type of normalization scheme;
3. The method ponderation of the dimensions and indicators;
4. The choice of the type of aggregation.

The sensitivity analysis of the index of money quality will be based on the consideration of ponderation and aggregation. The index includes all the dimensions of the index which were found to be relevant in the literature for the notion of the quality of money, and for which quantitative data is available. Moreover, the procedure of choosing the indicators was quite inclusive. There are only a few indicators that are available to measure the different dimensions of the index and all of the identified indicators were included. The impact of the choice of indicators on the results of the composite index will be at least partly measured in performing the sensitivity analysis of ponderation. The min-max normalization scheme, which was used, fits the type of the data and the purpose (theoretical framework) of the index quite well (see the section on the “Normalization” above). Thus the sensitivity analysis on the normalization scheme will not be performed as well. Instead we will focus on the ponderation and aggregation schemes.

The baseline scenario of ponderation (which was the result of the two-step procedure explained in the section above on “Ponderation”) will be compared to the most common alternative type of ponderation – equal weighting. This will allow to see to what extent the results of the index vary depending on the system of ponderation



chosen for the index. Moreover, the baseline scenario of aggregation (weighted arithmetic) will be compared to its most common alternative – weighted geometric.

Therefore, the sensitivity analysis contains four indices:

- Weighted arithmetic average (main index, baseline case);
- Weighted geometric average;
- Equal weights arithmetic average;
- Equal weights geometric average.

All 4 indices and their values are shown in the Fig. 32 below.

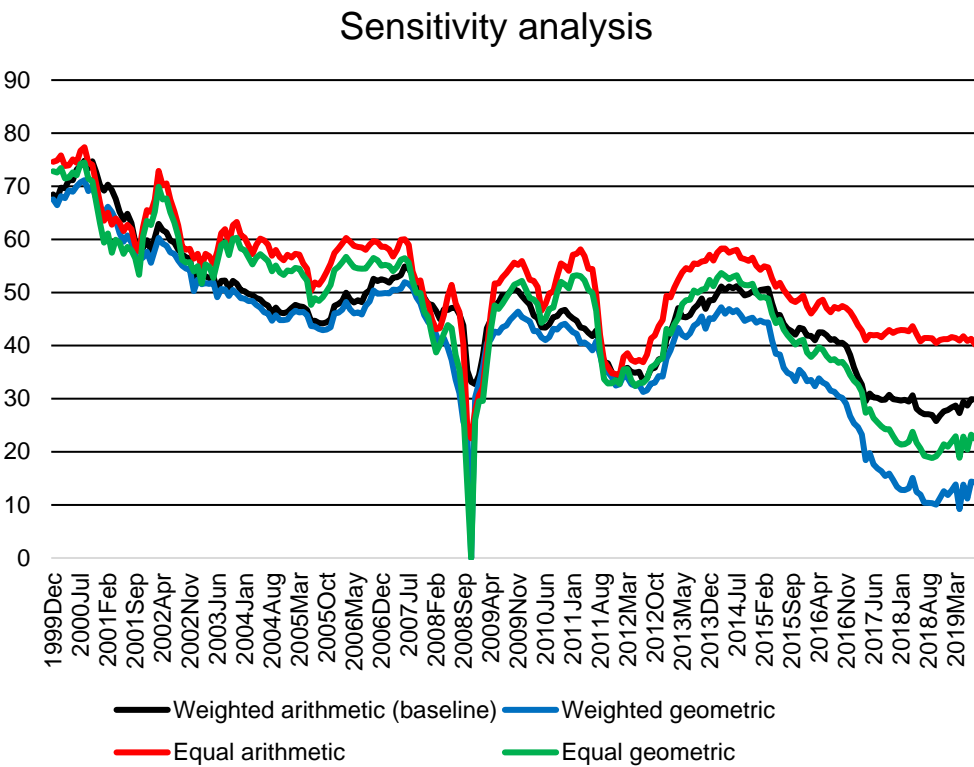


Fig. 32. Results of the sensitivity analysis

The differences among the alternative indices, which represent different ponderation and aggregation schemes, are mainly in the level, but not in the direction of the index. The patterns of the indices are very similar and they do not vary much depending on the ponderation and aggregation schemes' assumptions. One noticeable difference is between the arithmetic and the geometric aggregation when the values of the two

indices with geometric aggregation drop to 0 (year 2008 and 2019). This is due to a feature of geometric means – when any of the values of the dimensions are 0, then the geometric mean also becomes zero.

However, the graphical analysis does not suffice for our purposes for two reasons. First, in order to analyze to what extent the assumptions of the index impact its results, we need a measurable criteria. Second, what is most important is not the analysis of the nominal levels of index, but the changes in the index. This is because in the second part of our empirical analysis, we will use changes in the index to see, how they influence prices of financial assets. Therefore, below we will look at some quantitative criteria of sensitivity analysis.

Table 5. The sensitivity analysis of month-to-month changes in the 4 indices

		Ponderation		Statistic	
		Weighted	Equal weights		
<b>Aggregation</b>	Arithmetic	Base line	-0,05	Average in differences	
			2,5	Standard deviation of differences	
			24%	Percentage of cases of different signs	
	Geometric		-0,03	0,03	Average in differences
			2,6	1,6	Standard deviation of differences
			12%	25%	Percentage of cases of different signs

Table 5 above contains quantitative parameters of the sensitivity analysis of the month-to-month changes of the 4 indices. The table shows to what extent the results of the 3 indices (representing different assumptions of aggregation and ponderation) are different to the results of the baseline index. Three parameters that are used are:

- The average difference between the changes in the index compared to the baseline index (plus sign means that on average the changes in the index where bigger than those of the baseline index);
- The standard deviation in the differences between the changes in the index compared to the baseline index;
- Percentage of cases (months), where the changes in the index and the changes in the baselines index had different signs.

A comparison between the changes in the baseline index and 3 other indices shows that assumptions on ponderation and aggregation do not play a big role in the results of the index of money quality. The average in differences vary between only -0.05 and 0.03 points (on a scale of 100). The standard deviation of these differences vary between 1.6 and 2.6 out of 100. The cases where the sign in the changes of the baseline index are different from the other indices vary from 12 to 25%. We should keep in mind that this percentage will decrease significantly in the case of quarterly and yearly data used in the regression analysis below.

To sum up, the sensitivity analysis revealed that the impact of the assumptions which were made while compiling the index on ponderation and aggregation do not have a significant impact on the results of the index. This gives us confidence that the value-driven and subjective choices in the methodology of the index are not likely to distort the results of our analysis.

## **4.2. Empirical asset pricing using the macro approach**

The next step of our empirical framework is to test the relationship between the composite indicator of money quality and prices of financial assets. As discussed in the methodological part, the model, which was chosen for this task, was arbitrage pricing model using macro indicators as control variables and the index of money quality as the main exogenous variable. The empirical link between the quality of money and stock prices is investigated by running linear regressions. Dependent variables are the broad stock price indices for Eurozone (Dow Jones Euro Stoxx Price Index) and stock price indices (MSCI Standard Large and Mid Cap indices) of 10 Eurozone countries, which were the initial members<sup>120</sup> since the introduction of the Euro. The main independent variable was the index of money quality – its current, lagged and lead values.<sup>121</sup> Other independent variables were macro indicators most commonly used by other authors in these type of regressions, which were discussed in chapter 3.4. They are: GDP, industrial production, consumer prices, unemployment, short and long interest rates, money supply and exchange rate. Full list of the dependent and the independent variables can be found in the Appendix IV.

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<sup>120</sup> Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain

<sup>121</sup> For yearly data – two lead and lagged values, for quarterly data – four lead and lagged values, for monthly data – six lead and lagged values.

## Regression results

All the variables were regressed on the basis of monthly, quarterly and yearly data to check for the robustness of the results. The regressions were run using the backward elimination procedure – by including all variables first and gradually eliminating those that were not significant, until only the significant ones are left at the 95 percent confidence level. Table 6, Table 7 and Table 8 below present the results of the final regressions, each table corresponding to respectively monthly, quarterly and yearly data. There are 11 regressions for each frequency (one for the whole Eurozone, and 10 for countries separately). The tables present final regressions after all the not significant independent variables were removed.<sup>122</sup> Below are the short discussion of the results of the regressions. In the 5<sup>th</sup> part of the dissertation the results will be discussed more thoroughly in their theoretical context.

The results of the regressions show that the index of money quality is in most cases is statistically significant. The index was statistically significant in all 11 cases for the monthly data, in 9 cases for the quarterly data (the exceptions are Germany and Ireland) and in 8 cases for the yearly data (the exceptions are Eurozone, Ireland and Austria). The highest threshold of statistical significance ( $p \leq 0.001$ ) was achieved for France, Italy and Portugal for the monthly data, Eurozone, Belgium and Portugal for the quarterly data, and France, Germany, Spain and Finland for the yearly data).

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<sup>122</sup> Tables include only those independent variables, which were statistically significant at least once for different countries in each frequency.

Table 6. Results of the regressions based on the monthly data

	Eurozone	BEL	FRA	DEU	ITA	NLD	ESP	FIN	IRL	PRT	AUT
Quality of money	0.96** (0.36)	1.44** (0.48)	0.92*** (0.26)	0.97** (0.30)	0.97*** (0.30)	0.95** (0.33)	0.90** (0.31)	1.05** (0.38)	0.74* (0.35)	1.01*** (0.28)	1.29* (0.52)
Lag 1											0.74*** (0.23)
Lag 3			0.62** (0.22)	0.71** (0.27)	0.74** (0.24)	0.52* (0.21)	0.59* (0.24)				
Lag 4	0.46* (0.23)										
Lead 6											-0.91* (0.36)
Consumer prices										1.23** (0.45)	
Long-term interest rate				7.15** (2.66)	-4.62** (1.50)		-4.21* (2.10)			-2.01** (0.75)	
Nominal exchange rate	-0.69*** (0.20)	-1.22* (0.52)	-0.91* (0.37)	-1.24** (0.48)		-2.11*** (0.53)		-1.62** (0.55)			
Constant	0.31 (0.26)	0.58 (0.34)	0.59 (0.30)	0.78 (0.34)	0.25 (0.35)	0.75 (0.31)	0.41 (0.37)	0.29 (0.51)	-0.01 (0.39)	-0.10 (0.34)	0.51 (0.42)
R <sup>2</sup>	0.15	0.14	0.13	0.17	0.15	0.14	0.10		0.03	0.11	0.18
Observations	233	237	234	234	234	234	234		237	238	230

**Note.** \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$ , \*\*\*  $p \leq 0.001$ . Results of linear regression. Reporting: B, strength of statistical significance, (standard error). Only statistically significant variables are presented in the table.

Table 7. Results of the regressions based on the quarterly data

	Eurozon e	BEL	FRA	DEU	ITA	NLD	ESP	FIN	IRL	PRT	AUT
Quality of money	1.46*** (0.32)	1.45*** (0.36)	0.78* (0.37)		1.04** (0.34)	1.06** (0.37)	0.81* (0.33)	1.49** (0.56)		1.15*** (0.34)	1.85** (0.68)
Lag 1			0.99* (0.39)	0.91* (0.38)	0.91* (0.37)	0.95** (0.34)	1.00** (0.37)			0.86** (0.29)	
Lead 2											-1.33* (0.59)
GDP	6.04*** (1.55)	7.35** (2.30)			4.01** (1.51)		2.84* (1.27)		0.95** (0.35)		
Consumer prices						-2.24* (0.86)		-7.09** (2.65)			
Long-term interest rate			6.46* (3.16)	12.73** (4.01)							
Nominal exchange rate	-1.00* (0.39)			-1.81* (0.90)		-2.72** (0.87)		-2.55* (1.10)			
Constant	-0.82 (1.10)	-1.40 (1.54)	2.19 (0.88)	2.46 (1.07)	0.90 (1.01)	3.66 (0.93)	0.47 (1.17)	4.26 (1.84)	-1.51 (1.61)	0.87 (1.02)	1.09 (1.45)
R <sup>2</sup>	0.38	0.28	0.26	0.28	0.26	0.37	0.22	0.20	0.06	0.20	0.29
Observations	79	79	78	78	78	78	78	79	79	78	77

**Note.** \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$ , \*\*\*  $p \leq 0.001$ . Results of linear regression. Reporting: B, strength of statistical significance, (standard error). Only statistically significant variables are presented in the table.

Table 8. Results of the regressions based on the yearly data

	Eurozone	BEL	FRA	DEU	ITA	NLD	ESP	FIN	IRL	PRT	AUT
Quality of money		2.72* (0.97)	1.90*** (0.49)	2.84*** (0.72)	1.92** (0.58)	2.09** (0.56)	1.86*** (0.41)	2.77*** (0.50)		1.98** (0.58)	
Lag 2											-1.79* (0.68)
Lead 2				1.48* (0.60)							
GDP	2.75* (1.02)							3.53** (1.10)			
Unemployment											62.85** (18.44)
Short-term interest rate	14.29** * (2.26)										30.42** (9.44)
Long-term interest rate										17.54* (6.68)	
Constant	3.15 (2.21)	7.75 (4.60)	6.60 (3.01)	10.87 (3.56)	3.60 (3.15)	7.70 (3.02)	6.68 (3.38)	5.37 (4.13)		6.63 (3.44)	2.93 (5.53)
R <sup>2</sup>	0.75	0.43	0.51	0.57	0.49	0.52	0.47	0.62		0.54	0.72
Observations	19	19	19	17	78	19	19	19	19	19	17

**Note.** \*  $p \leq 0.05$ , \*\*  $p \leq 0.01$ , \*\*\*  $p \leq 0.001$ . Results of linear regression. Reporting: B, strength of statistical significance, (standard error). Only statistically significant variables are presented in the table.

The coefficients for the index of money quality, which quantify the average impact of the change in the index of money quality on the price index, differ across countries and the frequency of data used. For monthly data, a change in one point of the index of money quality on average increases the price index by 0.96 percent for the whole Eurozone. The coefficients for countries vary between 0.74 and 1.44. The average of country coefficients is 1.02, which is pretty close to the coefficient based on the data for the Eurozone. Quarterly coefficient for the whole Eurozone is 1.46, country coefficients vary between 0.78 and 1.85 and the average of country coefficients is 1.21. Lastly, country coefficients based on yearly data vary from 1.86 to 2.84, the average being 2.26. To summarize the results, an increase in the quality of money indicator by one point on average is associated with an increase in stock indices ranging from 0.74 to 2.84 percent, depending on the region and frequency of the data.

The most consistent significance of lagged values of the index of money quality were for three-month lag (3<sup>rd</sup> lag) in the monthly frequency (five out of 11 cases for the country regressions) and three-month lag (1<sup>st</sup> lag) in the quarterly data (six out of 11 cases for the country regressions, five cases coinciding with the monthly frequency). The general tendency is that the lag is significant in cases where the current value of the quality of money indicator is also significant (there are two exceptions from 12 cases). Other cases where lagged or lead values are significant are rare and on the border of being statistically insignificant.

There are some tendencies related to other independent variables. In monthly data, most cases of significance were for the exchange rate (negative coefficients) and long-term interest rate (mixed coefficients). In quarterly data, most cases of significance were for GDP (positive coefficients), nominal exchange rate (negative coefficients) and long-term interest rate (positive coefficients). In the yearly data, macro indicators were sparsely significant.

### **Pre-estimation tests: stationarity**

Before running the regressions, all variables were checked for stationarity using the Augmented Dickey-Fuller unit-root test. This test checks if a variable follows a unit-root process. The null hypothesis of the test is that the variable contains a unit root. The alternative hypothesis is that the variable was generated by a stationary process.



