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Thi Thu Ha Nguyen

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A dissertation submitted for the Degree of
Doctor of Philosophy
in Economics

**Essays on globalisation and the effects of climate
change for developing countries:
a case study of Viet Nam
with a stock-flow consistent framework**

Presented by
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December 2022

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To my beloved children, little angels, Minh Thien and Minh Phuc...

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Résumé

Cette thèse présente un modèle stock-flux cohérent (SFC) qui fournit une représentation conforme à la théorie de l'économie du Viet Nam - une petite économie ouverte - et offre des capacités de simulation de politiques répondant aux besoins des décideurs. Notre thèse développe pour la première fois un modèle SFC empirique pour le Viet Nam. Le modèle se compose de six secteurs institutionnels: firmes, banque centrale, banques commerciales, gouvernement, ménages et reste du monde. En raison de la disponibilité des données financières, le bilan et la matrice des flux sont construits sur la base des principes du système de comptabilité nationale SNA 2008. Les données proviennent de différentes sources. Cela justifie certaines hypothèses simplifiées dans le modèle. En s'appuyant sur la théorie économique mais aussi sur une approche appliquée, les équations comportementales sont estimées en utilisant les données annuelles de 1997 à 2019 et complètent les équations comptables.

Le modèle peut être utilisé pour la simulation de politiques ou l'analyse de scénarios afin d'évaluer les impacts/effets de politiques ou chocs sur le Viet Nam. Nous mettons en œuvre trois types de chocs pour tester la pertinence du modèle : politique budgétaire, politique monétaire et choc externe. Ensuite, nous analysons les différents mécanismes de transmission des effets sur la croissance économique et les différentes composantes du PIB, les prix et le côté financier de l'économie, y compris les taux d'intérêt, les changements dans les actifs financiers de chaque secteur. En particulier, nous effectuons deux exercices spécifiques en utilisant le modèle. Le premier vise à analyser les conséquences sur les aspects réels et financiers de l'économie des réponses du gouvernement vietnamien pour faire face à la pandémie de COVID-19. En particulier, nous examinons les effets potentiels sur la soutenabilité de la dette publique qui est toujours une préoccupation du gouvernement. La deuxième application est liée aux impacts macroéconomiques du changement climatique et aux effets potentiels des mesures d'adaptation en intégrant les fonctions de dommages et les investissements d'adaptation dans le modèle. Même si le modèle requiert beaucoup de temps pour la construction, il couvre beaucoup de potentiel pour étendre et fournir un cadre d'analyse de politiques économiques utile en tenant compte des différents objectifs de développement du Viet Nam.

Mot-clés: modèle stock-flux cohérent, macroéconomie post-keynésienne, économies émergentes, Viet Nam, changement climatique

JEL: E12, E17, E60, Q56, O53

Abstract

This dissertation presents a stock-flow consistent (SFC) model which provides a theory-consistent representation of Viet Nam's general structure - a small open economy - and offers policy simulation capabilities to meet the needs of policymakers. We are the first to develop an empirical SFC model for Viet Nam. The model comprises six institutional sectors: firms, central bank, commercial banks, government, households and rest of the world. Due to the availability of financial data, the balance sheet and flow matrix are built based on the principles of the system of national accounting SNA 2008 and by gathering data from different sources. It justifies several simplification hypotheses made in the model. Building upon economic theory but also a data-driven approach, besides accounting equations, behavioural equations are estimated econometrically by using annual data from 1997 to 2019.

The model can be used for policy simulation or scenario analysis to assess the impacts/effects of policies or shocks on the Vietnamese economy. We implement three types of shock to test the usefulness of the model: fiscal policy, monetary policy and foreign shock. Then, we analyse the different transmission mechanisms of the effects on economic growth and different components of Gross Domestic Product (GDP), prices and the financial side of the economy, including interest rates and changes in financial assets of each sector. Especially we perform two specific exercises using the model. The first one aims to analyse the different consequences of the policy responses of the Vietnamese government to cope with the COVID-19 pandemic on both the real and financial sides of the economy. We examine the potential effects on public debt sustainability, which is always a concern of the government. The second application is related to the macroeconomic impacts of climate change and the potential effects of adaptation measures by integrating damage functions and adaptation investment into the macroeconomic model. Albeit time-consuming, the development of this model has a lot of potential to expand and provide a sound economic policy/macroeconomic analysis framework, taking into account the different economic and social development objectives of Viet Nam.

Keywords: stock-flow consistent modelling, Post-Keynesian macroeconomics, emerging economies, Viet Nam, climate change

JEL: E12, E17, E60, Q56, O53

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List of Abbreviations

ADB	Asian Development Bank
AFD	Agence Francaise de Developpement
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CGE	Computable General Equilibrium
CIEM	Central Institute of Economic Management
CPI	Consumer price index
FDI	Foreign Direct Investment
FPAS	Forecasting and Policy Analysis System
GCM	General Circulation Model
GDP	Gross Domestic Product
GHG	Greenhouse gas
GMSL	Global mean sea level
GSO	General Statistics Office
GWL	Global warming level
ILO	International Labour Organisation
IMF	International Monetary Fund
IMHEN	Institute of Meteorology, Hydrology and Climate Change
IPCC	Intergovernmental Panel on Climate Change
LEAP	Long-range Energy Alternatives Planning
MFMod	Macroeconomic and fiscal model
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Plan and Investment
NAP	National Adaptation Plan
NAPRCC	National Action Plan to Respond to Climate Change

NDC	Nationally Determined Contribution
NSCC	National Strategy on Climate Change
PDP8	Power Development Plan VIII
PIPA	Plan for the Implementation of Agreement
PKE	Post-Keynesian Economics
RCP	Representative Concentration Pathways
SAM	Social Accounting Matrix
SFC	Stock-flow consistent
SNA	System of National Accounting
TFP	Total factor productivity
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	US Dollar
VND	Vietnam Dong
VNMST	Viet Nam mean surface temperature
VSL	Value of Statistical Life
WTO	World Trade Organisation

List of Symbols

γ^{bb}	Share of government bonds hold by banks
α_{soc}	Social contribution rate
ΔB	Changes in government bonds
ΔB^h	Changes in government bonds held by households
ΔB^b	Changes in government bonds held by banks
ΔB^{cb}	Changes in government bonds held by the central bank
ΔDM^f	Changes in dong deposits of firms
ΔDM^h	Changes in dong deposits of households
ΔE^f	Changes in equities issued by firms
ΔE^h	Changes in equities issued by households
ΔE^r	Changes in portfolio investment
ΔE^b	Changes in equities issued by banks
ΔFDI	Changes in FDI
ΔFL	Changes in foreign loans
ΔFL^f	Changes in foreign loans of firms
ΔFL^b	Changes in foreign loans of banks
ΔFL^g	Changes in foreign loans of government
ΔFM^f	Changes in foreign deposits of firms
ΔFM^h	Changes in foreign deposits of households
ΔFM^g	Changes in foreign deposits of government
ΔGM^b	Changes in dong deposits of government in banks
ΔGM^{cb}	Changes in dong deposits of government in central bank
ΔH	Changes in cash
ΔL^f	Changes in firms' debt
ΔL^h	Changes in households' debt
ΔLB^{cb}	Changes in advances
ΔMB^{cb}	Changes in banks' reserves
ΔOTA^b	Changes in banks' other financial assets

ΔOTA^f	Changes in firms' other financial assets
ΔOTA^g	Changes in government's other financial assets
ΔOTA^h	Changes in households other financial assets
ΔOTA^r	Changes in ROW's other financial assets
ΔOTA^{cb}	Changes in central bank's other financial assets
Δp_{FDI}	Changes in price of FDI
ΔRES	Changes in international reserves
ΔT	Changes in temperature
δ_K^f	Depreciation rate of firms' non-financial assets
δ_K^g	Depreciation rate of government's non-financial assets
δ_K^h	Depreciation rate of households' non-financial assets
γ_{FL}^g	Share of external debt out of total public debt
γ_{FM}^g	Ratio of government's foreign deposits to external public debt
γ_{AGR}^{va}	Share of agriculture's value-added out of total
γ_{ENER}^{va}	Share of energy's value-added out of total
γ_{RICE}^{va}	Share of rice's value-added out of total agriculture
γ_B^h	Share of government bonds held by households
γ_{GM}^b	Share of government's dong deposits in banks
γ_{GR}	Ratio of transfers from the ROW to the government to GDP
γ_G	Growth rate of public spending
γ_{MB}	Ratio of required bank reserves
γ_{PR}	Ratio of transfers of the private sector to the ROW to GDP
γ_{RP}	Ratio of transfers from the ROW to the private sector to GDP
γ_{SBE}	Ratio of social benefits to GDP
γ_{DM}^f	Growth rate of dong deposits of firms
γ_{EB}	Ratio of banks' equities to credits
γ_{FM}^f	Ratio of firms' foreign deposits to trade
γ_{FM}^h	Ratio of households' foreign deposits to received foreign transactions
γ_{HP}	Share of hydropower out of total energy production
γ_{ict}^{wb}	Share of personal income taxed
γ_{ic}^{im}	Share of imported intermediate consumption out of total
γ_{INV}	Ratio of inventories stock to past sales
γ_{RE}	Share of electricity consumption out of total consumption

γ_{RICE}	Share of rice out of agriculture production
γ_{soc}^{wb}	Share of wage deducted social contribution
γ_{VA}^b	Share of banks' value-added out of total
γ_{VA}^f	Share of firms' value-added out of total
γ_{VA}^g	Share of government's value-added out of total
γ_{WBR}	Ratio of income from abroad to GDP
λ^b	Share of wages paid by banks out of total
λ^f	Share of wages paid by firms out of total
λ^g	Share of wages paid by government out of total
λ^h	Share of wages paid by households out of total
λ_n	Share of worked employed by firms out of total
ϕ	Ratio of dividendes to firms' profit
π	Inflation
τ^f	Profit tax rate
τ^r	Import tax rate
τ^w	Personal income tax rate
τ_{TOP}	Ratio of taxes on production to GDP
B	Government bonds
B^b	Government bonds held by banks
B^h	Government bonds held by households
B^{cb}	Government bonds hold by central bank
c	Real consumption
$DEBT_G$	Stock of public debt
DIV	Dividends
DM^f	Stock of dong deposits held by firms
DM^h	Stock of dong deposits held by households
E^b	Stock of equities issued by banks
E^f	Stock of equities issued by firms
E^h	Stock of equities issued by households
E^r	Portfolio investment
F^f	Firms' profit
F^h	Households' profit
FDI	Stock of FDI inwards in VND

FDI_{us}	Stock of FDI inwards in US dollar
FL^b	Stock of foreign loans of banks in VND
FL^f	Stock of foreign loans of firms in VND
FL^g	Stock of foreign loans of government in VND
FL_{us}^f	Stock of foreign loans of firms in US
FL_{us}	Stock of foreign loans in US dollar
FL_{us}^b	Stock of foreign loans of banks in US dollar
FL_{us}^g	Stock of foreign loans of government in US dollar
FM^f	Stock of foreign deposits of firms in VND
FM^g	Stock of foreign deposits of government in VND
FM^h	Stock of foreign deposits of households in VND
FM_{us}^f	Stock of foreign deposits of firms in US
FM_{us}^h	Stock of foreign deposits of households in US
FM_{us}^g	Stock of foreign deposits of government in US
g	Public expenditures
GM	Dong deposits of government
GM^b	Dong deposits of government in banks
GM^{cb}	Dong deposits of government in central bank
gr_Y	Economic growth rate
H	Stock of cash
i^f	Firms' real investment
i_A^f	Firms' adaptation investment
i^g	Public real investment
i_A^g	Public adaptation investment
i^h	Households' real investment
i_A^h	Households' adaptation investment
i_A	Adaptation investment
i_{12}	Changes in inventories
ic	Real intermediate consumption
im	Real imports
IMP_{PTN}	Imports of main partners
k^f	Real stock of non-financial assets of firms
k_A^f	Real stock of adaptation capital of firms

k^g	Real stock of non-financial assets of government
k_A^g	Real stock of adaptation capital of government
k^h	Real stock of non-financial assets of households
k_A^h	Real stock of adaptation capital of households
k_{12}	Stock of inventories
L^f	Firms' debt
L^h	Households' debt
LB^{cb}	Stock of advances
MB^{cb}	Required bank's reserves
$MIGRANT$	Stock of international migrants
$MORT_{GR}$	Mortality growth rate
NBW	Number of workers
NBW^f	Number of workers employed by firms
NE	Employment
NFC^b	Net financing capacity of banks
NFC^f	Net financing capacity of firms
NFC^g	Net financing capacity of government
NFC^h	Net financing capacity of households
NFC^r	Net financing capacity of ROW
NW^b	Net wealth of banks
NW^f	Net wealth of firms
NW^g	Net wealth of government
NW^h	Net wealth of households
NW^r	Net wealth of ROW
NW^{cb}	Net wealth of central bank
OTA^b	Other financial assets of banks
OTA^f	Other financial assets of firms
OTA^g	Other financial assets of government
OTA^h	Other financial assets of households
OTA^r	Other financial assets of ROW
OTA^{cb}	Other financial assets of central bank
p^*_{IM}	World price of imports
p_E	Price of equity

p_X^*	World price of exports
p_{FDI}	Price of FDI
p_C	Price of consumption
p_G	Price of public expenditures
p_{IM}	Price of imports
p_{INV}	Price of inventories
p_K	Price of capital
p_Q	Price of output
p_X	Price of exports
p_Y	GDP deflator
pop	Stock of population
pop_{ACTIV}	Stock of active population
pop_{gr}	Population growth rate
q	Real output
q_{AGR}	Real output of agriculture
q_{ENER}	Real output of energy
r_l^{us}	FED's interest rate
r_b	Rate of return of bonds
r_{fl}	Interest rate of foreign loans
r_{fm}	Interest rate of foreign deposits
r_l	Lending rate
r_l^{cb}	Interest rate of advances
r_m	Deposit rate
RES	Stock of international reserves in VND
RES_{us}	Stock of international reserves in US
SOC	Social contributions
TOP	Taxes on production
TR_p^r	Remittances
u	Unemployment rate
ULC	Unit labor cost
VA	Nominal value-added
va	Real value-added
VA^b	Nominal value-added of banks

va_s^d	Expected value-added by demand
va_s^e	Supply constraint
VA^f	Nominal value-added of firms
VA^g	Nominal value-added of government
VA^h	Nominal value-added of households
w	Wage rate
WB	Wage bills
WB^f	Wage paid by firms
WB^r	Wage received from ROW
x	Real exports
xr	Exchange rate
y	Real GDP
Y^*	World GDP
y^*	Potential GDP
YD^h	Households' disposable income
YP^b	Banks' disposable income
YP^f	Firms' disposable income
YP^g	Government's disposable income
YP^h	Households' disposable income