The test was first run on the initial data for the indicators, separately for the monthly, quarterly and yearly data. For most of the variables (193 out of 210), the null hypothesis (that the variable contains a unit root) was rejected at 5% confidence level. Therefore, the data in variables were transformed by calculating first percentage differences. After the transformation, all the variables passed the unit root test except 7 for the monthly data. However, since these 7 variables were insignificant in the final regressions, their non-stationarity can be ignored. All the statistically significant variables that are contained in the final regressions are non-stationary.

### **Post-estimation tests: heteroscedasticity, multicollinearity and autocorrelation**

The presence of heteroscedasticity in the results was checked by performing the Breusch-Pagan test. The null hypothesis of the Breusch-Pagan test is that the error variances are all equal (homoscedasticity), the alternative hypothesis is that the error variances are a multiplicative function of one or more variables (presence of heteroscedasticity). The null hypothesis of constant variance was rejected at 5% level of significance for 18 out of 33 initial regressions (the table with the results of post-estimation tests can be found in the Appendix V). Therefore all regressions were updated by running robust standard errors. Tables with the results above contain results with robust standard errors.

The presence of multicollinearity in the regressions was tested by using the VIF test. The value for VIF starts at 1 and has no upper limit. A value of 1 shows that there is no correlation between a given variable and any other variables in the model. A value between 1 and 5 indicates moderate correlation. A value greater than 5 indicates severe correlation. According to this test, all 33 regressions did not contain any significant amount of multicollinearity, The average VIF value for all regressions was 1.07, maximum – 1.44.

The Durbin-Watson statistic was used to check for the autocorrelation in the residuals of the regressions. The Durbin-Watson statistic has a value between 0 and 4. A value of 2 means that there is no autocorrelation. Values from 0 to less than 2 show positive autocorrelation. Values from 2 to 4 indicate negative autocorrelation. The test indicated that there is no significant amount of autocorrelation in the regressions. The average value of the statistic for all regressions was 2.0. The lowest value of the statistic was 1.6 and the highest was 2.36.

### **4.3. Hypothesis testing based on the results of the empirical research**

Based on the empirical research results, presented in 4.1 and 4.2, the following hypotheses are accepted:

- 1<sup>st</sup> hypothesis: the quality of money in the Eurozone over the long-term has decreased to correspond to the development of prices of financial assets vs general price level. As discussed above, the composite indicator shows that the quality of money in the Eurozone has declined by 38 points (on a scale of 0 to 100), from 68 in December 1999 to 30 in August 2019.
- 2<sup>nd</sup> hypothesis: there is a statistically significant relationship between the medium-term (yearly) changes in the quality of money and the changes in the stock price indices. The results show that there was a statistically significant relationship in 8 out of 11 cases.
- 3<sup>rd</sup> hypothesis: there is a statistically significant relationship between the short-term (monthly and quarterly) changes in the quality of money and the changes in the stock price indices. The results show that there was a statistically significant relationship in 9 out of 11 cases for the quarterly data, and the relationship was statistically significant in all 11 cases for the monthly data.

Based on the empirical results, the following hypothesis is rejected:

- 4<sup>th</sup> hypothesis: the medium and short-term relationships between the changes in the quality of money and changes in the stock price indices is negative. The results show that all the statistically significant relationships were positive.

In what follows we will discuss the empirical results of the 4<sup>th</sup> part of the dissertation in their theoretical context and will present their limitations.

## **5. Discussion and limitations**

### **5.1. Discussion of the theoretical framework**

The theoretical part of this dissertation showed that central banks influence prices of financial assets not only through the direct demand, but also through changing the properties of financial assets. Moreover, the prices of financial assets do not only depend on the value of financial assets, but also on the value of money. Central banks can influence financial-asset prices through changing the properties of money.

The view that monetary policy influences the prices of financial assets through the modification of the properties of the financial assets and money adds to the existing understanding of the connection between monetary policy and the prices of the financial assets. The standard view of the transmission mechanism of the monetary policy explains that monetary policy influences prices of financial assets through the interest rate (wealth and broad credit channel), quantity of money (monetarist channel), supply and availability of financial assets (portfolio balance channel) and communication of future interest rates (signaling channel). Thus, the influence manifests through interest rates, direct demand of financial assets, and the money supply. The approach taken in this dissertation shows that the influence of monetary policy on the prices of financial assets has more dimensions to it. A subjectivist approach recognizes that central banks transform the properties of both financial assets and money.

As discussed above in more detail, monetary policy transforms such properties of financial assets as return, risk, liquidity, serviceability as collateral, cost of compliance. Change in these properties, in turn, change subjective value, demand, and thus prices of financial assets. These effects are not a part of the traditional understanding of the connection between the monetary policy and the prices of financial assets. The influence of monetary policy on the value and prices of financial assets through the transformation of these properties is thus a contribution of this dissertation.

Moreover, monetary policy not only transforms properties of financial assets, but also properties of money, which influences both the demand for money and the substitution of money to other assets – including financial assets. The idea that expected inflation is a factor of money demand, and that expectation of higher inflation negatively

influences demand for money, is not a new idea. It has been proposed in an influential article by Friedman (1956), who claimed that the demand for money is positively related to income and negatively related to expected inflation, interest rates on bonds and the rate of return on equity. Moreover, contrary to the Keynesian framework and their later neo-Keynesian developers (e.g. Tobin and Modigliani), Friedman recognized, that the excess money holdings (higher supply of money compared to the demand for money, caused by the increase in the former or the decrease in the latter) may lead to the purchase of the consumer durables and semi-durables, not only to the purchase of the interest-bearing financial assets.<sup>123</sup>

In the approach developed in this dissertation, the connection between excess money holdings and the demand for financial assets or other goods is similar to Friedman's. What differs, however, is the recognition that the channels through which central banks can cause excess money holdings is not simply its control of the quantity of money, where expected inflation is only the result of the changes in the money supply. A subjectivist approach recognizes that both the demand for money and inflation expectations can be influenced through other channels, discussed in the literature on the quality of money (e.g. institutional framework of the central bank, its constitution, emergence of new inflationary instruments of monetary policy, communication of the central bank and commitment to its future actions, quality of the balance sheet of the central bank, etc.) Thus, another contribution of this dissertation is the realization that central banks influence the demand for money through the transformation of other properties of the monetary unit itself, not just changing its supply and setting the interest rate.

In summary, the most important contribution of the dissertation is that it developed a framework, based on subjective value theory, which captures different channels through which monetary policy influences prices of financial assets. A subjectivist framework is very broad and flexible, in the sense that it can incorporate any properties

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<sup>123</sup> Friedman (1970, p. 28):

The difference between us and the Keynesians is less in the nature of the process than in the range of assets considered. The Keynesians tend to concentrate on a narrow range of marketable assets and recorded interest rates. We insist that a far wider range of assets and interest rates be taken into account - assets such as durable and semi-durable consumer goods, structures and other real property.

of financial assets and money, which are influenced or transformed by the monetary policy. However, this broadness comes with some limitations.

The theoretical framework of this work is based on the subjective value theory, which states that value depends on personal preferences of the individual, it always bound up with specific economic circumstances, and therefore it cannot be reduced to any objective measure. The inevitable limitation of the framework, which is inherent in the subjectivist approach, is that it cannot provide an exhaustive list of parameters to which the value of economic goods, in our case money and financial assets, depend on. Nevertheless, the framework was able to identify some new parameters (properties of financial assets and money) through which monetary policy influences the value and prices of financial assets, which are not in the standard explanation. Thus, despite the impossibility of being exhaustive, this framework is valuable and flexible enough to be able to include other parameters in further research.

It is important to clarify, that the discussion of prices based on the subjective value theory does not deny objective factors, which play a role in the determination of value and prices of economic goods. There is no tension between the subjectivity of value and the analysis of objective properties of economic goods and other physical characteristics of reality. The objective properties and parameters of economics goods inevitably play an important role in the determination of value and prices of economic goods. Economic goods are valued precisely because they objectively exist and have objective properties, which allow them to be useful in fulfilling the ends of individuals. However, the subjectivity of value recognizes that the exact set of objective properties and their relative importance in particular circumstances depend on the particular individual, who is making the valuation and is acting on it. Thus, objective properties of goods and characteristics of economic reality play a subjective role in the value considerations of individuals. Scientific analysis focuses on describing the objective parameters of our reality. However, economic analysis must recognize that the importance of objective factors for value considerations is always subjective.

Moreover, the dissertation focused on the discussion of value and demand for financial assets vs value and demand for money. However, as was seen from the development and description of this framework, the subjective value of financial assets strictly speaking depend on the value of money and on the value of other goods. Value and

demand for other goods was mostly omitted in the analysis and was only discussed briefly. The focus on money vs financial assets is justified, because (a) they are in many respects close substitutes and (b) there is a venerable tradition in economic analysis of focusing on this relationship, especially in Keynesian thought (Keynes (1936/2018), Gurley and Shaw (1960), Tobin (1961) and many others). Nevertheless, this omission is still a limitation of this work, which will be left to tackle for the further research.

## **5.2. Discussion of the empirical results**

The empirical part of this dissertation constructed a composite indicator of the quality of money, which showed that over the last 20 years the quality of money in the Eurozone has decreased. Moreover, there was a statistically significant positive relationship between the changes in the quality of money and stock price indices of the Eurozone countries.

The decreasing quality of the euro is in line with the theoretical reasoning suggested in the dissertation and also in Žukauskas and Hülsmann (2019). The claim is that the quantity theory of money cannot explain why prices in the financial sector grow faster relatively to prices in the non-financial sector of the economy. The quality of money channel suggests a novel explanation based on the quality of money - falling quality of money decreases the demand for money, with market participants shifting to the financial assets as an alternative form of holding wealth, resulting in increasing prices of financial assets relative to the prices of non-financial sector. The general downward tendency of the empirical measure of the quality of money created in this dissertation supports this reasoning.

The empirical results are important for other reasons as well. They show that the quality of money is one more factor, which needs to be incorporated into the analysis of the demand for money. In theory, given all the other factors (interest rate, income, prices etc.) of the demand for money, the preference of market participants to hold money balances may change due to the fluctuating quality of money. This factor is quite different from the ones already present in the theory since it is based on the qualitative – and not on the quantitative – theory of money and its purchasing power. The qualitative theory of money value allows for subjective judgements of market participants. This means that the changes in the perception of value, and thus the demand for money can be a lot more abrupt and extensive when compared to the

reasoning behind the quantitative theory of money, where demand for money depends on more stable factors (quantity of money, level of output etc.)

Moreover, the notion of the quality of money and demand for money is closely linked to prices. The price level is the result of the intersection of the demand for money balances and money supply. Shifts in the supply of money, as well as the demand for money, result in changes in the price level. Thus, changes in the quality of money, as one of the factors of money demand, may cause changes in the price level. More particularly, if a decreasing quality of money reduces the demand for money, the price level increases.

If the quality of money, which depends on the monetary policy and overall functioning of the monetary system, is a factor of money demand, then quality of money is part of the transmission mechanisms of monetary policy. Actions of central banks influence the quality of money, which in turns affects the money demand. According to this framework, then, monetary policy not only influences the economy through the changed supply of money, but also through the demand of money. Demand of money becomes (at least partly) an endogenous variable in the monetary policy.

However, there are important limitations to measuring the quality of money. The framework of quality of money is based on the subjective value theory. Money as a good is valued to the extent that it fulfils the needs of market participants. In particular, money is valued when it is a medium of exchange, a store of value, and a unit of account. However, what are these properties, which functions are most important, and how well does a particular monetary unit fulfil them – these are subjective value judgements. Therefore, attempts to measure the compositions of these properties cannot be thorough and objective by definition. They, in themselves, will be bound by individual value judgements, which may be different from those of other market participants. Moreover, the methodology (normalization, ponderation, aggregation) in the creation of composite index requires additional subjective decisions made by the researcher.

Moreover, not all dimensions which may be important for the quality of money can be easily quantified. E.g. literature identifies that the organization of a monetary authority (central bank independence, its accountability and transparency, its constitution, the competency of its decision makers, etc.) is one of the dimensions which is important

for the quality of money. However, there are no quantifiable indicators to measure this. These questions are especially laden with subjective judgements. This suggests that some of the identified dimensions of the quality of money are more quantifiable than others.

The second part of the empirical study used regression to measure the short-term relationship between the changes in the quality of money and changes in the prices of financial assets. The investigation of the monthly, quarterly, and yearly data on the changes of the quality of money indicator and their relation to the movements in the stock indices in the Eurozone – and separately in 10 countries of the Eurozone – showed that the short-term relation of the quality of money and stock prices is statistically significant and positive. This means that decreases in the quality of money are associated with decreases in the stock prices, and vice versa.

One possible explanation for the positive relationship is the phenomenon of the financial repression, discussed in the second part of the dissertation. The lower quality of money is related to a higher degree of financial repression, which is a factor in the lower demand for financial assets. Therefore, the substitution effect stemming from changes in the quality of money (the reduced quality of money resulting in monetary holdings being substituted for financial assets) is dominated by the financial repression effect (the reduction in quality resulting in part due to financial repression, which itself lowers the demand for the financial assets).

Therefore, the empirical results of the link between the quality of money and prices of the financial assets suggest the different long-term and short-term effects. In the long term, over two decades, the reduced quality of money leads to the substitution effect from money to financial assets, which means higher demand and faster growth of the prices of financial assets compared to the prices in the non-financial sector. However, in the short term, this relationship does not hold, since it is dominated by the financial repression effect, which reduces the demand for the financial assets (and money).

Thus, the narrative is that, in the short-term, financial repression caused by the monetary policy (as well as fiscal and regulatory policies), reduces the attractiveness (expected return) of holding financial assets, and thus reduces the demand for both financial assets and money. Nevertheless, in the long-term, the reduced quality of money causes market participants to shift their store of value from money to financial



assets. The short-term positive correlation between money and financial assets caused by the financial repression is complemented by the relative shift from money to financial assets due to the reduced quality of money in the long-term.

The simultaneous impact of the reduction in the quality of money and the financial repression effects is quite similar to the well-known relationship between the income and the substitution effects. The income effect causes the demand for all goods to shift when income (or budget constraint) changes. Similarly, the demand for money and financial assets is reduced due to the financial repression. On the other hand, the substitution effect simultaneously causes the demand to shift from one good to other good(s) when income (or budget constraint) changes. Similarly, the reduced quality of money shifts the demand from money to financial assets. Therefore, the analogy is that the effect of financial repression is analogous to the income effect, and the effect of the reduced quality of money is analogous to the substitution effect.

Moreover, the opposite relationship between two economic variables in short and long-term is not uncommon in the economic theory. For example, in capital theory, increased consumption at the expense of saving and investment may cause short-term economic growth. However, in the long term, it diminishes the capital stock and productivity, and reduces the long-term economic growth (e.g. Garrison (2002)).

There are important limitations to the second part of the empirical research as well. The regression analysis tested partial causal relationships between one or several independent variables (in our case, the quality of money and macroeconomic variables) and the dependent variable (in our case, prices of financial assets). This analysis is partial in the sense that in the realm of social sciences, and particularly economics, there always is a multitude of factors which simultaneously influence the dependent variable. This is especially true in case of broad, aggregated variables. Different models try to capture the most important variables, but this can never be done in its entirety for the two basic reasons. One is that there are too many factors effecting the dependent variable simultaneously. However, the number of independent variables must be limited, otherwise the model would get too complex or unspecifiable due to the lack of observations. Second is that not all relevant factors are quantifiable; they cannot be expressed in quantified measures in principle (e.g. economic value), or measures and data on them do not exist in the specific context. Thus the choice of

variables is always bound by the particular theoretical framework and model (in our particular case - APT using macro indicators), which is the basis of the choice of indicators. However, the choice of the framework does not make all other possible influences absent.

This limitation is relevant for the empirical investigation of this dissertation as well. Even though macroeconomic variables were added in the regressions to control for the other factors effecting the prices of financial assets, it is clear that there might be other factors, which were not controlled for. Then the quantitative relationship between the dependent variable and independent variables in focus is not captured in its entirety. The competing effects of the quality of money and the financial repression is one example of this.

Moreover, some limitations of the whole empirical approach in this dissertation should be mentioned as well. The theoretical framework of how monetary policy influences prices of financial assets which was developed in this dissertation is substantially bigger than the channel of the quality of money which was tested in the empirical part of this work. The task of empirically testing other channels, which were identified in the theoretical framework, has to be left for further research; otherwise, the empirical analysis would be too complex and longer than the requirements allow. This is another limitation of this work, which is inevitable in the sense that the theoretical part of the work aimed to create a new framework, based on the subjective value theory, which would encompass all different channels of impact. Since the framework is very broad, it is quite natural that not all aspects of this framework were tested empirically.

Another inevitable limitation of the subjectivist framework is that it cannot give a definite quantitative and objective measure of the importance of the different parameters or their relationship to the value of money or financial assets. The logic of subjectivist framework entails theorizing what properties of money and financial assets are related to their subjective value to the market participants. However, their particular expressions and their connection to value remains subjective, that is, it depends on different individuals and the economic circumstances of the valuation. Therefore, the importance of the results of the theoretical framework, and of the empirical research of this work, is that it (a) identifies, that monetary policy influence prices of financial assets through the modification of the properties of financial assets and money, and

(b) it gives the directional answer of how monetary policy influences prices of financial assets by theorizing (and in a way – assuming) which properties of money and financial assets are important for their value. However, it is unable to give the objective numerical relationships between these properties and the value of money and the financial assets. This is ultimately an inevitable limitation of this approach, which stems from the theory and philosophy of the subjectivity of value.

The identified properties of money and financial assets, through which monetary policy influences prices of financial assets are relevant, but the extent to which they change the value, demand and thus prices of financial assets, depends on the constellation of individuals and particular circumstances of the market. The empirical test of the quality of money channel and its impact on the prices of financial assets was an attempt to capture the relationship in the specific circumstances. However, the framework of subjective value recognizes that the particular numerical relationship, which was the result of this empirical work, is not universal and dependent upon the circumstances unique to this study. This does not mean, however, that the theoretical framework and the empirical results are neither void nor irrelevant. As much as the theoretical framework is sound and the empirical analysis is correct, the results give us definite answers about the channels through which the monetary policy influences the prices of the financial assets. The limitation is that the particular expression and manifestation of these channels will always depend on the circumstances.

## Conclusions

Financial assets are economic goods and are valued subjectively by market participants. Their value originates either from claims to future financial flows, such as dividends, interest, principle payments (claim value), an anticipated future sell (exchange value), – or a combination of the two. Financial assets contain basic properties such as return, risk, liquidity, maturity and others. Market participants base their valuations of financial assets on these properties, which results in their demand for financial assets. Although these properties may have objective quantitative expressions, the valuation of financial assets in the market is subjective.

The equilibrium price is the price which equalizes the quantities of the good supplied and demanded in the market at the given point in time. Alternatively, we can think of this equilibrium price as the one which equalizes the available stock and the total demand of the good. The latter is the sum of the exchange demand of non-owners to buy the good, and of the reservation demand of owners to hold the good. These two conditions are analogous. The second – total demand – approach is a useful analytical tool, alternative to the traditional demand and supply analysis, which allows for conceptualizing price formation in the market. It leads to several important insights, elaborated below.

The market price of a particular financial asset depends on the total demand for it and its total available stock. The lower its price, the higher is the reservation demand (more owners are willing to hold it) and the higher is the exchange demand (more non-owners are willing to purchase it). The amount of the financial asset to hold or to purchase depends on the subjective valuation of it, according to the aforementioned properties of the financial asset.

The total demand approach, and the notion of reservation demand, shows that subjective valuation of the financial asset is done vis-à-vis money. The reservation and exchange demand schedules in the market are a result of value comparisons of holding and acquiring different amounts of financial assets and different amounts of money unit. The decision on the amount of financial assets to hold and purchase depend on the demand for money. In particular, the amount of financial assets that one wants to purchase (exchange demand for financial assets) depends on the amount of money that one wants to hold (reservation demand for money). Moreover,

the amount of financial assets that one wants to hold (reservation demand for financial assets) depends on the amount of money that one wants to receive (exchange demand for money). Ultimately, the demand for financial assets and thus their prices depend on the demand for and value of money. This is the first significant insight coming from the total demand approach.

An obvious way of how monetary policy influences prices of financial assets is through the purchasing of such assets. Central bank purchases of a particular class of assets represent additional demand for them, which would not exist otherwise, and increase both their exchange demand and price. This is the direct effect of monetary policy on financial asset prices.

However, there are additional, indirect mechanisms of influence. The first of these is through a change in the properties of certain financial assets. One example is a policy change making a class of financial assets to be eligible as collateral to borrow from the central bank. In the Eurozone, conventional monetary policy in most cases is done not through financial asset purchases, but through borrowing against financial assets as collateral. The acceptance of particular financial assets as collateral means that owning this financial asset becomes closer to owning money, the difference being the target interest rate on the open market operations (which is set at zero or close to zero during the periods of expansionary monetary policy). Acceptance of a particular financial asset as a collateral is a valuable property of this financial asset. The existence of this privilege, to the extent that it is valuable, creates demand which would not exist otherwise. The source of this demand is different in the cases of asset purchases and loans. Asset purchases create direct demand from the central bank. On the other hand, when the central bank extends loans against collateral, the demand comes from the other market participants. Nevertheless, the central bank has an indirect control of this demand through the collateral rules and conditions under which it lends.

The extent of the direct effect through asset purchases, and indirect effect through collateral is decided by the central bank. Higher amounts of asset purchases and higher amounts of lending with lower interest rate generate higher additional demand, and thus have a more extensive impact on the prices of these particular financial assets. Therefore, there is a direct link between monetary policy and financial assets,

which the central bank chooses as a vehicle in the transmission of monetary policy. The additional demand for these assets generated by their involvement in the mechanism of monetary policy means that their prices are higher than they would be otherwise.

There are additional examples of indirect effects of monetary policy on financial assets, through changes to properties which generate additional demand for them.

Some aspects in existing regulatory frameworks have the effect of incentivizing financial institutions to prioritize holding a particular class of assets over others. This incentive may result from capital and liquidity requirements, which categorize financial assets into particular groups, and apply different requirements to financial institutions depending on the category of financial assets that they hold. This categorization creates an incentive for financial institutions to hold particular financial assets, for which capital and liquidity requirements are lower and thus compliance costs are lower. Consequently, the demand for (and prices of) these financial assets becomes higher than it would otherwise be without these regulations.

Central banks, through monetary policy, inevitably influence economic activity. They affect economic development and the expansion and contraction of economic output. This influence may not be uniform across sectors – some sectors may be influenced more than others. Financial assets (stocks and bonds) represent companies. Their ability to create value and earn profits is inevitably related to economic conditions. Therefore, monetary policy, through its impact on the economy, has an indirect effect on companies, incomes, and profits, and thus the cash flows being generated to the owners of the financial assets of these companies. Therefore, through its impact on economic activity, monetary policy indirectly influences the value and prices of financial assets. Some theories linking monetary policy to the economy suggest homogenous aggregate effects, while others propose the effects are asymmetric and structural.

Monetary policy also affects the risks associated with holding financial assets. Monetary policy and central banks aim to reduce the systemic risk of financial markets and thus of holding financial assets in general. Moreover, monetary policy reduces the idiosyncratic risk (credit and liquidity risks) of holding particular financial assets targeted by policy makers. Lower systemic risk means higher demand for financial

assets vis-à-vis other goods and lower idiosyncratic risk means higher demand for particular financial assets vis-à-vis other financial assets and other goods.

Thus, the indirect effect of monetary policy on financial assets work through the change in their properties. Monetary policy transforms the properties of financial assets (return, risk, liquidity, serviceability as collateral, cost of compliance) which changes the demand for and prices of the affected financial assets.

The total demand approach identifies that the change in properties of financial assets affects not only the exchange demand for financial assets (in the form of higher demand to purchase the financial asset by non-owners), but also the reservation demand for financial assets (in the form of higher demand to hold the financial asset by owners). This is because financial assets are durable goods, which means that the reservation demand is relatively high compared to the exchange demand. Therefore, the effect of the change in properties on the total demand is substantially higher than it would be in the case of a non-durable good.

A third mechanism of influence (besides the influence through direct demand and through change in properties of financial assets) is through the substitution of different financial assets. One example is the spread of monetary policy from short-term to long-term financial assets.

Changes in prices of financial assets that are not part of the money market, where central banks set short-term interest rates through regulating the amount of liquidity, come about through the changes in valuation of (and thus demand for) these assets by the market participants. The law of one price in the market is based on the idea of arbitrage - market forces tend to eliminate price differences of any asset across markets through profitable arbitrage opportunities. What makes two financial assets equivalent is a subjective notion. All financial assets share the characteristic that they are claims to future financial flows. However, as mentioned before, there are many differences between them that are embodied in their properties, which are subjectively important to market participants in judging their value.

Different manifestations of these properties among financial assets determine the degree to which they are subjectively equivalent, substitutable to the market participants. In this respect, all financial assets in the eyes of market participants fall within a spectrum according to their properties. This spectrum accounts for the

differences in their subjective valuation, demand and ultimately their prices. The prices of financial assets in this spectrum are interlinked to the degree that they are partial substitutes. The principle of arbitrage relates the prices of financial assets, which marginally differ in their properties, but are still close or distant substitutes. Price differences between financial assets account for the differences in their properties, which make them more or less valuable in the eyes of market participants. If the price difference in the eyes of market participants becomes too big or too small, they increase their demand for the financial asset, which in their eyes is underpriced, given its properties, and decrease their demand for the financial asset, which is overpriced. This mechanism brings the price differential at par with the subjective valuation of the differences in the properties of the two financial assets.

These interlinkages between financial assets also explain how central bank-induced changes of short-term interest rates in the money market affect the prices of the financial assets outside of the money market. Lower short-term interest rate in the money market means higher prices of money market financial assets, which causes market participants to shift their demand to other financial assets (which are seen as partial substitutes). Thus, a lower short-term interest rate leads to higher demand for longer-term financial assets, and a lower longer-term interest rate.

This mechanism works not only as a transmission from short-term to longer-term financial assets. It is relevant for other properties of financial assets too, e.g. risk, liquidity. If central bank increases its demand for a particular financial asset, the prices of other financial assets with similar properties will react as well. This is particularly relevant in the context of unconventional instruments of monetary policy, which often target specific financial assets. If a central bank chooses to increase its demand for a financial asset with a particular property and causes its price to increase; this will lead market participants to shift their demand for financial assets with similar properties and will increase their prices.

Lastly, monetary policy has an effect not only on the properties of financial assets, but also on the properties of money. The demand and value of money – as of any other good – is subjective. Central banks, through monetary policy, influence the properties of money that are subjectively important for money users in judging the ability of money to fulfil its functions. In particular, central banks control the quality of money, i.e. its



array of properties, which make money a reliable medium of exchange, a store of value and a unit of account. The quality of money in its store of value function depends on such factors as the quantity of money, the quality of the central bank balance sheet, inflation, stability of the financial system, among others. By changing these factors, monetary policy influences the subjective value, and thus the demand, for money. As mentioned before the total demand approach demonstrates that the demand for financial assets, and thus their prices, depends on the demand for and value of money.

These conclusions about the links between monetary policy and prices of financial assets are based on a theoretical framework developed on the grounds of subjective value theory and total-demand approach to pricing of financial assets. It is important to clarify that this theoretical framework is instructive in defining the channels or causal links of influence separately. However, it is limited in its ability to describe the relative importance of the different channels or to quantify their overall manifestations on the prices of financial assets. This is because scientific inquiry on the relationships between economic variables must always deal with partial causal analysis. Economic reality is such that there always is a multitude of factors influencing a particular economic variable. In order to understand the causal links, the analytic approach must first deal with one particular factor by keeping all others constant. After investigating a particular causal relationship, the impact of several factors working simultaneously can be analyzed. The necessity for this gradual or step-by-step approach comes not only from the limitations of the human mind to comprehend the effects of many factors working simultaneously and influencing a particular variable. It also comes from the practical considerations of scientific work, where time and resources dedicated to particular analytic enquiries are limited. We explain complex reality by simplifying and dissecting it into comprehensible parts. A simplification does not mean that the partial causal analysis is not useful. On the contrary, this is the only way social science can fulfil the ambition to explain universals – by tackling them one by one.

An empirical measure of the quality of money developed in this dissertation has shown that the quality of Euro over the last 20 years has significantly declined. A decreased quality of money leads to a reduction in the demand for money, which means an increased demand for financial assets if financial assets are seen as substitutes for money as a store of value (alternative form of holding wealth). This results in increased prices of financial assets.

However, the short-term relationship between the quality of money and prices of financial assets turned out to be statistically significant and positive. One of the possible explanations for the positive relationship in the short-term is financial repression, which is defined as government's strategy to gain privileged access to capital markets at preferential credit conditions. In the short-term, financial repression, caused by the monetary policy (as well as public debt management and financial policies) reduces the attractiveness (expected return) of holding financial assets, and thus reduces the demand for the financial assets (and also for money). Nevertheless, in the long term, the reduced quality of money causes market participants to shift their store of value from money to financial assets. Short-term positive correlation between money and financial assets caused by the financial repression is complemented by a relative shift from money to the financial assets due to the reduced quality of money in the long term.

Summing up, the results of this dissertation show that there are four mechanisms through which monetary policy influences value and prices of financial assets: the direct demand for financial assets, the modification of the properties of financial assets, the substitution of financial assets with similar properties, and the modification of the properties of money. The most important practical applicability of these results offers two directions. Firstly, the dissertation shows that central banks and monetary policy have more involvement in the financial markets than is accounted for in the traditionally accepted mechanism of monetary policy. This means that the standard view of the transmission mechanism of monetary policy should be updated, taking into account the new channels of impact, discussed in this dissertation. A subjectivist approach applied to the value and prices of financial assets poses a challenge to the usual risk-return analysis of pricing of financial assets, by claiming that there are more dimensions and properties of financial assets which are relevant if we want to understand the price formation of financial assets. Secondly, the theoretical framework developed in this dissertation is flexible enough to be applied to analyze other impact of monetary policy, e.g. on other economic goods and markets. If this dissertation is a good measure of the fruitfulness of this approach, its application to other economic goods has potential.

The results of the dissertation might shed some light on the broader issues regarding the place and importance of the financial sector in the economy. The financial sector fulfills very important functions in the economy, such as the organization of payments, accumulation of savings and distribution of credit to its most productive uses, allocation of risk, provision of market and liquidity for financial assets and others. However, economists and policy makers are often concerned about the power and the increase in the dominating position of the financial sector over the other sectors of the economy.

The relative size of the financial sector when compared to the real sector is increasing. The financial sector is often criticized for having abnormal profits. The average income of people working in the financial sector is usually substantially higher than in other sectors. There are many instances where people working in the top managerial positions of failing financial institutions receive bonuses, which by many are considered to be outrageous. Moreover, the financial sector has an enormous effect on the sectors of the real economy through its power to channel funds and distribute credit. Thus, the systemic risk and fragility inherent in the financial sector spills over and influences the whole economy during the times of financial crises.