General introduction

Motivation, research objectives and contributions

Globalisation, defined as the integration of an economy into the world through trade and financial flows, offers great opportunities for developing countries to grow faster and reduce poverty (Dollar and Kraay, 2004; Prasad et al., 2003). Developing countries as a whole have increased their share of world trade. It has risen from 36.8% in 2010 to 39.7% in 2013 but has stagnated ever since, increasing only slightly to 40.1% in 2021 (UNCTAD, 2021b). At the same time, capital flows to developing countries increased significantly during these last years. Foreign direct investment (FDI) has become the most important category. The share of developing countries in global FDI flows remained just above 50%. It contributes to transforming several countries from poor countries to middle-income countries. However, the crises in the emerging markets in the 1990s have made it quite evident that the opportunities of globalisation do not come without risks and issues (IMF, 2000). It includes the risks of macroeconomic instability and environmental degradation.

Because globalisation and the related global conditions might influence economic outcomes, the current account deficit problem is one of the major macroeconomic problems in developing countries. The current account balance represents the gap between savings and investment. When a country runs a current account deficit, the saving is less than the investment. It also implies a negative transfer of financial wealth across borders. The current account deficit raises an essential question about its financing. A current account deficit corresponds to foreign capital inflows, increasing a country's vulnerability to heightened risk and uncertainty/financial stability ("sudden stop"). Forbes, Hjortsoe, and Nenova (2016) highlight two important financial factors: income on international investments and changes in the valuations of those investments. They show how the size of the country's international investment portfolio, its currency denomination, its split between equity and debt, and its return characteristic – affect the dynamics of these financial factors.

On the other side, climate change is one of the global challenges of our time. Developing countries naturally situated in lower latitudes, with higher demographic growth, lower levels of development and resilience, and lower institutional quality, are much more vulnerable to climate change than the developed world. The OECD (2015) reports that Asian countries

will be the most affected regions in the world in the next 50 years due to the economic effects of climate change. The [IMF \(2020\)](#) reports that emerging and developing economies suffered almost twice as much average damage relative to the size of their economies during the period 1980-2018. The high level of vulnerability of developing economies will limit the ability to achieve long-term development goals and require adaptation measures. Therefore, building adaptation and resilience to climate risks are central components of any sustainable development strategy. Adapting to a warmer world certainly increases the financing needs of developing countries.

Viet Nam, one of the most open to the world and also among the most vulnerable to the climate change, aptly illustrates this background and offers an appropriate "research laboratory". The country has achieved remarkable economic development successes since the reform in 1986. Viet Nam witnessed an average of 6-7% annual growth rate and became a lower-middle-income country in 2010. These successes have contributed to the efforts in hunger and poverty reduction throughout the country. Behind this successful story, international trade has been considered one of the key drivers. The average exports and imports in % of GDP over the period 1990-2019 are respectively 61.5% and 66.6% for exports and imports. In 2019 before the COVID-19 pandemic, trade in merchandise reached 210% of GDP. In addition, exports and imports grew at an average rate of respectively 4.3% and 3.4% per year. On the financial side, since its integration in the early 1990s, Viet Nam has become an increasingly attractive destination for FDI. According to the [UNCTAD \(2021b\)](#), Viet Nam was ranked in the top 20 host economies by the amount of FDI inflows. However, participation in globalisation has also increased interdependence among countries, increasing Viet Nam's economic vulnerability in the context of rising trade tensions and volatility and weaker macroeconomic resilience to potential external shocks ([Mania, Rieber, and Tran, 2022](#)). In addition, with a lack of sustainable resource management, industrialisation and globalisation have consequently led to severe resource depletion and serious environmental damage.

Viet Nam was ranked 99 out of 182 by the Notre Dame Global Adaptation Initiative (ND-GAIN) in 2019 and 13th among 180 countries by the Germanwatch Global Climate Risk Index for 2000–2019. Climate change, therefore, sets out major challenges for this country, and the government is putting climate change and sustainable development at the heart of development policies such as the National climate change strategy and Green Growth Strategy.

In this context, it is crucial to have a comprehensive macroeconomic analysis and simulation tool for policy-making decisions to contribute to the economic growth strategy and the macroeconomic stability of Viet Nam in a warmer world. Vietnamese government institutions, research institutes and universities are using different types of macroeconomic models for modelling the economy and forecasting as well as policy analysis. It consists of input-output models, regression-based econometric models, time series models and Computable General Equilibrium (CGE) - an accounting-based macroeconomic modelling approach. However, overall, there needs to be more attention paid to the financial sector/system in these modelling frameworks. Nowadays, the behaviour of the real sector of the economy cannot be understood without linking it with the financial sector (Nikiforos and Zezza, 2017). The financial sector plays an increasing role in the economy. It promotes economic growth by mobilising resources for economic activities. To a certain extent, SFC modelling will overcome this missing part of the economy "picture". Besides integrating all sectors, representing the economy as a whole through the principles between stocks and flows, the SFC approach provides a monetary and financial framework. It makes it possible to combine the impact of global warming with the dynamics of capital, private and public debts.

Hence, the ultimate goal of this thesis is to understand the macroeconomic interactions of different sectors in the Vietnamese economy under globalisation and, thereby, to build an empirical SFC model intended for scenario analysis and policy simulations. To the best of our knowledge, we are the first to develop an empirical SFC model of the Vietnamese economy (*SFCVN model*, henceforth). It would expand the literature on empirically grounded SFC macro-modelling. The model also serves as a useful tool for policymakers in policy designing by examining the potential effects of public policy.

Thesis outline

To achieve this goal, the thesis comprises six chapters that link to each other (Chart 1).

After this introductory chapter, Chapter 1 describes the main macroeconomic features of the Vietnamese economy, which allow us to better understand observed dynamic behaviours in both the real economy and the financial sectors. We believe it is essential to overview the context within which all studies are carried out later. Then, Chapter 2 is devoted to providing the core literature for the thesis relating to the SFC modelling. These two main pillars enable to build of the SFCVN model. Given that the SFC model is a family of macroeconomic models

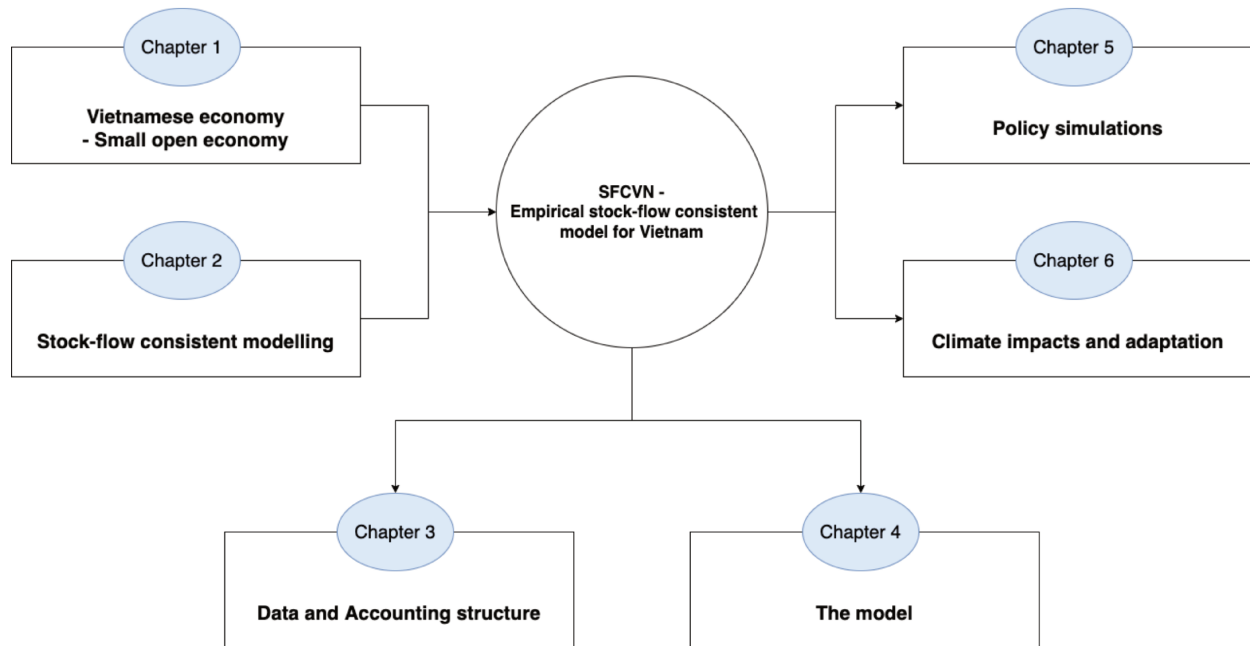


Chart 1: General thesis structure

based on a rigorous accounting framework, Chapter 3 explains how to build the accounting structure and dataset used in our model. Based on it, Chapter 4 will present the development of the SFCVN model.

Given that the goal of our work is to develop a model intended for scenario analysis and policy simulations, we will perform the application of the model to address the two major challenges of Viet Nam's economy: policy responses to coping with COVID-19 (Chapter 5) and climate change impacts and adaptation (Chapter 6). Finally, we are aware that developing this empirical SFC model is time-consuming, and several important limitations are related to the data and estimations. However, we can exploit/adapt/improve the model in different research subjects once the model is built. There are several areas where the analyses based on the model could be expanded, taking into account the different economic and social development objectives in Viet Nam. Thus, General conclusion will provide some ideas for further research.

Chapter 1 - Macrodynamics of the Vietnamese economy

Globalisation has opened up opportunities for developing countries to engage in global markets, including Viet Nam. Comprehensive macroeconomic analysis, taking into account different components and interactions within the economic system, is crucial for the policy-making decision to contribute to the country's economic growth and macroeconomic stability. Post-Keynesian research has extensively focused on understanding macroeconomic relationships and growth drivers using demand-led macroeconomic regimes. Moreover, understanding macroeconomic policies is also fundamental to know about the dynamics of the economy. Using the concept of demand and growth regimes and macroeconomic policy regimes with the data from 1996 to 2019, we aim to describe the main features and macroeconomic dynamics of the Vietnamese economy since the crucial reform in 1986. As we can learn for the future from what happened in the past, our analysis is a good starting point for the development and simulation of our SFCVN model.

Chapter 2 - Stock-flow consistent modelling literature

This chapter introduces the SFC modelling methodology and reviews the current literature. There were already four survey papers on the SFC literature. Here, in this chapter, we aim to update these surveys in the context of the growing number of contributions adopting the SFC approach. On the one hand, it reviews some of the literature on theoretical and empirical SFC models. On the other hand, it allows us to understand how to step-by-step develop an empirical SFC model for a whole country. It consists firstly of working with real data and coping with several issues to construct the model's accounting structure adopting the SNA 2008. Secondly, the structure of the model will be designed with respect to SFC principles. Lastly, the closures of the model and behavioural specifications must comply with the theoretical meaningfulness (economic theory) and take into account the structural characteristics of the Vietnamese economy.