Policies that are often proposed and implemented in response to these conditions are many. Usually, they are some combination of stricter regulation, heavier taxation, measures of competition policy, in some cases – government takeover and control of financial institutions. What these policies have in common is that they treat the situation to which they are responding as a bug, a flaw of the financial system, which originates from the imperfections of the financial market. If the right measures are applied (e.g. regulation) the problems of the ever-expanding power of the financial sector, moral hazard, fragility etc. can be corrected.

However, the conclusions of this work suggest that the relative expansion and domination of the financial sector over the other sectors is a feature, not a bug of the current financial system. This feature originates from the close connection between the financial markets and the monetary policy. The power and the expansion of financial sector comes from the fact that it is a vehicle of money production and monetary policy.

Monetary policy is executed through the financial sector, which means that financial assets are a vehicle of massive influx of money into the economy, creating huge

demand for financial assets and encouraging their production. Moreover, financial regulation and some instruments of monetary policy create preferable treatment of some financial assets over others, and financial assets in general over other asset classes. As discussed in this work, financial assets become an attractive store of value if the quality of money falls. All this suggests that the source of power, its relative size and the strength of the financial sector is related to deeper, institutional arrangement of central banks and money production. As long as this framework is present, irrespective of the policies, which do not recognize the fundamental source of this trend, the tendencies and the domination of the financial sector will remain.

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## Appendix I. Collateral in the Eurosystem

The criteria for collateral that central banks accept from private financial institutions is not a trivial matter. Strict quality requirements limit the temptation for credit institutions to rely excessively on central bank credit and reduce the risk of excessive leverage and moral hazard. On the other hand, it is argued that to achieve financial stability collateral framework should be broad enough to provide the market with liquidity, especially in situations of financial stress and reduced liquidity.

Eligibility rules for collateral and their changes influence the potential of the instruments of monetary policy that use collateral. Lenient rules of edibility mean higher amount of securities eligible for collateral and higher degree of borrowing from the central bank.

Eurosystem collateral framework (ESCF) was established together with the creation of the Euro in 1999. Since its establishment, ESCF accepts a rather broad set of collateral.

According to Bindseil et al. (2017, pp. 20-21), this is because: a) since the design of ESCF design was based on the idea that the ECB would implement monetary policy mainly through credit operations (as opposed to holding securities for monetary policy purposes), b) to include a broad set of counterparties located across different jurisdictions, and c) to ensure continuity with the frameworks that previously existed across the Euro area <sup>124</sup>.

*“Over the years, the ESCF has evolved in all three aspects - eligibility rules and rules on the use of collateral, pricing methods and risk control measures.”* (Bindseil et al., 2017, p. 23). During 2005-2007 ECB moved to a single list of collateral. This meant that some assets which had been eligible in some jurisdictions became eligible

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<sup>124</sup> Bindseil et al. (2017, p. 19)

The design of the ESCF took into account that the ECB would implement monetary policy mainly through credit operations which would be offered regularly to a wide range of diverse counterparties and which would be rather large. Indeed, the ECB decided before 1999 that the Eurosystem would initially not have holdings of securities for monetary policy purposes, which it referred to as "permanent operations", because securities once purchased may be held for a long period until they mature, and because permanent operations were considered less neutral towards capital markets. Hence, it decided that it would use credit operations, which it also referred to as "temporary operations" because they would have relatively short terms of usually one day (marginal lending facility), one week (main refinancing operations) and three months (longer-term refinancing operations).

throughout the Euro area (ECB, 2006). In 2008-2009 eligibility rules were amended for assets backed securities. Bindseil et al. (2017, p. 24) summarizes the third step in the broadening of ESCF:

*“The third milestone was in 2008 and 2011-2012, when the collateral framework was further broadened in order to maintain and increase collateral availability for euro area credit institutions and thereby facilitate the provision of increased credit by the Eurosystem. Such further broadening took several forms, including among other things:*

- *a relaxation in minimum credit quality requirements (to include the full so-called "investment-grade" credit quality instead of just the upper part of it, thereby reflecting the weakening of the average credit rating of euro area issuers);*
- *a relaxation of requirements and risk control measures for the simpler ABSs (also in view of increased transparency in the form of ABS loan-level data); and*
- *the acceptance of additional types of credit claims in some euro area countries [(Greece and Cyprus)], subject to eligibility and use requirements and risk control measures” (p. 24)*

In the context of ESCF and its changes over the years, there are two points relevant for our inquiry of the connection between monetary policy and prices of financial assets. First, the connection between eligibility rules of collateral and value and prices of financial assets is reciprocal. Eligibility criteria, valuation of financial and margin calls, haircuts applied to the securities pledged as collateral are part of the risk control framework that the ECB applies for collateral (ECB (2015), Gonzalez and Molitor (2009)). To what extent these risk mitigating measures are applied depend on the price, liquidity, fluctuation, risk and other market characteristics of the financial assets used as collateral.

However, the link also works the other way around. Collateral rules may influence how collateral markets behave (e.g. BIS (2015)). Eligibility for collateral, higher valuation of a security by the central bank, or lower haircut applied to it may change the value of this security for the market participants and thus its price in the market. The adjustment



of collateral rules by the ECB and broadening of the eligibility may have affected their prices, because the possibility to be used as a collateral may be an important factor in valuing these securities by market participants, especially in times of limited liquidity in the market.<sup>125</sup> In this respect, collateral rules and procedures are a channel through which ECB may influence value and prices of financial assets in the market.

The second point relates to the targeting of monetary policy. Collateral rules may also be used as a tool to target particular financial institutions or even countries. Broad acceptance of collateral allows the ECB to play its role as a lender of last resort (LOLR) more easily. LOLR, which aims to stabilize the liabilities of the liquidity-stressed financial institutions (Bindseil, 2013), is essentially a form of monetary policy targeting. Lender of last resort operations are credit extensions to single banks outside of the monetary policy framework (ECB, 2014). Another clear example of how collateral rules can be used in targeting is the exceptions made in the collateral eligibility rules of ECB for particular countries (Greece and Cyprus), introduced during the financial crisis. As previously discussed, targeting of monetary policy is one of the characteristics of unconventional instruments of monetary policy, which can also be seen in the developments of collateral rules of Eurosystem over the years.

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<sup>125</sup> Bindseil et al. (2017, p. 26)

There is no clear permanent effect of eligibility as collateral on market prices or market issuance amounts but there have probably been some temporary such effects when changes in eligibility rules, use rules or risk control measures took place.

## Appendix II. Correlation matrix of the indicators

Table 9. Correlation matrix for ponderation the individual indicators in the sub-categories of the index

	Liquidity_1a	Liquidity_1b	Liquidity_1c	Intstrength_1a	Intstrength_1b	Equity_1	Moneygrowth_1a	Moneygrowth_1b	Moneygrowth_1c	Moneygrowth_1d	Interest_1a	Interest_1b	Interest_1c	Interest_1d	Interest_1e	Stress_1a	Stress_1b	Forward_1	Inflation_1a	Inflation_1b	Inflation_1c	Inflation_1d	
Liquidity_1a	1,0																						
Liquidity_1b	0,7	1,0																					
Liquidity_1c	0,6	1,0	1,0																				
Intstrength_1a	0,1	0,8	0,8	1,0																			
Intstrength_1b	0,0	0,1	0,1	0,1	1,0																		
Equity_1	0,1	0,3	0,3	0,3	-0,2	1,0																	
Moneygrowth_1a	0,6	0,4	0,4	0,1	-0,1	0,3	1,0																
Moneygrowth_1b	0,1	0,1	0,1	0,0	-0,1	0,5	0,5	1,0															
Moneygrowth_1c	0,1	0,0	-0,1	-0,1	-0,1	0,0	0,1	0,3	1,0														
Moneygrowth_1d	0,0	-0,1	-0,1	-0,2	0,0	0,0	0,0	0,4	0,6	1,0													
Interest_1a	0,1	0,1	0,1	0,1	-0,3	0,1	0,0	0,0	0,2	-0,2	1,0												
Interest_1b	0,1	0,2	0,1	0,1	-0,2	0,2	0,1	0,1	0,2	-0,2	1,0	1,0											
Interest_1c	0,1	0,2	0,2	0,2	-0,2	0,2	0,1	0,2	0,2	-0,1	0,9	1,0	1,0										
Interest_1d	0,0	0,1	0,1	0,2	-0,1	0,1	0,1	0,1	-0,2	0,0	0,2	0,3	0,4	1,0									
Interest_1e	0,1	0,1	0,1	0,0	-0,2	0,2	0,0	0,1	0,1	0,0	0,8	0,8	0,8	0,4	1,0								
Stress_1a	0,0	0,0	0,0	0,0	0,0	0,1	0,2	0,2	0,1	0,0	0,1	0,1	0,1	0,1	-0,1	1,0							
Stress_1b	0,1	0,2	0,2	0,2	0,0	0,4	0,3	0,5	-0,1	0,1	-0,1	0,1	0,2	0,2	0,0	0,5	1,0						
Forward_1	0,2	0,1	0,1	0,0	0,2	0,1	0,2	0,2	0,2	0,2	-0,3	-0,3	-0,3	-0,2	-0,4	0,5	0,4	1,0					
Inflation_1a	-0,2	-0,2	-0,2	-0,1	0,0	0,0	-0,1	-0,1	-0,2	0,1	-0,4	-0,5	-0,5	-0,1	-0,2	-0,2	-0,1	-0,1	1,0				
Inflation_1b	0,1	0,2	0,2	0,2	0,1	0,1	0,1	0,1	-0,2	0,1	-0,4	-0,3	-0,2	0,1	-0,1	0,0	0,3	0,2	0,2	1,0			
Inflation_1c	-0,1	0,2	0,2	0,2	0,1	-0,1	0,0	-0,1	-0,3	-0,1	-0,6	-0,6	-0,6	0,0	-0,5	-0,1	0,0	0,1	0,4	0,6	1,0		
Inflation_1d	0,0	0,2	0,2	0,3	-0,1	0,0	0,1	0,0	-0,3	-0,1	-0,4	-0,3	-0,3	0,1	-0,2	0,1	0,1	0,1	0,2	0,5	0,7	1,0	

## Appendix III. Ponderation of the dimensions and the indicators

Table 10. Results of the regression analysis in the adjusting the weights of the categories

	Equal weights		1st adjustment		2nd adjustment - chosen weights		3rd adjustment - reverced		4th adjustment - reverced	
	Weights	R2	Weights	R2	Weights	R2	Weights	R2	Weights	R2
Balance sheet of the central bank	17%	15%	17%	22%	<b>20%</b>	29%	15%	23%	15%	21%
Money supply	17%	34%	13%	30%	<b>10%</b>	23%	10%	25%	5%	12%
Interest rate	17%	0%	25%	1%	<b>35%</b>	15%	35%	8%	35%	5%
Stability of the financial system	17%	54%	10%	41%	<b>5%</b>	24%	5%	32%	5%	28%
Forward guidance	17%	62%	10%	36%	<b>5%</b>	9%	10%	26%	10%	23%
Price inflation	17%	6%	25%	20%	<b>25%</b>	19%	25%	18%	30%	31%
	STD	23%	STD	13%	STD	6%	STD	8%	STD	9%

Table 11. Weights of the dimensions and indicators in the index

Category	Weight of the category	Indicator	Weight of the indicator
Balance sheet of the central bank	20%	Liquidity_1a	2,2%
		Liquidity_1b	2,2%
		Liquidity_1c	2,2%
		Intstrength_1a	3,3%
		Intstrength_1b	3,3%
		Equity_1	6,7%
Money supply	10%	Moneygrowth_1a	2,5%
		Moneygrowth_1b	2,5%
		Moneygrowth_1c	2,5%
		Moneygrowth_1d	2,5%
Interest rate	35%	Interest_1a	5,8%
		Interest_1b	5,8%
		Interest_1c	5,8%
		Interest_1d	11,7%
		Interest_1e	5,8%
Stability of the financial system	5%	Stress_1a	2,5%
		Stress_1b	2,5%
Forward guidance	5%	Forward_1	5,0%
Price inflation	25%	Inflation_1a	8,3%
		Inflation_1b	8,3%
		Inflation_1c	4,2%
		Inflation_1d	4,2%
Sum	100%	Sum	100%

## Appendix IV. Dependent and independent variables

Table 12. Dependent and independent variables used in the regressions

Indicator	Coding	Explanation	Source
<b>Dependent variables</b>			
Eurozone stock index	Stock_d1	Dow Jones Euro Stoxx Price Index	ECB, Data stream
Stock indices of 10 Eurozone countries	Stock_Country_d1	MSCI Standard (Large and Mid Cap)	MSCI
<b>Independent variables</b>			
GDP	GDP_d1	Real GDP	Eurostat
Industrial production	Industrial_d1	Industrial production (mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; construction)	Eurostat
Consumer prices	HICP_d1	Harmonized Index of Consumer Prices	Eurostat
Unemployment	Unempl_d1	Unemployment rate (percentage of total population)	Eurostat
Short-term interest rate	Refinancing_d1	Main refinancing operations interest rate	ECB statistical data warehouse
Long-term interest rate	Interest_d1	Long-term government bond yields - Maastricht definition	Eurostat
Nominal exchange rate	Exchange_d1	Nominal effective exchange rate - 42 trading partners	Eurostat
Monetary base	Basemoney_d1	Base money	ECB statistical data warehouse
Money supply M3	M3_d1	Monetary aggregate M3	ECB statistical data warehouse
Quality of money	Quality_d1	Quality of money indicator	Compiled by the author

## Appendix V. Post-estimation tests of the regressions

Table 13. Post-estimation tests of the regressions

	R-squared	Breusch-Pagan test, prob > chi2	Durbin-Watson d- statistic	Mean VIF
<b>Yearly data</b>				
Eurozone	0,75	0,97	1,9	1,35
Belgium	0,43	0,01	1,7	1,00
France	0,51	0,07	1,7	1,00
Germany	0,57	0,14	2,0	1,32
Italy	0,49	0,04	1,6	1,00
Netherlan	0,52	0,02	1,8	1,00
Spain	0,47	0,27	2,1	1,00
Finland	0,62	0,42	1,9	1,04
Ireland	0,40	0,00	2,0	1,07
Portugal	0,65	0,01	2,0	1,44
Austria	0,72	0,37	2,5	1,10
<b>Quarterly data</b>				
Eurozone	0,38	0,03	2,4	1,03
Belgium	0,28	0,38	2,0	1,01
France	0,26	0,00	2,2	1,06
Germany	0,32	0,00	2,1	1,07
Italy	0,26	0,14	2,2	1,10
Netherlan	0,40	0,05	2,1	1,12
Spain	0,22	0,79	2,0	1,05
Finland	0,24	0,73	2,3	1,10
Ireland	0,09	0,00	1,6	1,00
Portugal	0,20	0,07	2,1	1,02
Austria	0,33	0,01	1,8	1,05
<b>Monthly data</b>				
Eurozone	0,15	0,00	1,7	1,01
Belgium	0,14	0,00	1,7	1,01
France	0,13	0,03	2,0	1,02
Germany	0,17	0,00	2,0	1,04
Italy	0,15	0,14	2,0	1,01
Netherlan	0,15	0,01	2,1	1,03
Spain	0,10	0,01	2,0	1,01
Finland	0,08	0,97	1,7	1,03
Ireland	0,05	0,00	1,7	1,00
Portugal	0,11	0,33	1,9	1,01
Austria	0,22	0,00	1,7	1,10

## Résumé de la thèse de doctorat

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# The Implications of Monetary Policy for the Value and Prices of Financial Assets

Les implications de la politique monétaire sur la valeur et les prix des actifs  
financiers

## JURY

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## Introduction

En ces temps de ralentissement économique lié à la pandémie de COVID-19, le comportement des marchés boursiers pourrait être considéré comme déroutant. Tout d'abord, les indices boursiers ont chuté après la fermeture des économies due à la propagation de la maladie. Ensuite, ils se sont rapidement remis, sans doute à la suite d'interventions fiscales et monétaires massives des gouvernements et des banques centrales du monde entier. Toutefois, la troisième phase, au cours de laquelle les principaux indices boursiers (par exemple le S&P 500) ont remonté, certains jusqu'à des sommets historiques, "a laissé perplexes les analystes et les investisseurs chevronnés" (Economist, 2020). Les économistes affirment que les mesures de relance budgétaire et monétaire ont contribué à amortir le choc. Cependant, malgré ces politiques, les conditions économiques et la forte incertitude liée à la poursuite de la propagation du virus ne justifient pas une telle évolution des marchés financiers. Même si les mesures de relance économique visaient la reprise, il est peu probable qu'elles auraient pu permettre de relever l'économie à un niveau plus élevé qu'avant la crise. En outre, cette divergence des marchés boursiers par rapport aux fondamentaux n'est pas nécessairement considérée comme une bulle temporaire qui devra se corriger d'elle-même. Selon The Economist, beaucoup de ceux qui étaient initialement prudents recommandent maintenant d'acheter des actions à ceux qui ont "raté" la reprise, suggérant que si "les investisseurs pleins de remords entrent sur les marchés maintenant, les gains de la bourse pourraient continuer".

L'explication des moteurs qui sous-tendent la dynamique des marchés financiers est une tâche difficile et complexe. Toutefois, les économistes affirment généralement que les principaux facteurs sont identifiés par la théorie économique et financière. La question est de savoir comment les interpréter dans des circonstances économiques données, en particulier dans le monde économique actuel, caractérisé par une stimulation monétaire sans précédent et des taux d'intérêt négatifs. Les circonstances présentes nous donnent des raisons de penser que si nous connaissons les principaux facteurs qui influencent la dynamique des marchés financiers, nous ne connaissons peut-être pas tout à fait leurs manifestations. Peut-



être que le caractère sans précédent de la politique monétaire d'aujourd'hui peut nous offrir de nouvelles perspectives sur la manière dont certains de ces facteurs fonctionnent réellement. Et ce n'est peut-être pas une coïncidence, que les marchés financiers se redressent malgré les fondamentaux lorsque la monnaie est abondante et que certains créanciers doivent payer des intérêts, au lieu d'en recevoir, tout en prêtant de l'argent.

## **1. Sujet et pertinence**

Le sujet de cette thèse est le lien entre la politique monétaire et les prix des actifs financiers. La politique monétaire et la politique fiscale sont deux outils importants pour les gouvernements qui tentent de diriger l'économie. Les marchés financiers et les actifs financiers sont des éléments cruciaux dans notre compréhension actuelle de la façon dont la politique monétaire influence l'économie. Ce travail explique que la politique monétaire influence les prix des actifs financiers en changeant à la fois les propriétés des actifs financiers et les propriétés de la monnaie, ce qui à son tour affecte la valeur subjective des actifs financiers par rapport à la monnaie aux yeux des propriétaires actuels et potentiels.

Cette thèse vise à combler un vide dans la littérature. En effet, certaines régularités empiriques sur les marchés financiers demeurent inexplicées, ce qui suggère une compréhension incomplète de la connexion entre la politique monétaire et les prix des actifs financiers. Premièrement, il est un fait empirique bien connu que les prix des actifs financiers dans les économies développées croissent plus rapidement que les autres prix. Au cours des 70 dernières années, les prix des actions aux États-Unis ont augmenté plus rapidement que les prix à la consommation. Selon Žukauskas et Hülsmann (2019), les théories standards des mécanismes de transmission de la politique monétaire conduisent à la conclusion que la politique monétaire n'est pas à l'origine de la hausse observée des prix dans le secteur financier par rapport aux prix dans le secteur non financier de l'économie. Selon la théorie standard, la politique monétaire peut influencer les prix des actifs financiers de différentes manières, mais elle n'entraîne pas en soi une tendance à la hausse des prix des actifs financiers plus rapide que celle des actifs non financiers.

Deuxièmement, le lien réel entre la politique monétaire et les marchés financiers peut être plus fort que ce qui est identifié en théorie. Les marchés financiers sont souvent caractérisés comme étant très volatils et contenant un degré considérable d'irrationalité, comme un secteur où les prix sont souvent entraînés par l'exubérance des esprits animaux<sup>1</sup>. Les théoriciens de la politique monétaire affirment que le lien entre la politique monétaire et les prix des actifs financiers n'est pas très fort<sup>2</sup>. Cependant, les communiqués des banques centrales ont souvent un impact énorme sur les prix des actifs financiers et sur la volatilité des marchés financiers. Les réactions des marchés financiers sont étudiées et identifiées comme le miroir de la manière dont les acteurs du marché évaluent les décisions de la politique monétaire. Cependant, la théorie sur les canaux de transmission de la politique monétaire n'est pas toujours utile pour prévoir ces réactions. Une même décision de la banque centrale (par exemple, la baisse du taux d'intérêt de base) peut avoir des réactions différentes en fonction d'autres circonstances. La conclusion qu'il convient peut-être de tirer du fait que les marchés financiers semblent souvent imprévisibles, volatils et détachés des fondamentaux n'est pas qu'ils sont trop souvent portés par des esprits animaux, mais que le lien entre la politique monétaire et les marchés financiers est plus fort que nous le pensons et que notre compréhension de ce lien est incomplète.

Troisièmement, la conception traditionnelle de l'influence de la politique monétaire sur l'économie (y compris sur le prix des actifs financiers) est en train de changer. Traditionnellement, le taux d'intérêt, la demande d'actifs financiers par la banque centrale et l'offre de monnaie étaient les principaux canaux. À l'époque de la politique monétaire non conventionnelle, les banques centrales s'appuient sur de nouveaux instruments de politique monétaire, ce qui élargit naturellement notre vision de la

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<sup>1</sup> Le terme "esprits animaux" a été inventé par le célèbre économiste britannique John Maynard Keynes pour décrire la façon dont les gens prennent des décisions financières, y compris l'achat et la vente de titres. Aujourd'hui, les esprits animaux décrivent souvent les facteurs psychologiques et émotionnels qui poussent les investisseurs à agir lorsqu'ils sont confrontés à des niveaux élevés de volatilité sur les marchés financiers.

<sup>2</sup> Par exemple, Mishkin (2001, p. 16) :

The linkage between monetary policy and stock prices, although an important part of the transmission mechanism, is still nevertheless, a weak one. Most fluctuations in stock prices occur for reasons unrelated to monetary policy, either reflecting real fundamentals or animal spirits. The loose link between monetary policy and stock prices therefore means that the ability of the central bank to control stock prices is very limited.

manière dont les banques centrales influencent les marchés financiers et l'économie entière. Il est important de noter que certains de ces instruments non conventionnels fonctionnent en envoyant des signaux au marché, qui ne sont pas nécessairement de nature quantitative (par exemple, des indications sur l'orientation future (*forward guidance*) et un engagement à l'égard d'une politique monétaire particulière dans le futur). Inévitablement, l'impact de ces mesures n'est pas seulement de nature quantitative, c'est-à-dire qu'elles agissent en modifiant les perceptions et les attitudes des participants au marché. La question de la subjectivité devient ici importante - si nous voulons comprendre l'impact de la politique monétaire sur les prix des actifs financiers, en particulier l'impact des instruments qui fonctionnent par le biais d'un changement de sentiment du marché, nous devons élargir notre analyse des prix des actifs, en incorporant les perceptions subjectives des participants au marché au-delà de l'analyse traditionnelle de l'agent rationnel du marché. Laisser la place à une plus grande subjectivité dans l'analyse de la détermination des prix des actifs financiers pourrait révéler davantage de canaux de transmission de la politique monétaire.

Tous les points abordés ci-dessus, notamment l'écart entre les mouvements de prix des actifs financiers et les prix dans l'économie réelle, l'interconnexion des marchés financiers et de la politique monétaire, les nouveaux canaux de transmission de la politique monétaire non conventionnelle illustrent la pertinence du sujet de cette thèse.

## **2. Littérature**

Le mécanisme de transmission standard de la politique monétaire (présenté par Mishkin (1995), Bank of England (1999), Kuttner et Mosser (2002), Agitis et Pitelis (2001) et d'autres) repose largement sur le marché financier et les actifs financiers. Selon le point de vue standard, les actions des banques centrales affectent l'activité économique par différents canaux de causalité ou mécanismes de transmission (Mishkin, 2013, p. 687). Certains de ces mécanismes sont enclenchés par des changements de prix des actions, des obligations, de l'immobilier et des taux de change. Ces changements affectent à leur tour les décisions d'investissement et de consommation des entreprises et des ménages.

Selon le point de vue standard, les banques centrales influencent directement le prix des actifs financiers qui sont achetés ou vendus dans le cadre d'opérations d'open market. En outre, le taux d'intérêt à court terme affecte également le coût du capital pour les entreprises et le taux d'actualisation. L'impact de la politique monétaire sur les taux d'intérêt à long terme et les actifs financiers à long terme s'explique par les effets de l'équilibrage du portefeuille et les effets de signalisation. L'effet d'équilibrage du portefeuille s'explique par une modification du stock et de la composition des actifs financiers entre les mains des acteurs du marché après un achat. Lorsque la banque centrale réduit le montant de certains actifs financiers sur le marché, cela incite les acteurs du marché à acheter d'autres actifs financiers similaires, ce qui modifie à son tour les prix et les rendements de ces derniers. Le canal de signalisation passe par les changements du taux d'intérêt à court terme futur attendu, qui a un impact sur les taux d'intérêt à long terme, et par ce biais - les taux d'actualisation et les rendements requis des actifs financiers à long terme.

D'autres canaux d'influence de la politique monétaire sur les prix des actifs financiers fonctionnent indirectement. Le Q de Tobin, le bilan, le crédit bancaire, la liquidité des ménages et les canaux de richesse expliquent comment une augmentation des prix des actifs financiers affecte la consommation et l'investissement dans l'économie. La hausse des prix des actifs financiers améliore les conditions d'emprunt des ménages et des entreprises ainsi que leur volonté de dépenser et d'investir. Une hausse de la consommation et des investissements peut entraîner une augmentation des revenus et des flux de trésorerie des entreprises qui sont les fournisseurs des biens d'investissement ou de consommation. Cela peut également conduire à une croissance générale plus élevée de l'économie, qui peut avoir le même impact sur les entreprises en général.

Par conséquent, dans la vision traditionnelle, la politique monétaire influence les prix des actifs financiers en modifiant le taux d'intérêt à court terme, la masse monétaire, l'offre d'actifs financiers par la banque centrale (ou de sa demande d'actifs financiers) et la communication à propos de l'avenir de la politique monétaire. En utilisant ces instruments, les banques centrales influencent d'autres variables de l'économie, qui influencent la demande d'actifs financiers.

Cependant, cette thèse suggère que notre compréhension générale actuelle du lien entre la politique monétaire et les prix des actifs financiers est incomplète.

### **3. Problématique, objectifs et nouveauté**

Le problème de cette thèse est de savoir quel est l'impact théorique de la politique monétaire sur la valeur et les prix des actifs financiers et comment cet impact peut être appréhendé empiriquement.

L'objectif est, après avoir examiné différentes approches analysant l'impact de la politique monétaire sur les prix des actifs financiers, de créer un cadre théorique basé sur la théorie de la valeur subjective englobant les différents canaux par lesquels la politique monétaire influence la valeur et les prix des actifs financiers, puis de le tester empiriquement.

Le but de la thèse est atteint grâce aux étapes suivantes :

1. Analyser la littérature sur la transmission de la politique monétaire afin d'identifier la thèse orthodoxe à propos de l'influence de la politique monétaire sur la valeur et les prix des actifs financiers ;
2. Passer en revue et systématiser les instruments de politique monétaire conventionnels et non conventionnels dans la mesure où ils sont pertinents concernant la question de la valeur et les prix des actifs financiers ;
3. Analyser théoriquement la formation des prix des actifs financiers en utilisant l'approche de la théorie de la valeur subjective et en déduire les déterminants des prix des actifs financiers ;
4. Développer un cadre théorique complet qui expliquerait les différents canaux par lesquels la politique monétaire influence les prix des actifs financiers ;
5. Appliquer le cadre théorique pour étudier empiriquement l'influence de la politique monétaire sur les prix des actifs financiers par l'un des canaux nouvellement identifiés qui n'existe pas encore dans la littérature scientifique).

La nouveauté scientifique et l'importance de ce travail proviennent de l'introduction de la multidimensionnalité et du recours aux principes de la théorie de la valeur subjective dans l'analyse de la fixation des prix des actifs financiers, ce qui permet de créer une compréhension plus complète de la manière dont la politique monétaire influence les prix des actifs financiers.

## **6. Méthodes et structure**

Dans la thèse, différentes méthodes de recherche sont appliquées. Dans l'analyse de la littérature sur le mécanisme de transmission de la politique monétaire (1er objectif), et dans le résumé des outils de la politique monétaire (2ème objectif) les méthodes suivantes à été appliquées : revue et synthèse de la littérature, déduction, généralisation, analyse comparative et typologisation. Pour l'analyse théorique de la formation des prix des actifs financiers (3ème objectif), les principes de la théorie de la valeur subjective ont été appliqués à la valeur et aux prix des actifs financiers et de la monnaie. En outre, pour l'analyse de la formation des prix, un outil analytique particulier de la demande totale a été utilisé pour compléter l'analyse conventionnelle de la demande et de l'offre. La création d'un cadre théorique (4ème objectif) a fait appel au raisonnement déductif et aux principes de la modélisation économique - définissant les relations entre les différentes variables économiques dans le cadre théorique de la fixation des prix des actifs financiers. Pour l'analyse empirique (5e objectif) les méthodes des indicateurs composites et de l'analyse de régression ont été appliquées.

La thèse est organisée en cinq parties. La première partie aborde le mécanisme de transmission standard de la politique monétaire, qui reflète la manière traditionnelle de comprendre comment la politique monétaire influence les prix des actifs financiers. De plus, la première partie de la thèse traite des instruments de la politique monétaire, qui sont liés aux marchés financiers et aux actifs financiers. La discussion sépare la politique monétaire conventionnelle et non conventionnelle et se concentre ensuite sur les instruments de la politique monétaire de la Banque centrale européenne et leur évolution dans le temps.

La deuxième partie développe le cadre théorique de la valeur et des prix des actifs financiers, qui est basé sur la théorie de la valeur subjective et qui est présenté comme une alternative à l'analyse standard. En utilisant l'approche de la demande totale, la deuxième partie propose une autre façon d'analyser le lien entre la politique monétaire et les actifs financiers, qui est basée sur l'idée que la politique monétaire transforme les propriétés des actifs financiers et de la monnaie.

La troisième partie expose la méthodologie de la recherche empirique. Elle explique le lien entre le modèle théorique et empirique, le choix et la paramétrisation des variables. Le cadre empirique se concentre sur les canaux d'influence, qui ont été identifiés dans le cadre théorique, à savoir, la qualité du canal de l'argent.

La quatrième partie étudiera empiriquement comment la politique monétaire influence les prix des actifs financiers par l'un des canaux identifiés (canal de la qualité de la monnaie) dans le contexte de la zone euro. Nous allons tout d'abord créer un indice qui quantifiera la qualité de la monnaie. Ensuite, nous examinerons la signification statistique de cette mesure dans le modèle d'évaluation des actions multifactoriel basé sur des variables macroéconomiques appliquées aux indices boursiers de la zone euro et de dix pays de la zone euro.

Enfin, la cinquième partie aborde les résultats du cadre théorique et de l'analyse empirique, explique leur importance et leurs limites.