Chapter 3 - Data and accounting structure

The first step of developing an empirical SFC model is constructing the balance sheet and flow matrix. For most countries whose data are available, the balance sheet data are published in the financial accounts of institutional sectors. To the best of our knowledge, there are not yet either institutional sector stock accounts or estimations of national wealth for the Vietnamese economy. Regarding the transaction flows data, a social accounting matrix (SAM) allows to

capture of products and monetary (incomes and expenditures) flows of an economy in a year and respect the accounting consistency. However, the details of financial institutions and transactions of agents' assets and liabilities were not developed in these SAMs. Therefore, we decide to rely on the international guidelines of system national accounting (SNA 2008) and collect the data from different sources to build the balance sheet and transaction flow matrix. We explain how to address the accounting consistency issue that has come up when combining different data sources. Our completed accounting structure sheds light on several dynamics of the Vietnamese economy, which allows us to have a better understanding of the economy.

Chapter 4 - SFCVN - An empirical stock-flow consistent model for Viet Nam

This chapter presents the SFCVN model. The aim of this model is twofold. First, the model provides a theory-consistent representation of the general structure of the country's economy. Second, it offers policy simulation/scenario analysis capabilities to meet the needs of policymakers. It constitutes a means of evaluating the impact/feedback effects of different policies or shocks on the Vietnamese economy. In order to achieve these objectives, the model has to be able to capture the interrelationships between the real and financial sectors of the economy.

The model contains six institutional sectors: firms, central bank, commercial banks, government, households and the rest of the world. Accounting consistencies allow us to see how the sector's decisions in the real economy will affect their assets/liabilities and how the changes in their balance sheet will provide feedbacks on their choices above. Building upon economic theory but also a data-driven approach, the estimations of behavioural equations will be presented in detail. We simulate the model to examine its performance in fitting with the past data. Overall, the model replicates quite well the historical data.

Chapter 5 - Policy responses and model simulation

This chapter is a first attempt to assess the country's ability to conduct macroeconomic policies and to face global external shocks such as the COVID-19 pandemic, given its deep integration into the global economy. To do this, we present some simulation exercises aimed at examining the potential impacts of policy shocks on Vietnamese macroeconomic variables. It consists of three distinct shocks (fiscal, monetary and foreign shocks). Then, in the second part of this chapter, it develops an application of the model to perform a detailed analysis of the government policy responses to the COVID-19 pandemic, which combines simultaneously

monetary and fiscal policies.

Vietnam was deeply affected by the COVID-19 pandemic and faced unprecedented challenges. To attenuate the negative impact of the COVID-19 pandemic on businesses and households and promote the economic recovery post-COVID-19, the government took several measures. The targeted discretionary fiscal stimulus supported the healthcare sector and affected workers. Companies received support from the government through tax breaks, delayed tax payments, and reductions in land lease fees. The State Bank of Vietnam (SBV) took monetary policies to ease liquidity and financing conditions for households, businesses, and commercial banks, which will assume the provided credit to the economy. Given that the COVID-19 stimulus package financing mainly comes from the government's debt in the short term, it raises the crucial question of public debt sustainability. Hence, this chapter aims to analyse the different consequences of this public intervention on both the real and financial sides of the economy using our SFCVN model.

Chapter 6 - Macroeconomic impacts of climate change

With a long coastal line and abundant geological and natural diversity, Viet Nam has emerged as one of the most vulnerable countries to climate change in the Asia-Pacific region. Climate change has deeply impacted different economic sectors, including cereal production, fishing, and electricity from hydropower. The Vietnamese economy also is exposed to the transversal impact of climate change on labour and capital, which are production factors. Climate change, therefore, sets out major challenges for the country, and the Vietnamese government is putting climate change, climate adaptation and sustainable development at the heart of its development policy. Thus, assessing climate change impacts and adaptation is crucial for policy planning at the macroeconomic level.

This chapter aims to develop an integrated prospective economy-wide assessment to analyse the economic impacts of climate change and adaptation measures in the context of a greener industrialisation process for Viet Nam. It consists of three main steps: apply a monetary valuation to each damage; then, develop damage functions which represent losses in each sector represented as conditional on Viet Nam mean surface temperature (VNMST) change and finally, integrate into the SFCVN model, in order to assess the intersectoral and aggregate effects. In order to examine the economy-wide impacts of adaptation investments, we integrate adaptation which is produced via an adaptation capital stock.

Recently, SFC models have been used to investigate ecological macroeconomic issues. The PhD thesis is integrated into the research project GEMMES Viet Nam of the French Development Agency (AFD) and Viet Nam's Ministry of Natural Resources and Environment (MONRE). It is part of the GEMMES project launched by AFD, which aims to develop a new macroeconomic modelling tool. Within its scenarios, it will allow incorporating of financial and monetary risks and their interaction with the impact of global warming. Thus, it is an especially suitable tool for the country's political decision-making.

CHAPTER 1

Macrodynamics of the Vietnamese economy

1.1 Introduction

Over the last three decades, Viet Nam, a small open economy with significant trade and FDI contributions to economic growth, has emerged as one of Asia's great success stories. At the 6th National Congress of the Communist Party of Viet Nam in December 1986, the government abandoned the central planning model to adopt the socialist-oriented market economy. Since then, Viet Nam has witnessed remarkable economic growth. The country became a lower-middle-income country in 2010. In recent years, integration into the world economy and financialisation have contributed to Vietnamese economic outcomes. However, it has also increased interdependence among countries, increasing Viet Nam's economic vulnerability in the context of rising trade tensions and complexity of financial transactions and weaker macroeconomic resilience to potential external shocks.

Comprehensive macroeconomic analysis is crucial for policy-making decisions to contribute to a country's economic growth and macroeconomic stability. Post-Keynesian economics (PKE), one economic thought school of heterodox economics, focus on macroeconomics. Post-Keynesian research has extensively focused on understanding macroeconomic relationships and growth drivers using demand-led macroeconomic regimes. PKE argue that effective demand is the key determinant of economic performance. In the context of globalisation, the Post-Keynesian approach allows analysing the interaction between domestic and external demands of the economy. Finance is also one of the essential features considered in PKE with the analysis of the balance sheet of institutional sectors and financial flows in the economy. Understanding macroeconomic policies is fundamental to understanding the macrodynamics of the economy. The post-Keynesian notion of macroeconomic policy regimes includes monetary policy, fiscal policy, wage policy and foreign economic policy. It allows us to analyse how the country-specific macroeconomic policy regimes supported the shift (or non-shift) of macroeconomic regimes.

The main objective of this chapter is to analyse the main features and macroeconomic dynamics of the Vietnamese economy since the crucial reform in 1986 by using the PKE

concept of demand and growth regimes and macroeconomic policy regimes. Given that the Vietnamese economy is the context within which all studies constituting this thesis are carried out, our analysis is a good starting point for developing the SFCVN model. This chapter also contributes to the literature on the macroeconomic analysis of developing countries with a post-Keynesian approach.

Our analysis proceeds as follows. Section 1.2 gives a "snapshot" of the Vietnamese economic performance. Section 1.3 assesses the demand and growth regimes by looking at the growth contributions of the main demand aggregates to GDP growth and sectoral financial balances of the institutional sectors. Section 1.4 examines the macroeconomic policy regimes in the context of important globalisation and financialisation. Finally, Section 1.5 concludes this chapter.

1.2 Viet Nam's macroeconomic performance

Macroeconomic indicators can capture the macroeconomic performance of a country. [Crockett and Goldstein \(1987\)](#) distinguished three types of economic indicators:

- i) Indicators of economic performance cover the more fundamental objectives of economic policy: economic growth, employment, the balance of payments and price stability.
- ii) Indicators of economic policy (monetary and fiscal) consist of control variables by the government and authorities, such as monetary growth, exchange market intervention, and fiscal deficit.
- iii) Indicators of intermediate variables are indirect policy channel transmission (interest rate and exchange rate). They can influence the saving and investment decision of agents.

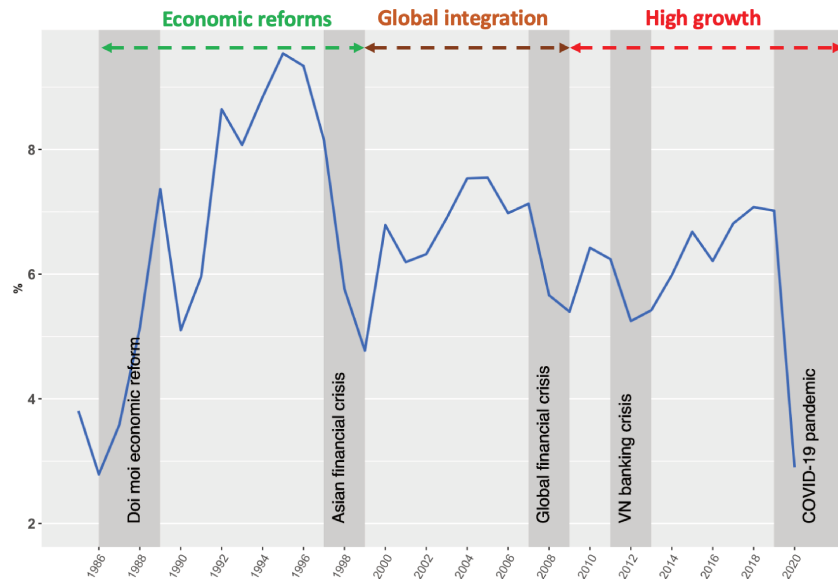
In addition, according to the New Developmentalism approach ([Bresser-Pereira, 2020](#)), which is a theoretical framework for understanding middle-income countries, to understand how the economy grows with price and financial stability, we will also focus on two main macroeconomic accounts (the fiscal and the current accounts) and five macroeconomic prices (the profit rate, the interest rate, the wage rate, the inflation rate and the exchange rate). Especially the exchange rate is a strategic variable in the process of growth. The New Developmentalism demonstrates that the exchange rate in developing countries is volatile and behaves according to an exchange rate cycle: it remains overvalued for several years between financial crises.

In this section, although the distinction between the three types of indicators above can sometimes be blurred, we will analyse the Vietnamese macroeconomic performance based on these three types of indicators. Our analysis placed in the historical context will help us understand the different macrodynamics of the economy.

1.2.1 Economic performance

GDP growth rate

Viet Nam's economic development process can be divided into three main periods. The first is the period 1986-1999 associated with the Doi Moi economic reforms. The second period is from 2000 to 2009, with a rapid global integration. The last one is from 2010, with high economic growth.



Source: General Statistics Office (GSO)

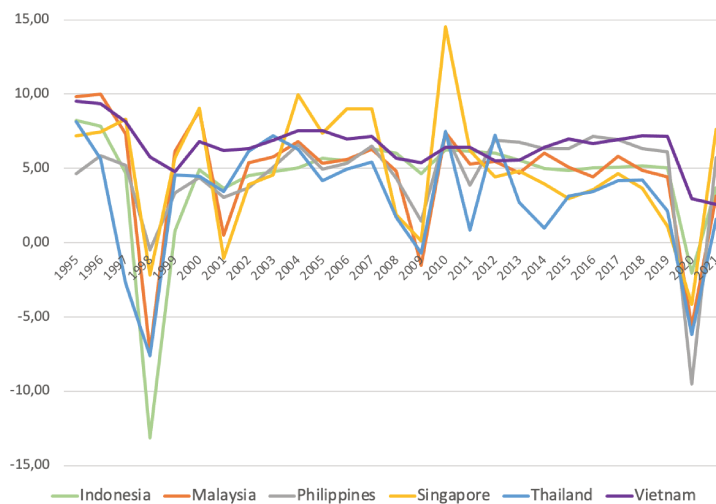
Figure 1.1: GDP growth rate, %

The “Doi moi” economic reforms in 1986 brought a remarkable development record for the Vietnamese economy, with a growth rate of 2.7% in 1986 to 7.3% in 1989. Viet Nam began actively opening up to the world and integrating into global trade. Viet Nam joined ASEAN (Association of Southeast Asian Nations) in 1995 and APEC (Asia Pacific Economic Cooperation) in 1997. Various free trade agreements were signed between Viet Nam and different countries worldwide. In 2000, the government signed a bilateral trade agreement

with the US. In 2007, Viet Nam became a member of the World Trade Organisation (WTO).

Further agreements followed with China, India, Japan, South Korea, Trans-Pacific Partnership and Europe. Viet Nam has pursued an export-oriented industrialisation strategy to attract FDI. After the great fall due to the Asian financial crisis in 1997, the average growth rate of the Vietnamese economy was 6-7% per year (Figure 1.1). Despite a fall in GDP growth rate during the global financial crisis in 2008 and the banking crisis in 2011-2012, the Vietnamese economy has quickly recovered since 2014-2015. Despite the COVID-19 pandemic, the economic growth still was positive at 2.9% in 2020.

Compared to other Southeast Asian countries, Figure 1.2 shows the annual economic growth rate of the six ASEAN countries from 1995 to 2021. In general, Viet Nam experienced a higher average annual economic growth than Indonesia, Malaysia, the Philippines, and Thailand over the study period and Singapore since 2011. Nevertheless, all six countries were affected by the Asian financial crisis of 1997–1998, the global financial crisis of 2008–2009 and the pandemic of 2020-2021.



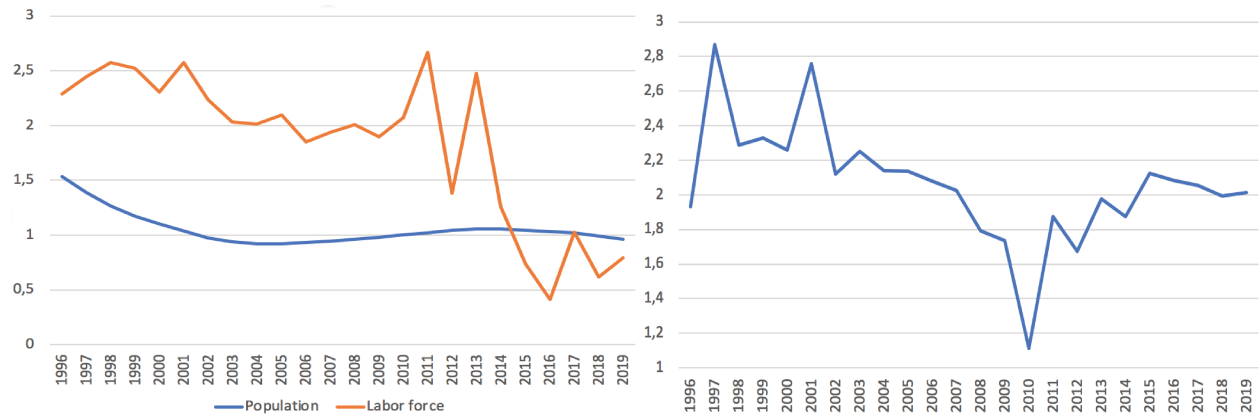
Source: World Bank

Figure 1.2: GDP growth rate of six ASEAN countries, %

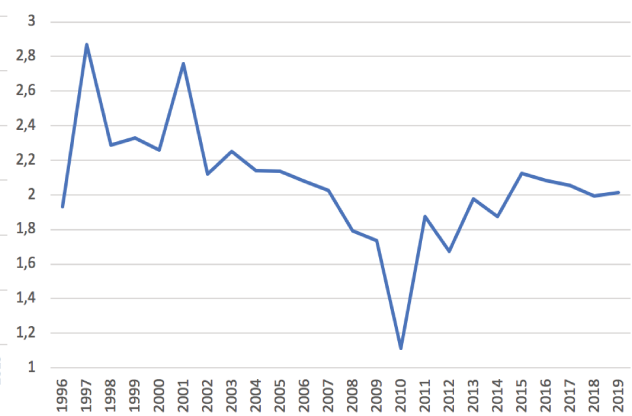
Regarding GDP per capita, in the 1980s, the GDP per capita was stuck at 200 - 300USD; the rapid economic development transformed Viet Nam from one of the poorest nations in the world to a lower middle-income country in 2010. The real GDP per capita reached around 3700 USD in 2021. The Communist Party aims for Viet Nam to achieve a GDP per capita of 5000 USD by 2025 and be a developed country by 2045.

Unemployment

One of the macroeconomic objectives is to keep the unemployment rate low. Viet Nam has succeeded in keeping the unemployment rate stable and at such a moderate level. The unemployment rate has remained less than 3% despite some slight rise in the crisis period (Figure 1.4). High economic growth will increase job opportunities. Indeed, Viet Nam has experienced rapid demographic growth (Figure 1.3). The population reached around 90 million in 2019. The growth of the workforce in Viet Nam was, on average, 2.37% (Figure 1.3). The middle class accounts for approximately 13% of the total population. It is considered a favourable factor for economic growth.



Source: GSO, World Bank



Source: GSO

Figure 1.3: Population vs Labor force growth, % Figure 1.4: Unemployment, % total labor force

Like in other developing countries, the unemployment rate in Viet Nam is not the best indicator of market clearing (Cling, Razafindrakoto, and Roubaud, 2011). The labour market is clearing through qualitative adjustments. It will justify our modelling specifications of the labour market in the SFCVN model later.

Inflation

Price stability (inflation) is one of the important stability macroeconomic indicators (Tobin, 1965; Friedman, 1977; Fischer, 1993). Consumer price index (CPI) and GDP deflator are two measures of inflation in Viet Nam. There are two main differences between CPI and GDP deflator. Firstly, CPI measures the prices of purchases by consumers only. However, the GDP deflator measures the prices of purchases by consumers, the government, and businesses. Secondly, in the calcul of GDP, we use the net exports, i.e. exports minus imports. Therefore, the GDP deflator measures the prices of domestic expenditures only. On the contrary, CPI

measures the price level of expenditures, including domestic and imported goods and services. CPI reflects the change in the price level of a basket of selected representative consumer goods and services. This basket consists of popular goods and services that represent the Vietnamese population's consumption and are revised and updated every five years to conform with the population's consumption structure in each specific period. The CPI and GDP deflator mostly fluctuate in the same direction (Figure 1.5). Since the GDP deflator is a measure of the overall change in prices of the domestic economy, we use this as the domestic price in the SFCVN model in Chapter 4.

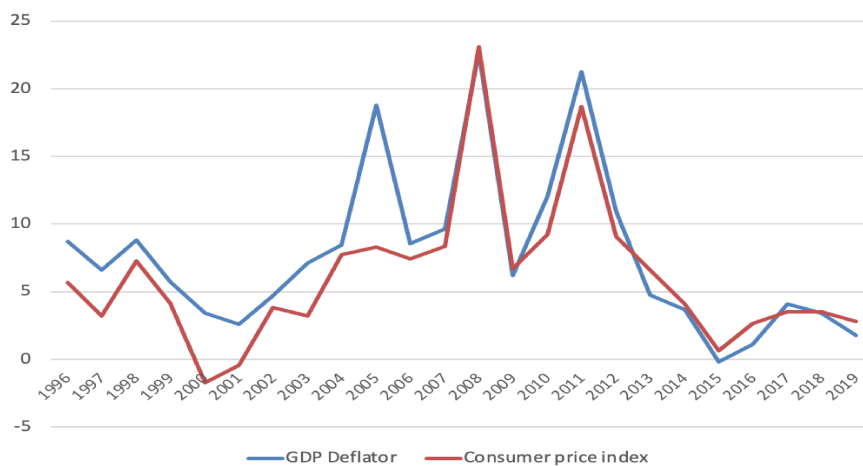


Figure 1.5: Inflation, %

Figure 1.5 shows the evolution of the inflation rate with both measures given by the rate of change in the GDP deflator and that of the CPI. The tight monetary and fiscal policy reduced inflation and kept it stable in the early 1990s (Bhattacharya, 2014). The key determinant of the high inflation in 1997-1998 was the Asian crisis. Then, the period before 2001 witnessed a low level of inflation. The decline in aggregate demand could explain it. Then, inflation began to increase sharply in 2001 with the rise in nominal wages in 2004 and supply shocks then fluctuated during the following years. The inflation peaked at 23% in 2008 due to the huge capital inflows after the adhesion to WTO, the boom in the banking sector and the rising of minimal wages. Viet Nam faced the "impossible trinity" problem (Mundell, 1963), which indicates that we cannot achieve at the same time three objectives: (i) a fixed exchange rate regime, (ii) the independence of monetary policy and (iii) free capital flows.

As a result of the global financial crisis in 2008, inflation decreased considerably in 2009 with the decline of international prices and aggregate demand. However, after this period, inflation

rose again and reached another peak in 2011. Indeed, the increase in the global price of several imported food commodities and energy impacts the domestic price level. Moreover, the devaluation of the Viet Nam dong, strong expansion in money supply, and excessive credit growth have contributed to inflation. The government's economic stimulus package in 2009, which led to a strong increase in money supply and significant domestic demand growth, is also considered one of the factors which pushed inflation. Since 2012, inflation has remained at a modest level.

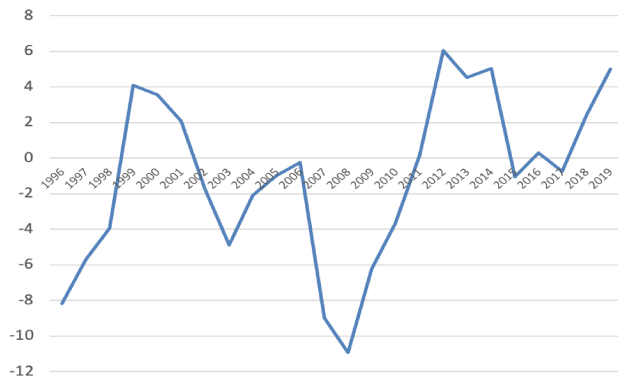
Various empirical studies aimed to explain the determinants of inflation in Viet Nam. They incorporate both cost-push and demand-pull factors, which include money factors, interest rates, exchange rates, international oil prices, and wages. [Nguyen, Nguyen, and Hoang \(2019\)](#) found that the accumulation of foreign exchange reserves will increase inflation because the increase in foreign reserves leads to an increase in the money supply. [Le et al. \(2019\)](#) showed that the US Dollar (USD)/ Vietnam Dong (VND) exchange rate fluctuation impacts mainly the CPI and the money supply. According to [Hoang and Van \(2020\)](#), the most important macroeconomic factors for Viet Nam's inflation are money supply and credit. The increase in money supply will reduce the interest rate and, therefore, devalue the domestic currency and increase the CPI. [Tran \(2018\)](#) found that the devaluation of Dong implied higher import price, and thus the CPI. The literature provides little evidence on the domestic determinants of inflation but is extremely influenced by foreign factors.

Balance of payments

The balance of payments (BOP) divides transactions into two main accounts: the current account and the financial account. The current account includes transactions in goods, services, investment income, and current transfers. A current account imbalance can reflect the difference between national savings and investment. A deficit current account represents a lower level of saving than investment; thus, the economy's financing needs to fund domestic consumption and investment. The financial account represents the financial side of the current account. It includes transactions in financial instruments and central bank reserves.

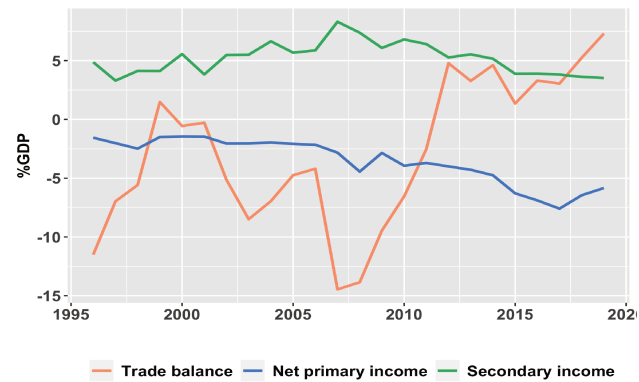
Viet Nam experienced a high gap between aggregate investment and gross national savings along the country's regional and global economic integration, especially during the Asian and global financial crises ([Figure 1.6](#)). The average difference was around 9.7% between 1996 and 2010 but fell significantly. Before 2005-2006, Viet Nam registered a negative current

account, mainly driven by a trade balance deficit. The high domestic demand was satisfied by imports. Moreover, the global financial crisis of 2007-2008 caused a reduction in world demand, decreased Vietnamese exports, and led to a bigger trade deficit. However, since 2012, the current account has become positive, which resulted from a trade balance and a secondary income surplus, offsetting the deficit in the primary income balance.



Source: World Bank

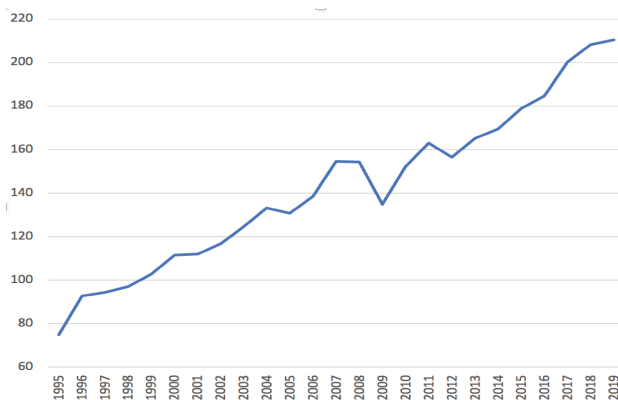
Figure 1.6: Current account balance, % GDP



Source: Balance of Payments, IFS

Figure 1.7: Current account, % GDP

The main determinant of the current account is the trade balance (Figure 1.7). In 2006, Viet Nam officially completed WTO accession culminating in a long process of efforts to integrate the national economy into global markets. It had significant implications for trade. The degree of openness, defined as the sum of exports and imports to GDP, has increased significantly and reached around 210% of GDP in 2019 (Figure 1.8). Over the last two decades, average export and import growth rates were 19.7% and 18.3%, respectively (Figure 1.9).