## **7. Résultats théoriques**

La partie théorique de la thèse développe une approche basée sur la théorie de la valeur subjective, qui explique la valeur et les prix des actifs financiers, et finalement - l'impact de la politique monétaire sur la valeur et les prix des actifs financiers.

Les actifs financiers sont des biens économiques et ils ont une valeur subjective. Leur valeur provient soit de créances à l'égard de flux financiers futurs, tels que les dividendes, les intérêts, les paiements de capital (valeur de créance) ou de ventes futures anticipées (valeur d'échange), soit de la combinaison des deux. Les actifs financiers contiennent des propriétés de base telles que le rendement, le risque, la

liquidité, l'échéance et autres. Les acteurs du marché fondent leur évaluation des actifs financiers sur ces propriétés, ce qui influence leur demande d'actifs financiers. Bien que ces propriétés puissent avoir des expressions quantitatives objectives, l'évaluation des actifs financiers sur le marché est subjective.

Le prix d'équilibre est le prix qui égalise les quantités du bien fournies et demandées sur le marché à un moment donné. On peut aussi considérer que ce prix d'équilibre est celui qui égalise le stock disponible et la demande totale du bien. Cette dernière est la somme de la demande d'échange des non-proprétaires pour acheter le bien et de la demande de réservation<sup>3</sup> des propriétaires pour détenir le bien. Ces deux conditions sont analogues. La deuxième approche - la demande totale - est un outil analytique utile, alternatif à l'analyse traditionnelle de l'offre et de la demande, qui permet de conceptualiser la formation des prix sur le marché. Elle conduit à plusieurs idées importantes, développées ci-dessous.

L'analyse de la demande totale a été introduite par Wicksteed (1944 [1910]) qui a souligné que la distinction entre l'offre et la demande en tant que deux causes indépendantes et ultimes du processus de fixation des prix est trompeuse. En fin de compte, les prix ne découlent que de la demande. L'offre n'est pas une cause indépendante et ultime. Ils sont plutôt déterminés par la "demande de réservation" que les propriétaires actuels ont pour les unités qu'ils possèdent déjà.

Le prix du marché d'un actif financier particulier dépend de la demande totale pour cet actif et de son stock total disponible. Plus son prix est bas, plus la demande de réservation est élevée (plus de propriétaires sont disposés à le détenir) et plus la demande d'échange est élevée (plus de non-proprétaires sont disposés à l'acheter). Le montant de l'actif financier à détenir ou à acheter dépend de son évaluation subjective en fonction des propriétés de l'actif financier mentionnées ci-dessus et des causes finales.

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<sup>3</sup> La demande de réservation correspond aux quantités d'un bien que ses propriétaires actuels veulent détenir ou se réserver (par opposition à l'approvisionnement du marché) à divers prix. Il s'agit de la demande que les propriétaires actuels du bien ont pour les unités qu'ils possèdent déjà.



L'approche de la demande totale et la notion de demande de réservation montrent que l'évaluation subjective de l'actif financier se fait par rapport à l'argent. Les demandes de réservation et d'échange sur le marché sont le résultat de comparaisons de la valeur de la détention et de l'acquisition de différents montants d'actifs financiers et de différentes unités monétaires. La décision sur le montant des actifs financiers à détenir et à acheter dépend de la demande d'argent. En particulier, la quantité d'actifs financiers que l'on veut acheter (demande d'échange d'actifs financiers) dépend de la quantité d'argent que l'on veut détenir (demande de réservation de la monnaie). En outre, le montant des actifs financiers que l'on veut détenir (demande de réservation d'actifs financiers) dépend de la quantité d'argent que l'on veut recevoir (demande d'échange de la monnaie). En fin de compte, la demande d'actifs financiers et donc leurs prix dépendent de la demande et de la valeur de l'argent. C'est la première observation significative qui découle de l'approche de la demande totale.

Une façon évidente d'influencer le prix des actifs financiers dans le cadre de la politique monétaire est l'achat d'actifs financiers. Les achats d'actifs financiers particuliers par les banques centrales représentent une demande supplémentaire pour ces actifs, qui n'existerait pas autrement, ce qui augmente leur demande d'échange et leurs prix. C'est l'effet direct de la politique monétaire sur les prix des actifs financiers.

Cependant, il existe d'autres mécanismes d'influence, qui sont indirects. La première influence indirecte se fait par la modification des propriétés des actifs financiers. Un exemple est la propriété d'être éligible comme garantie pour emprunter à la banque centrale. Dans la zone euro, la politique monétaire conventionnelle se fait dans la plupart des cas non pas par l'achat d'actifs financiers, mais par des emprunts contre des actifs financiers en garantie. L'acceptation d'actifs financiers particuliers comme garantie signifie que la possession de cet actif financier se rapproche de la possession d'argent, la différence étant le taux d'intérêt cible des opérations d'open market (qui est fixé à zéro ou proche de zéro pendant les périodes de politique monétaire expansionniste). L'acceptation d'un actif financier particulier en garantie à la banque centrale devient une propriété importante de cet actif financier. Cette

propriété crée une demande pour l'actif financier, qui n'existerait pas autrement. La différence entre les achats d'actifs et les prêts est que la demande supplémentaire, dans le cas des achats d'actifs, provient de la banque centrale, et dans le cas des prêts contre garantie, elle provient des autres acteurs du marché.

L'ampleur de l'effet direct par l'achat d'actifs et de l'effet indirect par la constitution de garanties est décidée par la banque centrale. Des montants plus élevés d'achats d'actifs et des montants plus élevés de prêts à taux d'intérêt plus bas génèrent une demande supplémentaire plus importante, et ont donc un impact important sur les prix de ces actifs financiers particuliers. Il existe donc un lien direct entre la politique monétaire et les actifs financiers, que la banque centrale choisit comme vecteur de transmission de la politique monétaire. La demande supplémentaire de ces actifs générée par leur implication dans le mécanisme de la politique monétaire signifie que leurs prix sont plus élevés qu'ils ne le seraient autrement.

Il existe d'autres exemples d'effets indirects de la politique monétaire sur les actifs financiers par la modification des propriétés des actifs financiers, qui génère une demande supplémentaire pour ceux-ci.

Certains aspects du cadre réglementaire des institutions financières ont pour effet d'inciter les institutions financières à privilégier la détention de certains actifs financiers par rapport à d'autres. Cette incitation peut résulter des exigences de capital et de liquidité, qui classent les actifs financiers en groupes particuliers et appliquent des exigences différentes aux institutions financières selon la catégorie d'actifs financiers qu'elles détiennent. Cette catégorisation incite les institutions financières à détenir des actifs financiers particuliers, pour lesquels les exigences de fonds propres et de liquidité sont moins élevées et donc les coûts de mise en conformité moins élevés. Par conséquent, la demande et les prix de ces actifs financiers deviennent plus élevés qu'ils ne le seraient autrement sans cette réglementation.

Les banques centrales influencent inévitablement l'activité économique par la politique monétaire. Elles influent sur le développement économique ainsi que sur l'expansion et la contraction de la production économique. Cette influence peut ne

pas être uniforme d'un secteur à l'autre, certains secteurs pouvant être plus influencés que d'autres. Les actifs financiers (actions et obligations) représentent les entreprises dont la capacité à créer de la valeur et à réaliser des bénéfices est inévitablement liée aux conditions économiques. Par conséquent, la politique monétaire, par son impact sur l'économie, a un effet indirect sur les entreprises, leurs revenus et leurs bénéfices, et donc sur les flux de trésorerie générés pour les propriétaires d'actifs financiers de ces entreprises. Par conséquent, par son impact sur l'activité économique, la politique monétaire influence indirectement la valeur et le prix des actifs financiers. Certaines théories liant la politique monétaire à l'économie suggèrent des effets structurels asymétriques, d'autres un effet homogène.

La politique monétaire affecte également les risques liés à la détention d'actifs financiers. La politique monétaire et les banques centrales visent à réduire le risque systémique du marché financier et donc de la détention d'actifs financiers en général. En outre, la politique monétaire réduit le risque idiosyncrasique (risques de crédit et de liquidité) lié à la détention d'actifs financiers particuliers qui sont visés par la politique monétaire. Un risque systémique plus faible signifie une demande accrue d'actifs financiers par rapport à d'autres biens et un risque idiosyncrasique plus faible signifie une demande accrue d'actifs financiers particuliers par rapport à d'autres actifs financiers et d'autres biens.

Ainsi, l'effet indirect de la politique monétaire sur les actifs financiers passe par la modification de leurs propriétés. Les propriétés des actifs financiers, de la monnaie ou d'autres biens économiques sont des caractéristiques des biens économiques. Les propriétés sont les dimensions des biens auxquelles les individus attachent subjectivement une valeur. La politique monétaire transforme les propriétés des actifs financiers (rendement, risque, liquidité, aptitude au service en tant que garantie, coût de conformité), ce qui modifie la demande et les prix des actifs financiers concernés.

L'approche de la demande totale permet d'identifier que le changement des propriétés des actifs financiers affecte non seulement la demande d'échange d'actifs financiers (sous la forme d'une demande plus élevée d'achat de l'actif financier par des non-propriétaires), mais aussi la demande de réservation d'actifs financiers (sous

la forme d'une demande plus élevée de détention de l'actif financier par des propriétaires). En effet, les actifs financiers sont des biens durables, ce qui signifie que la demande de réservation est relativement élevée par rapport à la demande d'échange. Par conséquent, l'effet du changement de propriété sur la demande totale est sensiblement plus élevé que dans le cas d'un bien non durable.

Un troisième mécanisme d'influence (outre l'influence par la demande directe et par le changement des propriétés des actifs financiers) est la substitution de différents actifs financiers. Un exemple est l'extension de l'effet de la politique monétaire sur les actifs financiers à court terme aux actifs financiers à long terme.

Les changements de prix des actifs financiers qui ne font pas partie du marché monétaire, où les banques centrales fixent le taux d'intérêt à court terme en régulant la liquidité, se produisent par des changements de l'évaluation (et donc de la demande) de ces actifs par les participants au marché. La loi du prix unique sur le marché est basée sur l'idée d'arbitrage - les forces du marché tendent à éliminer les différences de prix de tout actif sur les marchés grâce à des possibilités d'arbitrage rentables. Ce qui rend deux actifs financiers équivalents est une notion subjective. Tous les actifs financiers ont en commun la caractéristique d'être des créances sur des flux financiers futurs. Toutefois, comme nous l'avons déjà mentionné, il existe entre eux de nombreuses différences qui s'incarnent dans leurs propriétés, lesquelles sont subjectivement importantes pour les acteurs du marché lorsqu'ils jugent de leur valeur.

Les différentes manifestations de ces propriétés parmi les actifs financiers déterminent le degré auquel elles sont subjectivement équivalentes, c'est-à-dire substituables du point de vue des acteurs du marché. À cet égard, tous les actifs financiers aux yeux des acteurs du marché se situent dans une gamme de produits. Ce spectre explique les différences dans leur évaluation subjective, la demande et, finalement, leurs prix. Les prix des actifs financiers de cette gamme sont liés entre eux dans la mesure où ils sont partiellement substituables. Le principe de l'arbitrage concerne les prix des actifs financiers, qui diffèrent marginalement par leurs propriétés, mais qui sont toujours des substituts proches ou lointains. Les différences

de prix entre les actifs financiers correspondent aux différences de leurs propriétés, qui les rendent plus ou moins précieux aux yeux des acteurs du marché. Si la différence de prix aux yeux des acteurs du marché devient trop importante ou trop faible, ceux-ci augmentent leur demande pour l'actif financier, qui est à leurs yeux sous-évalué, compte tenu de ses propriétés, et diminuent leur demande pour l'actif financier, qui est surévalué. Ce mécanisme met l'écart de prix au même niveau que l'évaluation subjective des différences entre les propriétés des deux actifs financiers.

Ces liens entre les actifs financiers expliquent également comment les changements de taux d'intérêt à court terme induits par la banque centrale sur le marché monétaire affectent les prix des actifs financiers en dehors du marché monétaire. Un taux d'intérêt à court terme plus bas sur le marché monétaire signifie des prix plus élevés des actifs financiers du marché monétaire, ce qui amène les acteurs du marché à déplacer leur demande vers d'autres actifs financiers (qui sont considérés comme des substituts partiels). Ainsi, un taux d'intérêt à court terme plus faible entraîne une demande plus forte d'actifs financiers à long terme et un taux d'intérêt à long terme plus faible.

Ce mécanisme fonctionne non seulement comme une transmission d'actifs financiers à court terme vers des actifs financiers à plus long terme. Il est également pertinent pour d'autres propriétés des actifs financiers, par exemple le risque, la liquidité. Si la banque centrale augmente sa demande pour un actif financier particulier, les prix d'autres actifs financiers ayant des propriétés similaires réagiront également. Ceci est particulièrement pertinent dans le contexte des instruments non conventionnels de la politique monétaire, qui visent souvent des actifs financiers particuliers. Si une banque centrale choisit d'augmenter sa demande d'un actif financier ayant une propriété particulière et fait augmenter son prix, cela amènera les acteurs du marché à modifier leur demande d'actifs financiers ayant des propriétés similaires et fera augmenter leur prix.

Enfin, la politique monétaire a un effet non seulement sur les propriétés des actifs financiers, mais aussi sur les propriétés de la monnaie. La demande et la valeur de la monnaie, comme de tout autre bien, sont subjectives. Les banques centrales

influencent les propriétés de la monnaie qui sont subjectivement importantes pour les utilisateurs de la monnaie en jugeant de la capacité de la monnaie à remplir ses fonctions. En particulier, les banques centrales contrôlent la qualité de la monnaie, c'est-à-dire l'ensemble de ses propriétés, qui font de la monnaie un moyen d'échange fiable, une réserve de valeur et une unité de compte. La qualité de la monnaie dans sa fonction de réserve de valeur dépend de facteurs tels que la quantité de monnaie, la qualité du bilan de la banque centrale, l'inflation, la stabilité du système financier et autres. En modifiant ces facteurs, la politique monétaire influence la valeur subjective et donc la demande de monnaie. Comme mentionné précédemment, l'approche de la demande totale démontre que la demande d'actifs financiers, et donc leur prix, dépend de la demande et de la valeur de la monnaie.

L'idée que l'inflation attendue est un facteur de la demande de monnaie, et que l'anticipation d'une inflation plus élevée influence négativement la demande de monnaie, n'est pas une idée nouvelle. Elle a été proposée dans l'article influent de Friedman (1956), qui affirmait que la demande de monnaie est positivement liée aux revenus permanents et négativement liée aux taux d'intérêt attendus sur les obligations, au taux de rendement des capitaux propres et à l'inflation attendue. De plus, contrairement au cadre keynésien et à ses promoteurs néo-keynésiens ultérieurs (par exemple Tobin et Modigliani), Friedman a reconnu que les avoirs monétaires excédentaires (offre de monnaie plus élevée par rapport à la demande de monnaie, causée par l'augmentation de la première ou la diminution de la seconde) peuvent conduire à l'achat de biens de consommation durables et semi-durables, et pas seulement à l'achat d'actifs financiers portant intérêt.<sup>4</sup>

Selon l'approche développée dans cette thèse, le lien entre les avoirs monétaires excédentaires et la demande d'actifs financiers ou d'autres biens est similaire à celui discuté par Friedman. Toutefois, ce qui diffère, c'est la reconnaissance du fait que le

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<sup>4</sup> Friedman (1970, p. 28) :

The difference between us and the Keynesians is less in the nature of the process than in the range of assets considered. The Keynesians tend to concentrate on a narrow range of marketable assets and recorded interest rates. We insist that a far wider range of assets and interest rates be taken into account - assets such as durable and semi-durable consumer goods, structures and other real property.

canal par lequel les banques centrales et la politique monétaire peuvent provoquer les excédents de liquidités n'est pas seulement le contrôle de la masse monétaire, où l'inflation attendue est uniquement le résultat des changements de la masse monétaire. L'approche subjectiviste reconnaît que la demande de monnaie et les anticipations d'inflation peuvent être influencées par d'autres canaux, examinés dans la littérature<sup>5</sup> sur la qualité de la monnaie (par exemple, le cadre institutionnel de la banque centrale, sa constitution, l'émergence de nouveaux instruments inflationnistes de la politique monétaire, la communication de la banque centrale et l'engagement de ses actions futures, la qualité du bilan de la banque centrale). Ainsi, l'un des apports de cette thèse est la prise de conscience que les banques centrales influencent la demande de monnaie par la transformation d'autres propriétés de la monnaie, et pas seulement par la modification de son offre et la fixation du taux d'intérêt.