Source: GSO

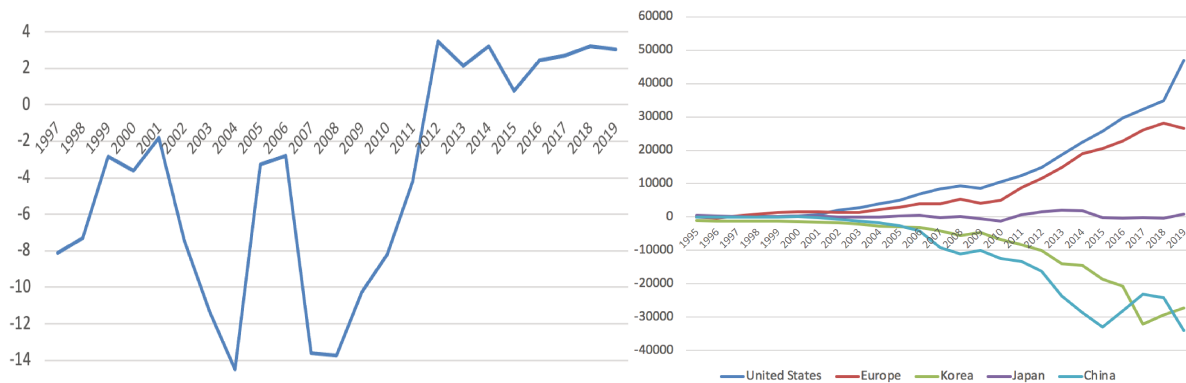
Figure 1.8: Openness, % GDP



Source: GSO

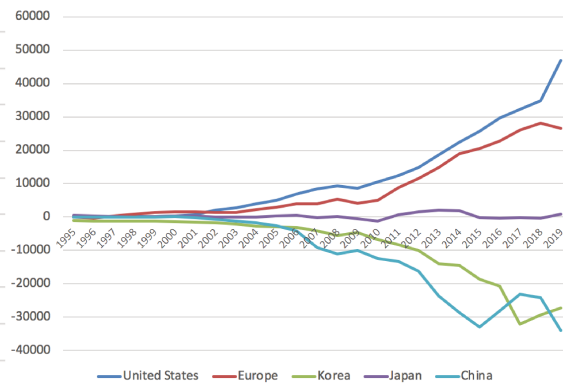
Figure 1.9: Export and import growth, %

Before 2012, Viet Nam's trade balance often tended to run a deficit. It can be explained by the demand for consumption and investment in the economy during the period of rapid growth and global integration. However, this trend has changed since 2012. Viet Nam's trade balance has maintained an average surplus of 3% GDP (Figure 1.10). The trade balance has deteriorated the most against countries pursuing export-led growth (China and South Korea) and has ameliorated against the US and Europe (Figure 1.11).



Source: GSO

Figure 1.10: Trade balance, %GDP



Source: GSO

Figure 1.11: By country, Million USD

However, a trade surplus is not necessarily favourable for long-run growth. Strong export growth was mainly in goods belonging to FDI enterprises. Figure 1.12 shows the composition of exports by type of goods. Viet Nam exports mostly heavy industrial/mineral products, light industrial and handicraft goods and agricultural/aquaculture products. However, there was a change in the composition of exports over time. The share of manufactured products increased, which might correspond to the rapid growth of FDI flows and their contribution to Vietnamese exports and the percentage of agricultural/aquaculture products decreased. Indeed, multinational companies or FDI firms have developed the production and exportation of higher value-added goods such as computers, telephones, electronics, and machinery. Regarding the determinants of export volume, [Fugazza \(2004\)](#) found that external factors refer to the demand side, such as world demand, and internal factors refer to the supply side. These factors include world demand, exchange rate, and production capacity. [Malhotra and Kumari \(2016\)](#) studied the determinants of export performance of Asian economies comprising Viet Nam from 1980 to 2012. It indicated that besides the conventional factors above, FDI inflows positively contribute to Vietnamese exports.

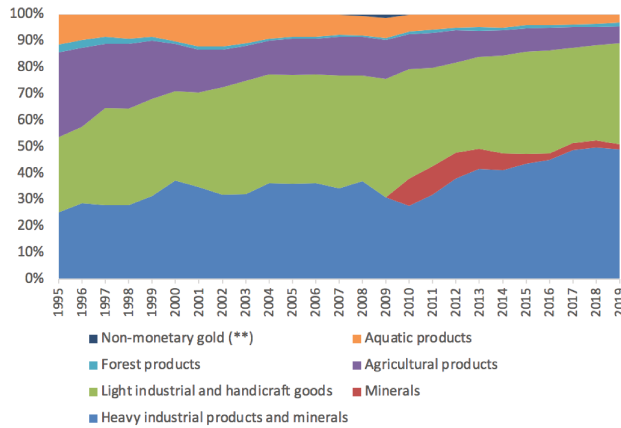


Figure 1.12: Exports by good, % total

Source: GSO

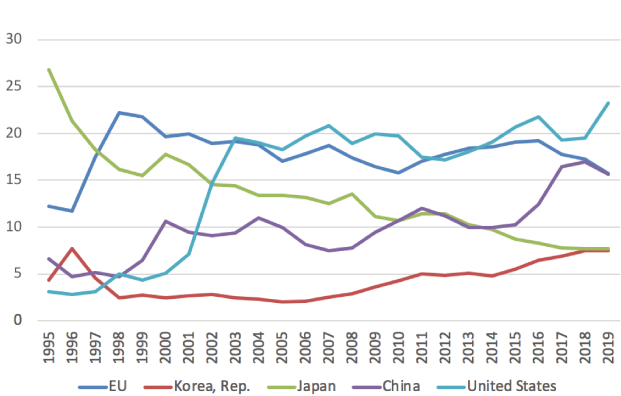


Figure 1.13: Exports by country, % total

Source: GSO

Regarding the composition of Viet Nam's trading partners, there are five main partners: the US, China, Japan, South Korea and the EU. However, their ratio in total exports changed from 1995 to 2019 (Figure 1.13). During the 1990s, Japan was the biggest export market. Then, over the last decade, the US became the biggest market, followed by China and the EU and accounted for more than respectively 23% and 16% of total exports in 2019 (Figure 1.13). Moreover, as discussed above, the part of FDI firms in total exports has dominated the domestic part since 2004 (Figure 1.15). Thus, it has increased the dependence of Viet Nam on multinational companies.

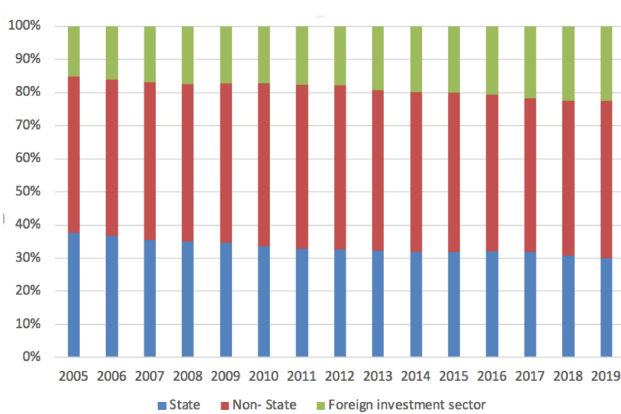


Figure 1.14: Contribution to GDP, % total

Source: GSO

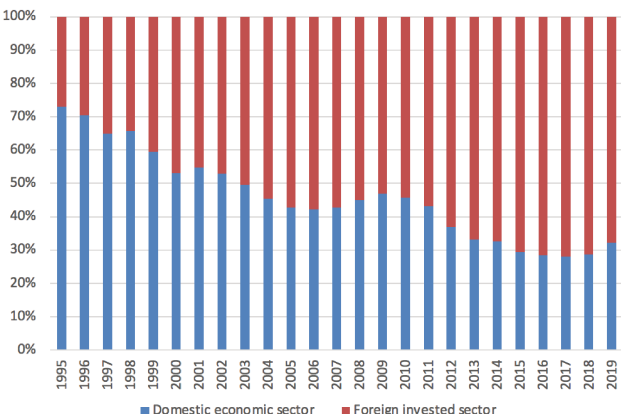
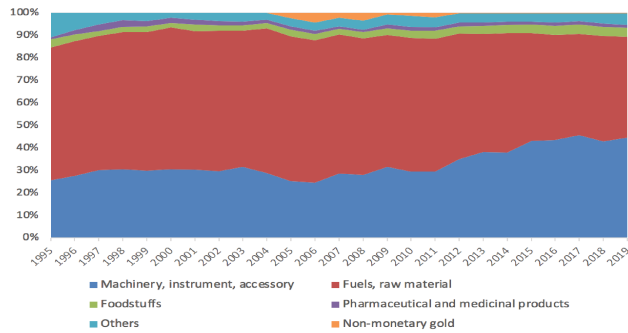


Figure 1.15: Contribution to exports, % total

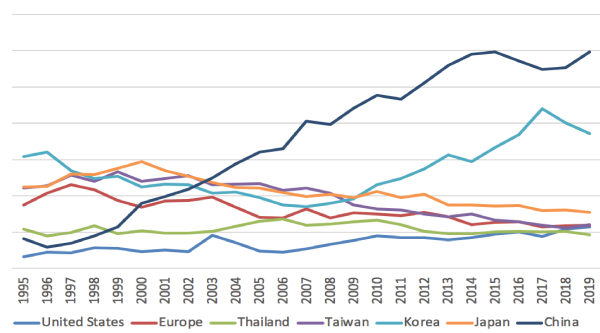
Source: GSO

Imports include both intermediate and final demand (consumption and capital goods). Figure 1.16 shows the import composition by goods. Indeed, Viet Nam has to import many machines, equipment, and accessories and produce and export apparel and footwear. Viet Nam imports mainly from China and South Korea (Figure 1.17).



Source: GSO

Figure 1.16: Imports by good, % total



Source: GSO

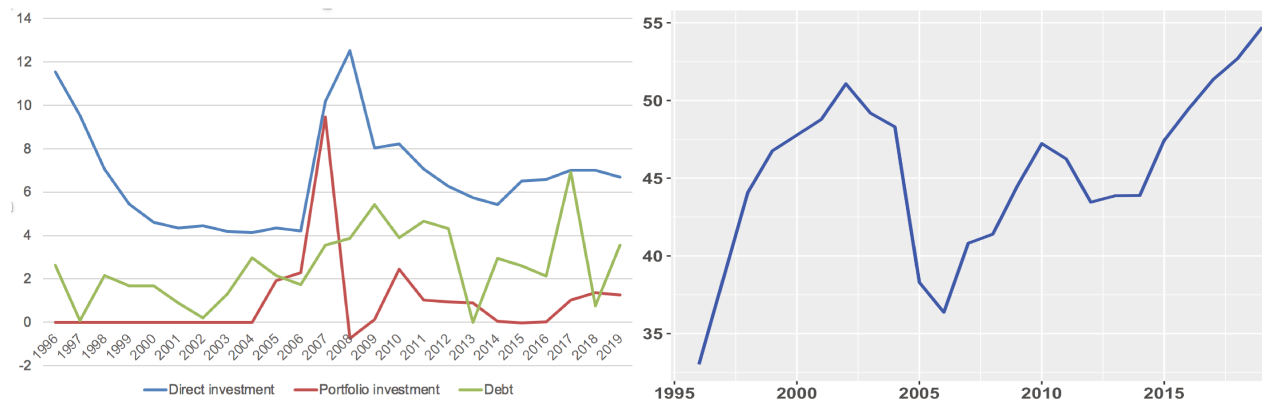
Figure 1.17: Imports by country, % total

As mentioned above, the financial account represents the financial side of the current account. According to Lane and Milesi-Ferretti (2015), financial flows, including debt, equity, FDI and other claims, can have different risks. A large deficit current account can face the important question of external debt sustainability and expose it to the risk of sudden stops. Integration into the world and regional economies enhanced Viet Nam's attractiveness for capital inflows. The country experienced massive capital inflows between 2005 and 2007; the current account deficit increased from 0.9% to 9.8% of GDP (Figure 1.6). The net capital inflows led to demand pressures and, thereby, changes in relative prices. The inflation rate remained high between 2008 and 2011. The asset price bubbles emerged during the same period, and much pressure on its currency. It implied a reduction in the stock of international reserves.

Terms of the financial account's composition include direct investment (FDI), debt and portfolio investment. The relative part of each type of capital flow can impact the external balance through the valuation effects and income flows. Figure 1.18 shows that capital flows into the country mainly are in the form of FDI, defined as an investment made by a firm or individual in one country into business interests in another country. It is distinguished from portfolio equity investment by the ownership of 10% or more of the ordinary shares or voting stocks.

Viet Nam has received FDI since the 1980s and has been considered an important factor in Vietnamese economic growth. Figure 1.19 reports the stock of FDI inward to Viet Nam. Up to 31/12/2019, Viet Nam accumulated 30943 FDI projects with total registered capital of 363,309 Billion and accounted for around 55%GDP. During 1997-2000, Viet Nam witnessed a slowdown in FDI due to the Asian financial crisis (Figure 1.18). However, FDI came back in 2001 and boomed in 2007 when Viet Nam accessed the WTO. The period 2007-2010 seems to be affected by the global recession in 2008. Then the next period of recovery and successful

economic growth has been associated with a large FDI inflow since 2011.



Source: International Financial Statistics

Source: GSO

Figure 1.18: Capital inflows, Billions USD

Figure 1.19: Stock of FDI inflows, %GDP

The level of development of the economy is one of the most important determinants of FDI. The study by Hsieh (2005) about the determinants of FDI inflows into the Southeast Asian transition economies, including Cambodia, Laos, Myanmar and Viet Nam, during the period from 1990 to 2003 showed that the lagged FDI inflows, GDP per capita, and the degree of openness are the most important determinants of FDI. Moreover, Nguyen (2006) found a two-way relationship between FDI and economic growth. FDI is considered an important factor in Vietnamese economic growth and global integration, which attracted international investors. Figure 1.14 shows the contribution of the FDI-related sector to GDP compared to other sectors of the economy from 2005 to 2019. It increased from around 15% in 2005 to more than 20% in 2019. Moreover, the foreign-invested sector also represents the main sector in the total Vietnamese exports (Figure 1.15). In 2019, it accounted for approximately 70%. The foreign-invested sector increasingly contributes to government revenues (Figure 1.20).

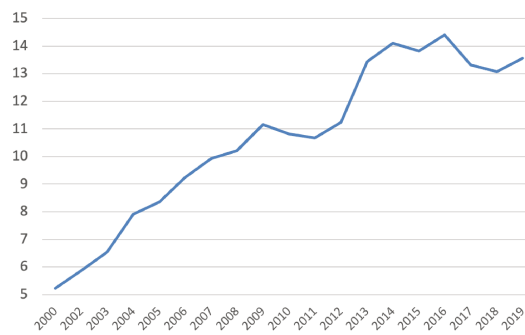
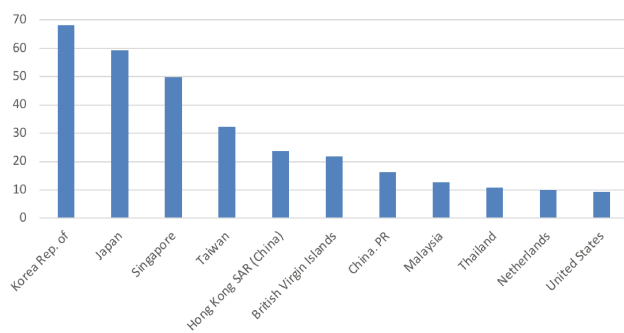


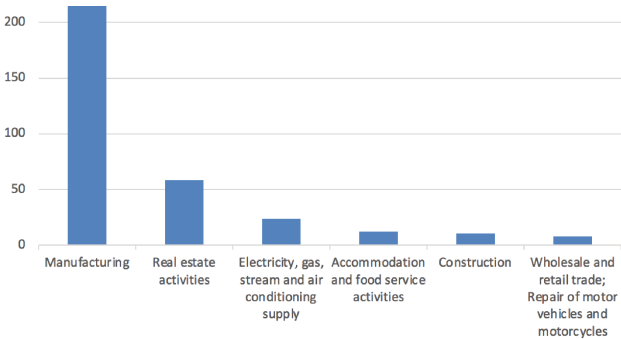
Figure 1.20: Part of FDI sector in government revenues, %total

FDI inflows mostly come from Asian countries such as South Korea, Japan, Singapore, and China (Figure 1.21). Manufacturing, real estate, electricity, and construction are the main host sectors of FDI (Figure 1.22).



Source: GSO

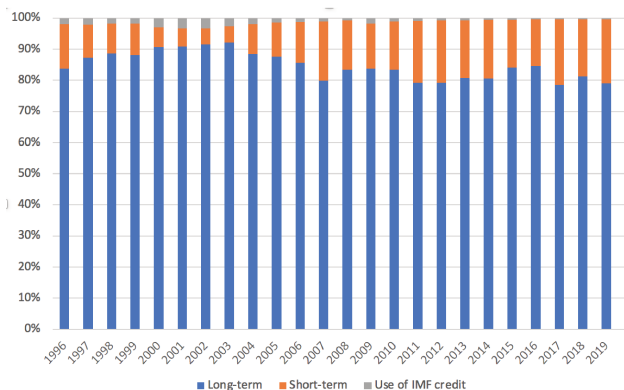
Figure 1.21: FDI by country, Billion USD



Source: GSO

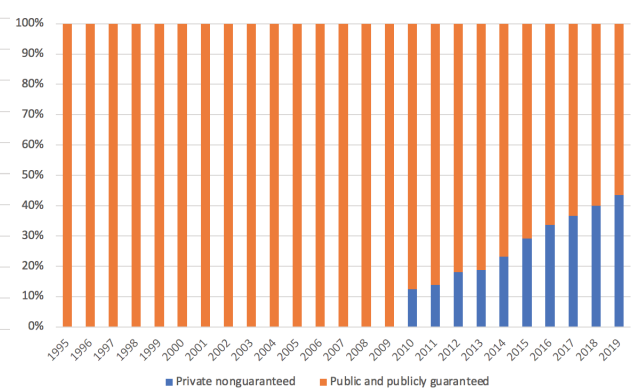
Figure 1.22: FDI by activity, Billion USD

Foreign debt is the second source of external finance for Viet Nam. It is defined as the debt repayable in foreign currencies or goods or services by both public and private sectors in the country. According to the International Monetary Fund (IMF) classification, external debt includes short-term (original maturity of one year or less) and long-term (maturity of more than one year) debt and IMF credit. Long-term debts account for more than 90% of the total debt (Figure 1.23). Among long-term debts, since 2010, private debt has increased significantly and mostly related to commercial banks and other creditors. Within public and publicly guaranteed (PPG) debt, official creditors, which include both bilateral and multilateral, are still the main creditors compared to private creditors (Figure 1.24).



Source: World Bank

Figure 1.23: External debt by maturity, %total



Source: World Bank

Figure 1.24: Long-term external debt, %total

Moreover, the share of concessional debts, including the Official Development Assistance (ODA), slowly raised when Viet Nam became a lower middle-income country in 2010. ODA

plays an important role in reducing Viet Nam's socio-economic development and poverty. The projects which received this funding are infrastructure (transportation, water supply and drainage) and social development (education and health care).

The third type of foreign capital inflows is portfolio investment. Before the global financial crisis, portfolio equity flows reached approximately 9.5 billion USD (Figure 1.18). However, it turned negative in 2008 and has remained low since 2010. This capital flow is supposed to seek short-term profits, potentially leading to market instability.

Remittances

Personal remittances from abroad constitute an important source of private capital inflows, contributing significantly to household incomes. According to The World Bank and the Global Knowledge Partnership on Migration and Development (KNOMAD), Viet Nam has been among the top ten countries receiving the biggest remittances.

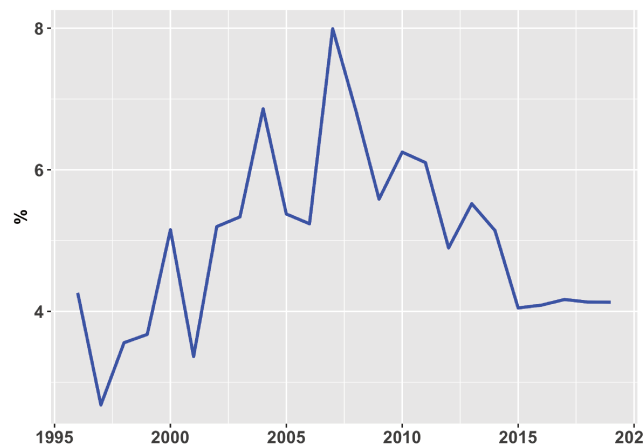
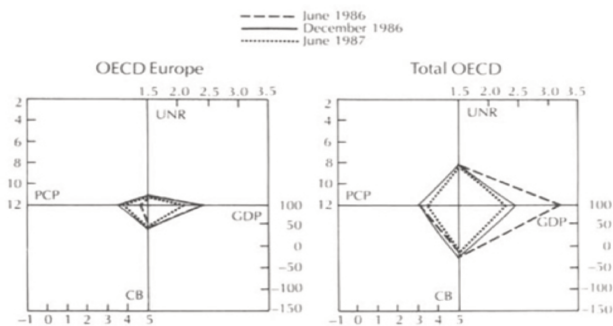


Figure 1.25: Remittances, %GDP

Figure 1.25 reports the evolution of remittances from 2000 to 2019. There was a reduction in 2008 due to the global financial crisis. It reflects that remittances might depend partly on world economic growth. However, since 2009, it has not ceased to increase and reached 18 billion USD in 2019, which corresponds to 4 % of GDP. Despite the high level of remittances, [Nguyen and Mont \(2012\)](#) found that in Viet Nam, the impact of remittances on economic development is very weak. Indeed, households spent mostly on housing investment, debt repayment or saving, not on production or current consumption.

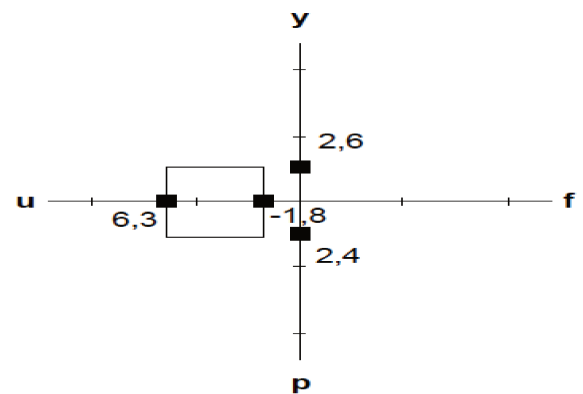
Magic diamond/square

The four indicators of economic performance (real growth, inflation, unemployment and external account) can be presented in a single diagram initiated by Kaldor (1971) called "the magic square". The magic diamond visualises these indicators using the same representation in some OECD publications. The x-axis illustrates the GDP growth rate on the right and the current price on the left. The y-axis represents the unemployment rate at the top and the current balance at the bottom (Figure 1.26). The more symmetric the "diamond", the better balanced macroeconomic performance in terms of the four objectives. Lovell, Pastor, and Turner (1995) studied the macroeconomic performance of OECD countries by using the definition of performance in terms of the ability of macroeconomic managers to provide four services to citizens (*a high level of real GDP per capita, a low rate of inflation, a low rate of unemployment and a favourable trade balance*).



Source: OECD (1987)

Figure 1.26: OECD Diamond



Source: Cherchye (1998)

Figure 1.27: Magic rectangle

Moesen and Cherchye (1998) developed a synthetic performance measure which merges the four separate indicators into one single statistic to get a global visual picture of macroeconomic performance (Figure 1.27). On the horizontal axis, it has from the origin to the right, which represents the average current account balance and from the origin to the left, which represents the average unemployment rate. Starting from the origin, the vertical axis measures upwards, representing the average real GDP, and downwards, representing the average change in the GDP deflator. The magic rectangle is obtained by drawing a perpendicular through four points. The more the rectangular is situated toward the northeast quadrant, the better the macro achievement.

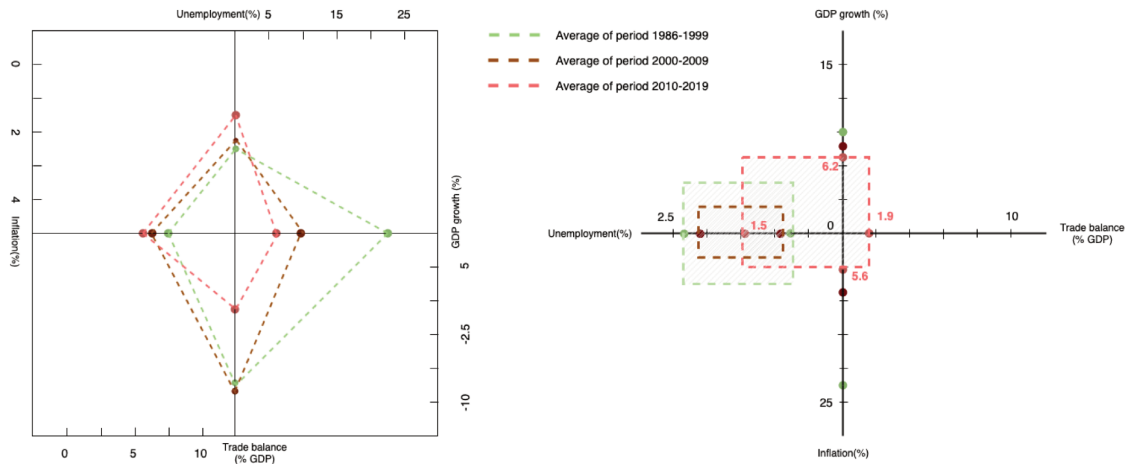


Figure 1.28: Magic diamond and rectangle of Viet Nam for different periods

Figure 1.28 shows that the Vietnamese economy experienced a better achievement based on four indicators since the *Doi moi* in 1986. Firstly, Viet Nam has recognised remarkable achievement in the GDP growth rate with an average of 6-7% annually. Secondly, the stability of the unemployment rate at a moderate level of less than 3% is a considerable accomplishment for Viet Nam. Thirdly, price stability appears to be the most substantial preoccupation of the Vietnamese government. Inflation increased sharply in the global financial crisis of 2008 and the banking crisis of 2011. Since 2012, inflation has remained at a modest level. Finally, regarding the trade balance, the country registered a deficit in trade balance before 2012. It can be explained by the fast economic growth, which domestic production has not fully satisfied. However, since 2012, the country has run a positive balance on goods and services.