Pour résumer la partie théorique de cette thèse, les banques centrales influencent les prix des actifs financiers non seulement par la demande directe, mais aussi en modifiant les propriétés des actifs financiers. Le point de vue selon lequel la politique monétaire influence les prix des actifs financiers par la modification des propriétés des actifs financiers et de la monnaie renforce la compréhension du lien entre la politique monétaire et les prix des actifs financiers. La conception classique du mécanisme de transmission de la politique monétaire explique que la politique monétaire influence les prix des actifs financiers par le changement du taux d'intérêt (canal de la richesse et du crédit au sens large), de la quantité de monnaie (canal monétariste), de l'offre et de la disponibilité des actifs financiers (canal de l'équilibrage du portefeuille) et de la communication du taux d'intérêt futur (canal de signalisation). Ainsi, l'influence se manifeste à travers le taux d'intérêt, la demande directe d'actifs financiers et la masse monétaire. L'approche adoptée dans cette thèse montre que l'influence de la politique monétaire sur les prix des actifs financiers a plus de dimensions. L'approche subjective reconnaît que les banques centrales transforment les propriétés des actifs financiers et de la monnaie.

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<sup>5</sup> Par exemple, Bagus (2009), Bagus (2015), Bagus et Howden (2016)

La contribution théorique la plus importante de la thèse est qu'elle développe une approche basée sur la théorie de la valeur subjective, qui identifie les différents canaux par lesquels la politique monétaire influence les prix des actifs financiers. L'approche subjectiviste est large et flexible, en ce sens qu'elle peut intégrer toutes les propriétés des actifs financiers et de la monnaie, qui sont influencées ou transformées par la politique monétaire.

Le cadre théorique de ce travail est basé sur la théorie de la valeur subjective, qui affirme que la valeur dépend des préférences personnelles de l'individu, qu'elle est toujours liée à des circonstances économiques spécifiques et qu'elle ne peut donc être réduite à une quelconque mesure objective. La limite inévitable de ce cadre, qui est basé sur l'approche subjectiviste, est qu'il ne peut pas fournir une liste exhaustive des paramètres dont dépend la valeur des biens économiques, dans notre cas – la monnaie et les actifs financiers. Néanmoins, on a pu identifier quelques nouveaux paramètres (propriétés des actifs financiers et de la monnaie) par lesquels la politique monétaire influence la valeur et les prix des actifs financiers, qui ne figurent pas dans l'explication standard. Ainsi, malgré l'impossibilité d'être exhaustif, ce cadre est suffisamment précieux et flexible pour pouvoir inclure d'autres paramètres dans les recherches ultérieures.

En outre, les conclusions sur les liens entre la politique monétaire et les prix des actifs financiers sont basées sur le cadre théorique, qui a été développé sur la base de la théorie de la valeur subjective et de l'approche de la demande totale pour l'évaluation des actifs financiers. Il est important de préciser que ce cadre théorique est instructif pour définir séparément les canaux ou les liens de causalité. Toutefois, il est limité dans sa capacité à décrire l'importance relative des différents canaux ou à quantifier leurs manifestations globales sur les prix des actifs financiers. En effet, la recherche scientifique sur les relations entre les variables économiques doit toujours faire appel à une analyse causale partielle. La réalité économique est telle qu'il y a toujours une multitude de facteurs qui influencent une variable économique particulière. Afin de comprendre les liens de causalité, l'approche analytique doit d'abord traiter un facteur particulier en maintenant tous les autres constants. Après avoir étudié une relation causale particulière, il est possible d'analyser l'impact de



plusieurs facteurs simultanément. La nécessité de cette approche progressive ou par étapes ne vient pas seulement des limites de l'esprit humain pour comprendre les effets de nombreux facteurs travaillant simultanément et influençant une variable particulière. Elle découle également des considérations pratiques du travail scientifique, où le volume et le temps consacrés à des enquêtes analytiques particulières sont limités. Nous expliquons la réalité complexe en la simplifiant et en la disséquant en parties compréhensibles. La simplification ne signifie pas que l'analyse causale partielle n'est pas utile. Au contraire, c'est la seule façon dont les sciences sociales peuvent répondre à l'ambition d'expliquer les universaux - en les abordant un par un.

Il est également important de préciser que la discussion des prix fondée sur la théorie de la valeur subjective ne nie pas les facteurs objectifs, qui jouent un rôle dans la détermination de la valeur et des prix des biens économiques. Il n'y a pas de tension entre la subjectivité de la valeur et l'analyse des propriétés objectives des biens économiques et des autres caractéristiques physiques de la réalité. Les propriétés et paramètres objectifs des biens économiques jouent inévitablement un rôle important dans la détermination de la valeur et des prix des biens économiques. Les biens économiques sont évalués précisément parce qu'ils existent objectivement et possèdent des propriétés objectives, qui leur permettent d'être utiles pour atteindre les objectifs des individus. Toutefois, la subjectivité de la valeur reconnaît que l'ensemble exact des propriétés objectives et leur importance relative dans des circonstances particulières dépendent de l'individu en question, qui procède à l'évaluation et agit en conséquence. Ainsi, les propriétés objectives des biens et les caractéristiques de la réalité économique jouent un rôle subjectif dans les considérations de valeur des individus. L'analyse scientifique se concentre sur la description des paramètres objectifs de notre réalité. Cependant, l'analyse économique doit reconnaître que l'importance des facteurs objectifs pour les considérations de valeur est toujours subjective.

De plus, la thèse se focalise sur la question de la valeur et de la demande d'actifs financiers par rapport à la valeur et à la demande de la monnaie. Cependant, comme l'ont montré le développement et la description du cadre théorique, la valeur

subjective des actifs financiers dépend à proprement parler de la valeur de la monnaie et de la valeur d'autres biens. La valeur et la demande d'autres biens ont été le plus souvent omises dans l'analyse, et n'ont été que brièvement discutées. L'accent mis sur la monnaie par rapport aux actifs financiers est justifié, car (a) ils sont à bien des égards de proches substituts et (b) il existe une tradition vénérable dans l'analyse économique qui consiste à se concentrer sur cette relation, en particulier dans la pensée keynésienne (Keynes ([1936]2018), Gurley et Shaw (1960), Tobin (1961) et bien d'autres). Néanmoins, cette omission est une limitation de ce travail, qui reste à étudier dans le cadre de recherches futures.

## **8. Résultats empiriques**

Le cadre théorique de l'évaluation des actifs financiers développé dans la thèse a permis d'analyser les différents canaux d'impact de la politique monétaire sur la valeur et les prix des actifs financiers. L'approche a permis de conceptualiser les canaux, qui sont déjà bien discutés dans la littérature, ainsi que certains des canaux qui sont moins répandus ou absents dans la littérature.

L'étude empirique de tous les canaux identifiés serait trop complexe et nécessiterait beaucoup plus de ressources et de temps que ce qui est disponible et serait un exercice dépassant le cadre d'une thèse. Ainsi, la partie empirique de la thèse s'est concentrée sur l'un des canaux - à savoir, le canal de la qualité de la monnaie. Les principales raisons pour lesquelles ce canal a été choisi pour l'étude empirique sont les suivantes :

- L'identification de la qualité du canal financier est une contribution théorique nouvelle de la thèse ;
- Il n'existe pas d'études empiriques, qui étudient l'impact de la qualité de la monnaie sur les prix des actifs financiers.
- Žukauskas et Hülsmann (2019) montrent que les prix dans le secteur financier augmentent plus rapidement que les prix dans le secteur non financier de l'économie. Le mécanisme de transmission traditionnel de la politique monétaire n'explique pas pourquoi il en est ainsi. Les auteurs

affirment que la baisse de la qualité de la monnaie peut expliquer cette tendance. Cependant, l'hypothèse doit être testée empiriquement.

En théorie, la qualité du canal monétaire peut influencer les prix des actifs financiers de la manière suivante. Les banques centrales influencent la qualité de la monnaie<sup>6</sup>, ce qui a un effet sur la façon dont les acteurs du marché perçoivent la valeur et le futur pouvoir d'achat de la monnaie. La politique monétaire a induit des changements dans la perception de la valeur de la monnaie qui se manifestent dans le changement de la demande de monnaie. Ce changement de la demande de monnaie influence inévitablement les décisions de dépense et de vente des acteurs du marché et modifie donc les demandes d'échange et de réservation de biens non monétaires et leurs prix (ceci est valable pour tous les biens non monétaires, y compris les actifs financiers). Une monnaie de moindre qualité signifie des demandes d'échange et de réservation de monnaie plus faibles et des demandes d'échange et de réservation de biens non monétaires (y compris les actifs financiers) plus élevées, et des prix plus élevés de ces biens, et vice versa. En outre, si la baisse de la qualité de la monnaie entraîne une diminution de la demande de monnaie en tant que réserve de valeur, les actifs financiers peuvent être considérés comme un substitut de la monnaie. Dans ce cas, la demande de réservation et d'échange d'actifs financiers augmentera relativement plus que celle d'autres biens non monétaires (qui n'ont pas les propriétés d'être une réserve de valeur ou qui les ont dans une moindre mesure).

Afin d'étudier empiriquement la qualité du canal de la monnaie et son impact sur les prix des actifs financiers, une mesure empirique de la qualité de la monnaie était nécessaire. Par conséquent, la partie empirique de la thèse a construit un indicateur composite de la qualité de la monnaie. Cet exercice empirique était basé sur l'hypothèse qu'une mesure de la qualité de la monnaie peut être créée en identifiant et en quantifiant différents paramètres et dimensions de la qualité de la monnaie, identifiés dans la littérature. Si le raisonnement théorique est correct, il devrait y avoir un lien statistiquement significatif entre la mesure de la qualité de la monnaie et les

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<sup>6</sup> La qualité de la monnaie peut être définie comme "la capacité de la monnaie, telle que perçue par les acteurs, à remplir toutes ses principales fonctions, à savoir servir de moyen d'échange, de réserve de richesse et d'unité comptable" (Bagus, 2009, pp. 22-23).

mouvements de prix des actifs financiers, ce qui démontrerait l'existence du canal de la qualité de la monnaie. L'indice de qualité de la monnaie a été construit comme un indicateur composite de manière à quantifier les domaines et les résultats de la politique monétaire, reconnus comme pertinents pour la perception de la qualité de la monnaie par d'autres auteurs. L'indice contient 18 indicateurs en cinq dimensions : bilan de la banque centrale, masse monétaire, taux d'intérêt, stabilité du système financier et orientation future. Les résultats de l'indice de la qualité de la monnaie ont montré qu'au cours des 20 dernières années, la qualité de la monnaie dans la zone euro a considérablement diminué.



Fig. 1. Indice de qualité de la monnaie (échelle : 0 à 100)

La diminution de la qualité de l'euro est conforme au raisonnement théorique suggéré dans la thèse et également dans Žukauskas et Hülsmann (2019). L'argument est que la théorie de la quantité de monnaie ne peut pas expliquer pourquoi les prix dans le secteur financier augmentent plus rapidement que les prix dans le secteur non financier de l'économie. Le canal de la qualité de la monnaie suggère une nouvelle

explication basée sur la qualité de la monnaie - la baisse de la qualité de la monnaie diminue la demande de monnaie, les acteurs du marché se tournant vers les actifs financiers comme forme alternative de détention de la richesse, ce qui entraîne une augmentation des prix des actifs financiers par rapport aux prix du secteur non financier. La tendance générale à la baisse de la mesure empirique de la qualité de la monnaie créée dans cette thèse soutient ce raisonnement.

Les résultats empiriques de l'indice sont également importants pour d'autres raisons. Ils montrent que la qualité de la monnaie est un facteur supplémentaire, qui doit être intégré dans l'analyse de la demande de monnaie. En théorie, compte tenu de tous les autres facteurs (taux d'intérêt, revenus, prix, etc.) de la demande de monnaie, la préférence des acteurs du marché pour la détention d'encaisses monétaires peut changer en raison des fluctuations de la qualité de la monnaie. Ce facteur est très différent de ceux déjà présents dans la théorie, puisqu'il est basé sur la théorie qualitative et non sur la théorie quantitative de la monnaie et de son pouvoir d'achat. La théorie qualitative de la valeur de la monnaie permet aux participants au marché de porter des jugements subjectifs. Cela signifie que les changements dans la perception de la valeur et donc de la demande de monnaie peuvent être beaucoup plus abrupts et étendus par rapport au raisonnement qui sous-tend la théorie quantitative de la monnaie, où la demande de monnaie dépend de facteurs plus stables (quantité de monnaie, niveau de production, etc.)

De plus, la notion de qualité de la monnaie et de demande de monnaie est étroitement liée aux prix. Le niveau des prix est le résultat de la rencontre de la demande d'encaisses monétaires et de l'offre de monnaie. Les variations de l'offre de monnaie ainsi que de la demande de monnaie entraînent des changements dans le niveau des prix. Ainsi, les modifications de la qualité de la monnaie en tant que l'un des facteurs de la demande de monnaie peuvent entraîner des changements du niveau des prix. Plus particulièrement, si la diminution de la qualité de la monnaie réduit la demande de monnaie, le niveau des prix augmente.

Si la qualité de la monnaie, qui dépend de la politique monétaire et du fonctionnement global du système monétaire, est un facteur de la demande de monnaie, alors la

qualité de la monnaie joue un rôle dans les mécanismes de transmission de la politique monétaire. Les actions des banques centrales influencent la qualité de la monnaie, qui à son tour affecte la demande de monnaie. Selon ce cadre, la politique monétaire n'influence donc pas seulement l'économie par la modification de l'offre de monnaie, mais aussi par la demande de monnaie.

Il existe des limites importantes à la mesure de la qualité de la monnaie. Le cadre de la qualité de la monnaie est basé sur la théorie de la valeur subjective. La monnaie en tant que bien est évaluée dans la mesure où il répond aux besoins des acteurs du marché. En particulier, la monnaie est évaluée lorsqu'elle a les propriétés d'être un moyen d'échange, une réserve de valeur et une unité de compte. Cependant, ce que sont ces propriétés, lesquelles sont les plus importantes et comment une monnaie particulière les remplit relèvent de jugements de valeur subjectifs. Par conséquent, les tentatives de mesurer la composition de ces propriétés ne peuvent pas être exhaustives et objectives par définition. Elles seront en elles-mêmes liées par des jugements de valeur, qui peuvent être différents de ceux des acteurs du marché. En outre, la méthodologie (normalisation, pondération, agrégation) de la création d'un indice composite en soi exige des décisions subjectives de la part du chercheur.

En outre, toutes les dimensions qui peuvent être importantes pour la qualité de la monnaie ne peuvent pas être facilement quantifiées. Par exemple, la littérature indique que l'organisation de l'autorité monétaire (indépendance de la banque centrale, sa responsabilité et sa transparence, la constitution de la banque centrale, les décideurs de la banque centrale) est l'une des dimensions qui est importante pour la qualité de la monnaie. Cependant, il n'existe pas d'indicateurs quantifiables pour la mesurer. Ces questions sont particulièrement chargées de jugements subjectifs. Cela suggère que certaines des dimensions identifiées de la qualité de la monnaie sont plus quantifiables que d'autres.

L'objectif de l'enquête empirique est d'analyser si et dans quelle mesure la politique monétaire influence les prix des actifs financiers par le canal de la qualité de la monnaie. La première étape du cadre empirique consiste à élaborer un indicateur

composite de la qualité de la monnaie. La deuxième étape consiste à tester la relation entre l'indicateur composite et les prix des actifs financiers.

Le lien empirique entre la qualité de la monnaie et les cours des actions est étudié en effectuant des régressions linéaires multiples. L'indice de qualité de la monnaie appliqué à la zone euro est la principale variable exogène du modèle. Pour saisir les mouvements des prix des actifs financiers, un indice large des actions de la zone euro est utilisé (Dow Jones Euro Stoxx Price Index). En outre, les régressions sont également effectuées pour 10 pays de la zone euro séparément. Les pays choisis sont les membres initiaux de la zone euro depuis l'introduction de l'euro : Autriche, Belgique, Finlande, France, Allemagne, Irlande, Italie, Pays-Bas, Portugal, Espagne. Les variables endogènes dans les régressions par pays sont les indices généraux des prix des actions (indices MSCI Standard Large and Mid Cap). Les régressions incluent également des variables macroéconomiques comme variables de contrôle (exogènes), qui sont les plus couramment utilisées par d'autres auteurs dans ce type de régressions<sup>7</sup>. En outre, pour tester les relations à court et moyen terme, les régressions sont effectuées séparément pour les données mensuelles, trimestrielles et annuelles.

Les résultats des régressions montrent que l'indice de qualité de la monnaie est dans la plupart des cas très significatif sur le plan statistique. L'indice est statistiquement significatif dans les 11 cas pour les données mensuelles (une régression pour la zone euro, et 10 régressions distinctes pour les pays de la zone euro), dans 10 cas pour les données trimestrielles (l'exception est l'Allemagne) et dans 9 cas pour les données annuelles (les exceptions sont l'ensemble de la zone euro et l'Autriche). Cependant, la relation à moyen et court terme entre la qualité de la monnaie et les prix des actifs financiers s'est avérée statistiquement positive. Cela signifie que les baisses de la qualité de la monnaie sont associées à des baisses des prix des actions, et vice versa. Ce résultat est contre-intuitif, puisque la relation théorisée entre la qualité de la monnaie et les prix des actifs financiers est négative.

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<sup>7</sup> Ils le sont : PIB, production industrielle, prix à la consommation, chômage, taux d'intérêt à court et à long terme, masse monétaire et taux de change.

Une explication possible de cette relation positive est le phénomène de la répression financière, évoqué dans la thèse. La répression financière est définie comme la stratégie du gouvernement pour obtenir un accès privilégié aux marchés des capitaux à des conditions de crédit préférentielles. La moindre qualité de la monnaie est liée au degré plus élevé de répression financière, qui entraîne une diminution de la demande pour les actifs financiers. La répression financière causée par la politique monétaire (également la gestion de la dette publique et les politiques financières), réduit l'attrait (le rendement attendu) de la détention d'actifs financiers et réduit ainsi la demande pour les actifs financiers (et aussi pour la monnaie). Par conséquent, l'effet de substitution découlant de la qualité de la monnaie (la qualité réduite de la monnaie entraîne la substitution de la monnaie aux actifs financiers) est dominé par l'effet de répression financière (la qualité réduite de la monnaie est en partie le résultat de la répression financière, qui réduit la demande d'actifs financiers).

Par conséquent, les résultats empiriques du lien entre la qualité de la monnaie et les prix des actifs financiers suggèrent les différents effets à long et à court terme. À long terme, sur deux décennies, la qualité réduite de la monnaie entraîne un effet de substitution de la monnaie aux actifs financiers, ce qui signifie une demande plus élevée et une croissance plus rapide des prix des actifs financiers par rapport aux prix dans le secteur non financier. Toutefois, à court terme, cette relation ne tient pas, car elle est dominée par l'effet de répression financière, qui réduit la demande d'actifs financiers (et de monnaie).

Ainsi, l'un des récits possibles est que la répression financière à court terme, causée par la politique monétaire (également la gestion de la dette publique et les politiques financières), réduit l'attrait (le rendement attendu) de la détention d'actifs financiers et donc la demande d'actifs financiers (et aussi la demande de monnaie). Néanmoins, à long terme, la qualité réduite de la monnaie amène les acteurs du marché à déplacer leur réserve de valeur vers les actifs financiers. La corrélation positive à court terme entre la monnaie et les actifs financiers causée par la répression financière est complétée par le déplacement relatif de la monnaie vers les actifs financiers en raison de la qualité réduite de la monnaie à long terme.



Le fonctionnement simultané de la qualité de la monnaie et des effets de répression financière est assez similaire à la relation bien connue entre le revenu et les effets de substitution. L'effet de revenu entraîne un déplacement de la demande de tous les biens lorsque le revenu (ou la contrainte budgétaire) change. De même, la demande de monnaie et d'actifs financiers est réduite en raison de la répression financière. D'autre part, l'effet de substitution entraîne simultanément un déplacement de la demande d'un bien vers un ou plusieurs autres biens lorsque le revenu (ou la contrainte budgétaire) change. De même, la qualité réduite de la monnaie déplace la demande de monnaie vers les actifs financiers. Par conséquent, l'analogie est que l'effet de la répression financière est analogue à l'effet de revenu, et l'effet de la qualité réduite de la monnaie est analogue à l'effet de substitution.

De plus, la relation inverse entre deux variables économiques à court et à long terme n'est pas rare dans la théorie économique. Par exemple, dans la théorie du capital, l'augmentation de la consommation au détriment de l'épargne et de l'investissement peut provoquer une croissance économique à court terme. Toutefois, à long terme, elle diminue le stock de capital et la productivité, et réduit la croissance économique à long terme (Garrison (2002)).

La deuxième partie de la recherche empirique présente également des limites importantes. L'analyse de régression a testé les relations causales partielles entre une ou plusieurs variables indépendantes (dans notre cas, la qualité de la monnaie et les variables macroéconomiques) et la variable dépendante (dans notre cas, les prix des actifs financiers). Cette analyse est partielle en ce sens que dans le domaine des sciences sociales et particulièrement de l'économie, il y a toujours une multitude de facteurs qui influencent simultanément la variable dépendante. Cela est particulièrement vrai dans le cas de variables larges et agrégées. Différents modèles tentent de saisir les variables les plus importantes, mais cela ne peut jamais être fait dans son intégralité pour deux raisons fondamentales. La première est qu'il y a trop de facteurs qui influencent simultanément la variable dépendante. Cependant, le nombre de variables indépendantes doit être limité, sinon le modèle deviendrait trop complexe ou imprécis en raison du manque d'observations. La deuxième est que tous les facteurs pertinents ne sont pas quantifiables ; ils ne peuvent pas être

exprimés en mesures quantifiées en principe (par exemple, la valeur économique), ou les mesures et les données les concernant n'existent pas dans le contexte spécifique. Ainsi, le choix des variables est toujours lié au cadre théorique et au modèle particuliers (dans notre cas particulier - APT utilisant des macro-indicateurs), qui est à la base du choix des indicateurs. Cependant, le choix du cadre ne rend pas toutes les autres influences possibles absentes.

Cette limitation est également pertinente pour l'étude empirique de cette thèse. Même si des variables macroéconomiques sont ajoutées dans les régressions pour contrôler les autres facteurs affectant les prix des actifs financiers, il est clair qu'il pourrait y avoir d'autres facteurs qui n'ont pas été contrôlés. La relation quantitative entre la variable dépendante et les variables indépendantes n'est alors pas saisie dans sa totalité. Les effets concurrents de la qualité de la monnaie et de la répression financière en sont un exemple.

En outre, il convient de mentionner certaines limites de l'approche empirique de cette thèse. Le cadre théorique de l'influence de la politique monétaire sur les prix des actifs financiers qui a été développé dans cette thèse est sensiblement plus large que le canal de la qualité de la monnaie qui a été testé dans la partie empirique de ce travail. La tâche de tester empiriquement d'autres canaux, qui ont été identifiés dans le cadre théorique, doit être laissée pour des recherches plus approfondies ; sinon, l'analyse empirique serait trop complexe et plus longue que les exigences ne le permettent. Il s'agit là d'une autre limitation de ce travail, qui est inévitable dans le sens où la partie théorique du travail visait à créer un nouveau cadre, basé sur la théorie de la valeur subjective, qui engloberait tous les différents canaux d'impact. Étant donné que le cadre est très large, il est tout à fait naturel que tous les aspects de ce cadre n'aient pas été testés de manière empirique.

Une autre limitation inévitable de l'approche subjectiviste est qu'elle ne peut donner une mesure quantitative et objective précise de l'importance des différents paramètres ou de leur relation avec la valeur de la monnaie ou des actifs financiers. La logique du cadre subjectiviste consiste à théoriser les propriétés de la monnaie et des actifs financiers en fonction de leur valeur subjective pour les acteurs du marché.

Toutefois, leurs expressions particulières et leur lien avec la valeur restent subjectifs, c'est-à-dire qu'ils dépendent de différents individus et des circonstances économiques de l'évaluation. Par conséquent, les résultats du cadre théorique et de la recherche empirique de ce travail sont importants car ils (a) suggèrent que la politique monétaire influence les prix des actifs financiers par la modification des propriétés des actifs financiers et de la monnaie et (b) donnent une réponse à la question de savoir comment la politique monétaire influence les prix des actifs financiers en théorisant (et d'une certaine façon en supposant) quelles propriétés de la monnaie et des actifs financiers sont importantes pour leur valeur. Cependant, il ne peut pas donner les relations numériques objectives entre ces propriétés et la valeur de la monnaie et des actifs financiers. Il s'agit en fin de compte d'une limitation inévitable de cette approche, qui découle de la théorie et de la philosophie de la subjectivité de la valeur. Les propriétés identifiées de la monnaie et des actifs financiers, par lesquelles la politique monétaire influence les prix des actifs financiers, sont pertinentes, mais la mesure dans laquelle elles modifient la valeur, la demande et donc les prix des actifs financiers, dépend de la constellation des individus et des circonstances particulières du marché. Le test empirique de la qualité du canal de la monnaie et de son impact sur les prix des actifs financiers était une tentative de saisir la relation dans les circonstances spécifiques. Cependant, la théorie de la valeur subjective reconnaît que la relation numérique particulière, qui est le résultat de l'étude empirique, n'est pas universelle et qu'elle dépend des circonstances de l'étude empirique. Cela ne signifie pas, cependant, que le cadre théorique et les résultats empiriques sont nuls, non pertinents ou sans importance. Plus le cadre théorique est solide et l'analyse empirique correcte, plus les résultats nous donnent des réponses définitives sur les canaux par lesquels la politique monétaire influence les prix des actifs financiers. La limite est que l'expression et la manifestation particulières de ces canaux dépendront toujours des circonstances.

## **9. Conclusion et implications plus larges**

En résumé, les résultats de la thèse montrent qu'il existe quatre mécanismes par lesquels la politique monétaire influence la valeur et les prix des actifs financiers : la

demande directe d'actifs financiers, la modification des propriétés des actifs financiers, la substitution d'actifs financiers ayant des propriétés similaires par les acteurs du marché, et la modification des propriétés de la monnaie. Le champ d'application pratique le plus important de ces résultats est double. Premièrement, l'étude montre que les banques centrales et la politique monétaire interviennent davantage sur les marchés financiers que ne le fait le mécanisme traditionnel de la politique monétaire. Cela signifie que la vision standard du mécanisme de transmission de la politique monétaire devrait être mise à jour, en tenant compte des nouveaux canaux de transmission, discutés dans cette thèse. L'approche subjective appliquée à la valeur et aux prix des actifs financiers pose un défi à l'analyse risquerendement habituelle de la fixation des prix des actifs financiers, en affirmant qu'il y a plus de dimensions et de propriétés des actifs financiers, qui sont pertinentes si nous voulons comprendre la formation des prix des actifs financiers. Deuxièmement, le cadre théorique qui a été développé dans cette thèse est suffisamment flexible pour être appliqué à l'analyse d'autres conséquences de la politique monétaire, par exemple sur d'autres biens économiques et marchés.

Les résultats de la thèse pourraient apporter un éclairage sur les questions plus larges concernant la place et l'importance du secteur financier dans l'économie. Le secteur financier remplit des fonctions très importantes dans l'économie, telles que l'organisation des paiements, l'accumulation de l'épargne et la distribution du crédit à ses usages les plus productifs, la répartition des risques, etc. Cependant, les économistes et les décideurs politiques sont souvent préoccupés par le pouvoir et l'augmentation de la position dominante du secteur financier sur les autres secteurs de l'économie.

La taille relative du secteur financier par rapport au secteur réel est en augmentation. Le secteur financier est souvent critiqué pour ses profits anormaux. Le revenu moyen des personnes travaillant dans le secteur financier est généralement beaucoup plus élevé que dans les autres secteurs. Il existe de nombreux cas où des personnes travaillant aux postes de direction d'institutions financières en faillite reçoivent des primes, que beaucoup considèrent comme scandaleuses. En outre, le secteur financier a un effet énorme sur les secteurs de l'économie réelle grâce à son pouvoir

de canaliser les fonds et de distribuer le crédit. Ainsi, le risque systémique et la fragilité inhérents au secteur financier se répandent et influencent l'ensemble de l'économie en période de crise financière.

Les politiques qui sont souvent proposées et mises en œuvre en retour sont nombreuses. Il s'agit généralement d'une combinaison de réglementations plus strictes, d'une fiscalité plus lourde, de mesures de politique de la concurrence, dans certains cas - prise de contrôle par le gouvernement et contrôle des institutions financières. Le point commun de ces politiques est qu'elles traitent la situation à laquelle elles répondent comme une anomalie, un défaut du système financier, qui provient des imperfections du marché financier. Si les bonnes mesures sont appliquées, les problèmes liés à l'expansion constante du pouvoir du secteur financier, à l'aléa moral, à la fragilité, etc. peuvent être corrigés.

Toutefois, les conclusions de ces travaux suggèrent que l'expansion relative et la domination du secteur financier sur les autres secteurs est une caractéristique, et non une anomalie du système financier actuel. Cette caractéristique provient du lien étroit qui existe entre les marchés financiers et la politique monétaire. Le pouvoir et l'expansion du secteur financier viennent du fait qu'il est un véhicule de production de monnaie et de politique monétaire.

La politique monétaire est exécutée par le secteur financier, ce qui signifie que les actifs financiers sont un véhicule d'afflux massif d'argent dans l'économie, créant une demande énorme d'actifs financiers et encourageant leur production. De plus, la réglementation financière et certains instruments de politique monétaire font que certains actifs financiers sont traités de préférence à d'autres, et les actifs financiers en général à d'autres catégories d'actifs. En outre, comme nous l'avons vu dans cette thèse, les actifs financiers deviennent une réserve de valeur attrayante si la qualité de la monnaie baisse. Tout cela suggère que la source du pouvoir, sa taille relative et la force du secteur financier sont liées à un arrangement institutionnel plus profond des banques centrales et de la production monétaire. Tant que ce cadre sera présent, les tendances et la domination du secteur financier se poursuivront, malgré les politiques qui ne reconnaissent pas la source fondamentale de cette tendance.

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