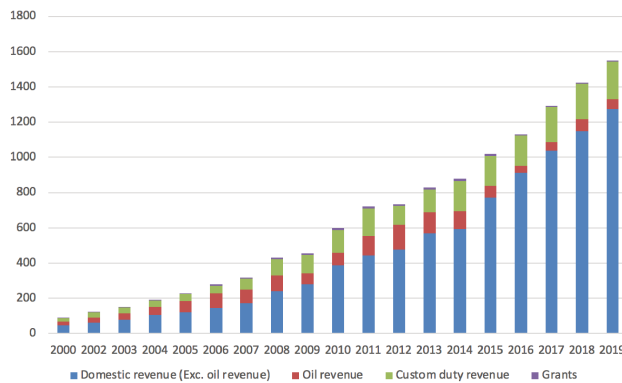
1.2.2 Economic policy

Macroeconomic policies include fiscal and monetary policies. In this subsection, we will analyse the available and relevant indicators of these two aspects while taking into account the characteristics of the Vietnamese economy.

Government and fiscal policy

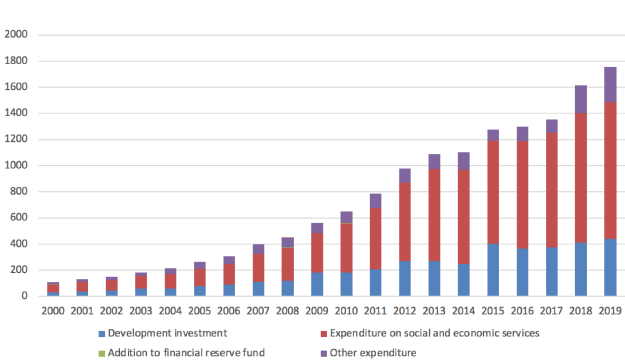
The government plays a crucial role in the country's economic development. Tax policy or government spending is a fiscal policy tool. A fiscal expansion by the government would mean taxes are decreased or government spending is increased. Either way, the result will be growth in real output because the government will stir demand with increased spending.

In the meantime, a consumer with more disposable income will be willing to buy more. On the contrary, the government can also raise taxes or lower government spending in order to conduct a fiscal contraction. This lowers real output because less government spending means less consumer disposable income. And, because more consumers' wages will go to taxes, demand will also decrease. The state revenue generally consists of domestic revenue (excluding oil revenue) and external revenue (oil revenue, custom duty revenue and grants). Domestic revenue accounts for the largest part of state budget revenue, contributing to government revenue stability. Value-added and corporate income tax are the two most important contributing sources among tax earnings.



Source: GSO, MOF

Figure 1.29: State revenues, Billion VND

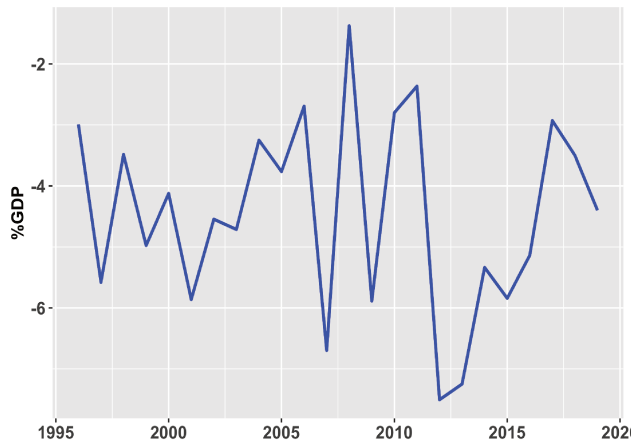


Source: GSO, MOF

Figure 1.30: State expenditures, Billion VND

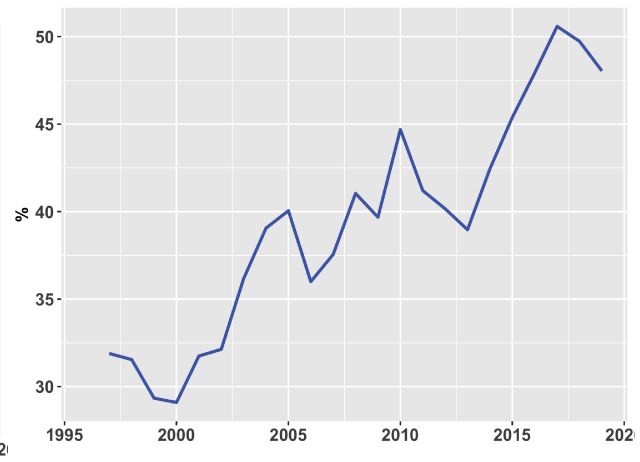
Figure 1.29 shows the evolution and composition of the Vietnamese government revenue from 2000 to 2019; the state revenue has increased by an average of 17% per year. However, the Vietnamese government, adopting the expansionary countercyclical fiscal policy due to slowing economic growth in recent years, leads to a lower tax and tariff rate, then reduces the state revenue. The personal income tax is increasing, but their part in total is still moderate due to difficulties in tracking personal earnings of the private sector, and the informal sector remains important. From 2008 to the present, oil revenue has decreased due to the lower oil price and stagnant crude oil production.

The government's expenditure grew annually by roughly 17% from 2000 to 2019 (Figure 1.30). We distinguish between development investment, current spending, addition to financial reserves fund and other expenditures. Public investment accounts for 27% of total spending on average but has decreased these last years. Current expenditure, which includes social and economic activities (education, health, society, welfare...) and administration, remains the most significant part of total public spending.



Source: State Budget

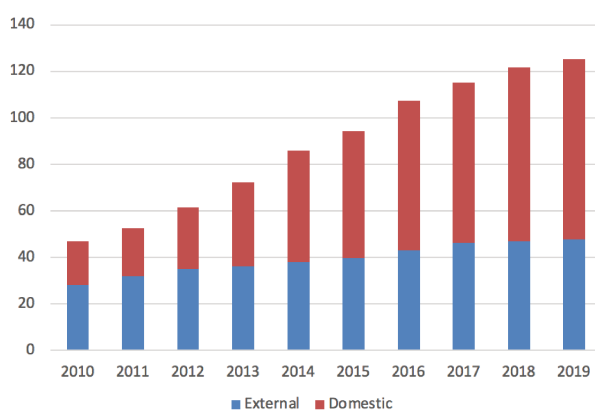
Figure 1.31: Public deficit, %GDP



Source: MOF

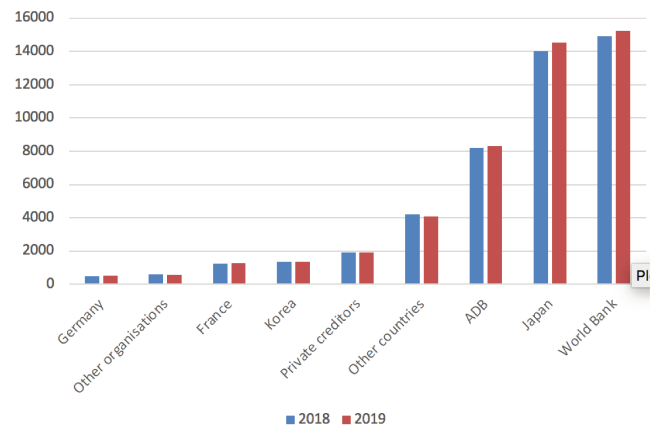
Figure 1.32: Public debt, %GDP

Viet Nam's fiscal position got worse in 2003-2016 due to cyclical and structural factors (Figure 1.31). The State budget deficit remains at a high level which causes the rising of public debt and becomes one of the biggest macro-economic risks facing Viet Nam. There was a huge increase in public debt in 2009 and 2013, which corresponded to two stimulus packages of 8 billion dollars in 2009 to deal with the negative impacts of the global financial crisis in 2008 and 1.4 billion dollars in 2013 to deal with the Vietnamese banking crisis in 2011-2012 (Figure 1.32). However, since 2016, the government has engaged in improving the budget deficit with a target of under 4 % for the period 2016-2020.



Source: MOF

Figure 1.33: Composition public debt, Trillion USD



Source: MOF

Figure 1.34: Debt by country/donor, Million USD

Both domestic and international sources can finance the budget deficit. Figure 1.33 shows that public domestic debt has sharply increased since the 2010s with the domestic bond market development. It reflects the more prudent public financing policies that reduce external debt

compared to domestic debt. It contributed to reducing considerably the currency risk related to foreign debt. The government mostly raised external funds to finance development from international organisations such as World Bank and Asian Development Bank and bilateral donors such as Japan (Figure 1.34).

Central bank and monetary policy

According to the Law on the State Bank of Viet Nam in 2010, the SBV is defined as a ministerial agency of the Government - the Central Bank of the Socialist Republic of Viet Nam. The SBV performs (i) the state management of monetary and banking activities and foreign exchange, (ii) the issuance of money, acts as the bank of credit institutions and provides monetary services for the Government and (iii) the state management of public services under the jurisdiction of the State Bank. The objectives of SBV are inflation control, stabilisation of the macro-economy, supporting economic growth and ensuring the liquidity of credit institutions. In order to achieve these objectives, the SBV can use tools, including interest rates tools, exchange rates, reserve requirements, open market operations and other tools. Depending on the macroeconomic conditions, the SBV will use different tools.

Policy interest rate

The SBV determines three interest rates: base rate, discount rate, and refinancing rate. The base rate is the reference rate for banks' mobilisation and lending activities. The discount rate is the interest rate for the central bank's principal refinancing operation – the short-term acquisition of bonds. The refinancing rate applies for marginal refinancing facilities (short-term mortgage loans, overdraft permission, and overnight loans). The discount rate is referred to as the SBV's floor rate, while the refinancing rate is the ceiling rate. The SBV announces its benchmark interest rates to support economic growth. Credit institutions set lending and deposit rate in VND based on the central bank's interest rate.

Figure 1.35 shows that the deposit rate and lending rate vary with the refinancing rate. In order to reduce or fight the downward direction of inflation, the SBV gradually adjusts interest rates to implement monetary policy.

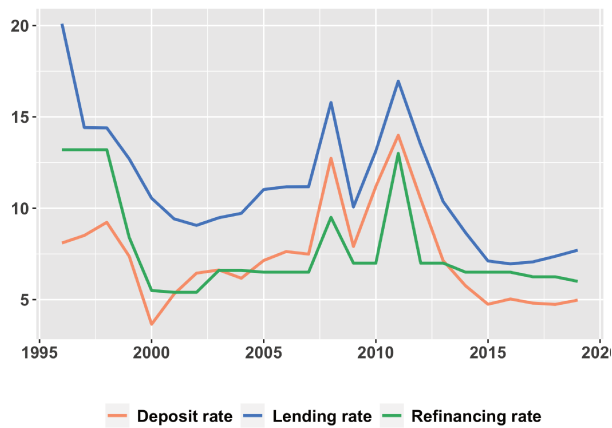


Figure 1.35: Interest rates, %

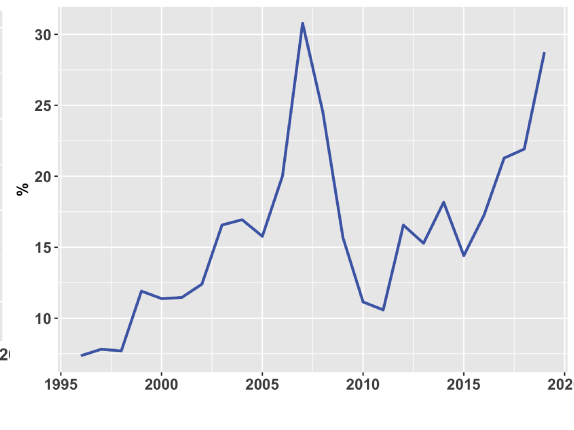


Figure 1.36: International Reserves, %GDP

International Reserves

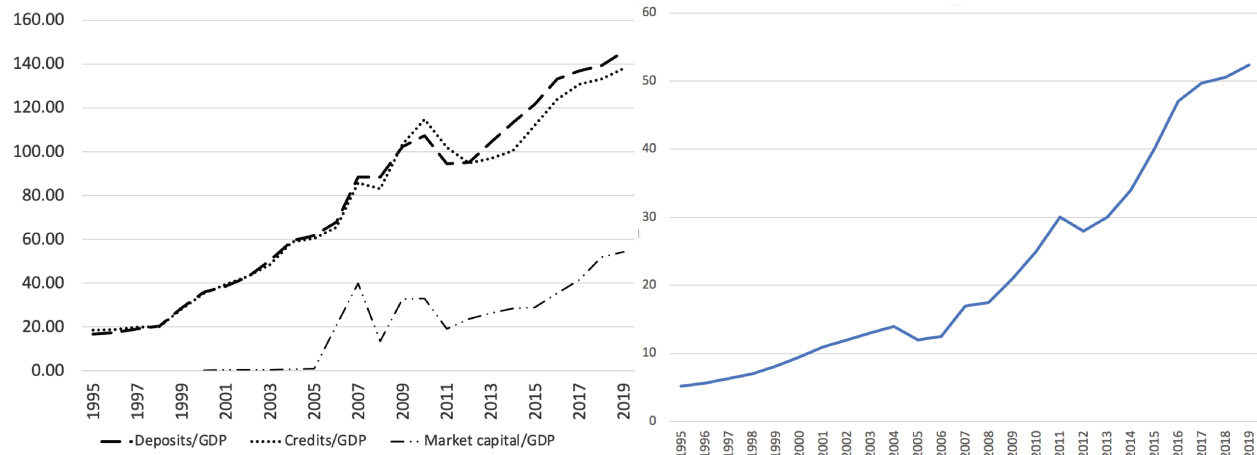
For Viet Nam - an emerging market- the foreign exchange reserves are a crucial monetary and exchange rate policy tool. The huge capital inflows in recent years facilitate the accumulation of international reserves. Foreign reserves reached around 30% GDP in 2019 (Figure 1.36). According to the [IMF \(2019\)](#), the SBV actively responds to Viet Nam's dong depreciation by intervening in the foreign exchange market through reserve decumulation. International reserves will decline by 8.6 per cent in response to a one percentage point depreciation. [Ho and Ho \(2018\)](#) explain that due to the intermediate impossible trinity policy followed by Viet Nam (fixed exchange rate and a relatively open capital account), high foreign reserves accumulations are needed to cope with external shocks.

The SBV will decide the reserve requirements: the amount of money that credit institutions must deposit at the SBV for each type of credit institution and each kind of deposit at credit institutions. They can receive interest for reserve requirement deposits and excess deposits applicable to each type of credit institution for each sort of deposit. This reserve requirement ratio is adjusted to align with the monetary policy objective. For example, to neutralise the banking system's excess liquidity or tighten monetary policy to reduce inflation, the SBV increases the reserve requirement for credit institutions. In contrast, the SBV will lower the reserve requirement to decrease the liquidity pressure for credit institutions and reduce the cost of capital mobilisation, encouraging credit institutions to lend to the economy. Open market operations constitute a monetary policy tool for purchasing and selling valuable papers with credit institutions.

1.2.3 Financial system

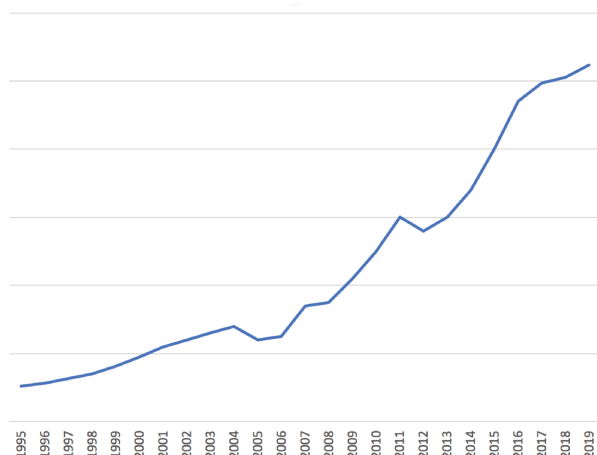
Monetary policies influence the economy via several monetary transmission mechanisms, including the interest rate channel. The interest rate transmission channel depends, importantly, on the structure of the financial system. In other words, the links between the financial sector and other economic sectors play a central role in monetary policy design. King and Levine (1993), Levine and Zervos (1998) and Levine, Loayza, and Beck (2000) found that financial development has a significant positive effect on economic growth. The financial system can provide credit to the economy, collect deposits from the public, provide the means of payment for customers, and process payments. The central bank plays an important role in ensuring the development and stability of the financial system and maintaining price stability.

The Vietnamese financial system has developed since the 1990s with the transformation of the banking system from one-tier to two-tier, including the SBV as a central bank and commercial banks, the development of equity and bond markets to facilitate access to finance for firms in the economy. The ratio of deposit to GDP and credit to GDP has increased sharply since 1999 (Figure 1.37). The market capitalisation rose dramatically in 2007. However, there was a reduction during the global financial crisis in 2008-2009 and the Vietnamese banking crisis in 2011, but it has rapidly recovered since 2012.



Source: World Bank, SBV, HOSE

Figure 1.37: Domestic financing, % GDP



Source: SBV

Figure 1.38: Household's debt, %GDP

Household debt data is taken from the SBV. However, there were changes in the statistical regime over time. For the period from 2000 to 2004, the data used are outstanding personal debts - outstanding loans of individuals. From 2005 to 2010, the data included individual economic data, meaning the outstanding debt of production and business households. From

2011 to now, the data consists of business households and individuals. However, the data covers only the outstanding debt in the banking system. In Viet Nam, people can borrow money from their family, relatives, friends, or informal agents (black credit with high interest rates). The size of black credit was estimated to reach 30% of the total credit of the banking system or about US\$50 billion, which is considered extremely high by international standards. Household debts in Viet Nam rose rapidly from 2000 to 2019 (Figure 1.38). The ratio of household debt to GDP also increased significantly during the same period. The increase in household debt can have a positive impact on economic growth. However, [Cecchetti, Mohanty, and Zampolli \(2011\)](#) found that when household debt to GDP exceeds a threshold value of 85%, it can have a negative effect on macroeconomic indicators such as GDP growth or consumption. [Debelle \(2004\)](#) demonstrated that interest rate, which represents the cost of lending and lending conditions, will impact household debt. The lower (higher) interest rates and favourable (restricted) lending conditions, household debts will increase (decrease). Over the past few years, the SBV, through commercial banks, has created credits for low-income groups to purchase houses. It contributes to improving housing conditions as well as socio-economic development.

Exchange rate dynamics

Since the reform in 1986, Viet Nam began the process of global integration and progressively removed trade barriers and capital controls. However, it also increased the high risk of external shocks. Poor macroeconomic policies can cause real exchange rate misalignment and negatively influence economic growth ([Husain, Mody, and Rogoff, 2005](#); [Kamin and Rogers, 2000](#)). Therefore, Viet Nam's exchange rate has been one of the most important policies to sustain Vietnamese economic growth.

The exchange rate regime went through several phases (Table 1.1), gradually moving from a strictly pegged exchange rate system to the current stabilised arrangement system (which allows more flexibility but remains a fixed exchange rate system).

The SBV can announce exchange rates and decide on the exchange rate regime and the mechanism of regulating exchange rates. According to the Decision No.2730/QĐ – NHNN of the SBV in 2015, the SBV will announce the central rate of VND versus USD and the cross rate of VND versus other foreign currencies. This main exchange rate is the basis for credit institutions and commercial banks to determine their buying and selling exchange rates. The

Table 1.1: Exchange rate regimes

Period	Regime
1989-90	Pegged exchange rate with crawling bands
1991-93	Pegged exchange rate within horizontal bands (de facto on USD)
1994-96	Conventional fixed peg arrangement
1997-98	Pegged exchange rate with crawling bands (de facto on USD)
1999-00	Conventional fixed peg arrangement (de facto on USD)
2001-07	Crawling peg (de facto on USD)
2008-15	Pegged exchange rate with crawling bands
2015-Today	Stabilised arrangement

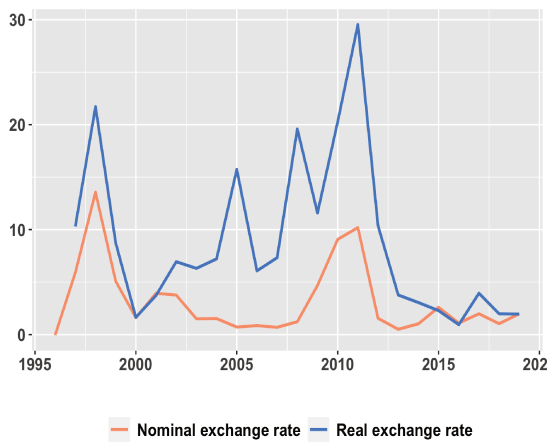
Source: *Nguyen (2012), Vuong (2003)*

central rate of VND versus USD is calculated based on the inter-bank average VND/USD exchange rate, the exchange rate in the international market of foreign currencies of our main trading partners, countries with a large investment with Viet Nam, the macroeconomic conditions and monetary policy objectives. This mechanism allows the SBV to stabilise the exchange rate of VND and the foreign exchange market, thereby promoting production, trade and investment and stabilising the macro-economy. Moreover, the current exchange rate regime has been described as a managed float. It means that the exchange rate is determined by both market forces and the government's influence. Indeed, the SBV will perform consistent measures and monetary policy tools by selling foreign currencies to stabilise the foreign exchange market and exchange rate within the set band. However, it is evident that economic and financial vulnerabilities increase as the economy opens its borders.

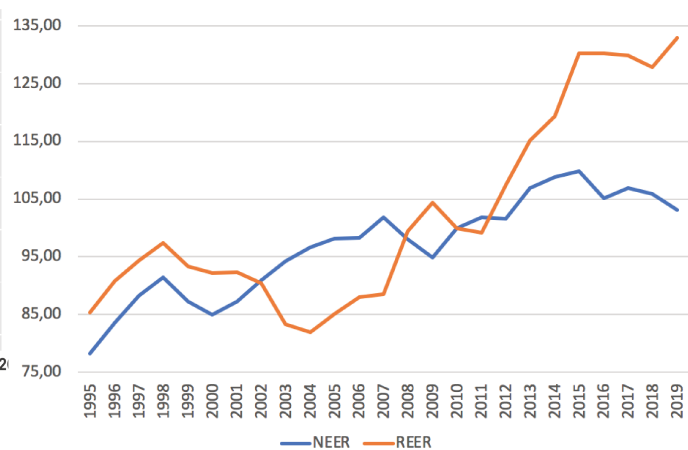
Figure 1.39 shows the evolution of the nominal bilateral VND/USD rate. A rise corresponds to a depreciation/weakening of the Vietnamese dong (VND). The nominal exchange rate increased in 1997, and it remained stable during the period 2000-2004. It began to climb during the global financial crisis in 2008 and the banking crisis in 2011.

The Nominal Effective Exchange Rate (NEER) measures the value of a national currency against a weighted average of several foreign currencies. The Real Effective Exchange Rate (REER) is the nominal effective exchange rate divided by a price deflator or index of costs. They can be considered one indicator of the country's competitiveness. Figure 1.40 shows the evolution of the NEER and REER of Viet Nam from 1995 to 2019. To our knowledge,

Viet Nam does not publish official data on NEER and REER. Then, we take the data from the updated database of the papers of [Darvas \(2012\)](#). An increase (decrease) of the REER represents an appreciation (devaluation) of the VND and then a decrease (increase) in the country's price competitiveness. The NEER and REER experienced substantial changes during periods of crisis, such as the Asian financial crisis in 1997, the global financial crisis in 2007-2008 and especially the Vietnamese banking crisis in 2012-2013, which was a period of very high inflation.



Source: IFS



Source: SBV

Figure 1.39: Changes in exchange rate, % Figure 1.40: Nominal - Real Effective Exchange Rate

1.3 Demand and growth regimes

In the previous section, macroeconomic indicators allow us to examine how well the Vietnamese economy achieves economic development objectives. However, it is essential to identify the demand sources of growth and the macroeconomic policy drivers of growth. Recently, [Hein and Martschin \(2021\)](#), based on examining the growth contributions of demand aggregates and sectoral financial balances, link demand and growth regimes in finance-dominated capitalism with the post-Keynesian notion of macroeconomic policy regimes. They demonstrated for the four largest Eurozone countries, France, Germany, Italy, and Spain, how the country-specific macroeconomic policy regimes had supported the shift (or non-shift) of macroeconomic regimes from the pre- to the post-crisis. Thus, in this section and the next section, we will base on this PKE concept of demand and growth regimes and macroeconomic policy regimes to analyse the main features and macroeconomic dynamics of Viet Nam.

1.3.1 Post-Keynesian concept of demand and growth regimes

[Kalecki \(1971\)](#) argued the relationship between income distribution and aggregate demand. He considered three possible ways to stimulate aggregate demand: (i) deficit spending by the government, (ii) stimulation of private investment through lower interest rates or targeted tax breaks, and (iii) redistribution of income. An increase of the relative wage share in the value-added (redistribution of income toward wages) will contribute to a rise in consumption demand due to the higher marginal propensity to consume out of wages compared with profits. However, wages increase imply higher costs and lower profits for firms. Since profit is a determinant of investment, lower profits lead to lower investment. Higher wages also mean higher costs and lower price competitiveness, reducing net exports. Hence, demand is wage-led when the positive effect of a higher wage share on consumption dominates the potentially negative impact on investment and net exports.

A different view of income distribution emphasised that a redistribution of income toward wages may result in a higher investment via a higher capacity utilisation rate under some implicit assumptions ([Blecker, 1989](#)). He also found that a domestically wage-led demand and growth regime may turn profit-led through redistribution effects on net exports. High wages can reduce the country's competitiveness, economic growth, and employment in a relatively open economy. The economy only can enjoy wage-led growth *"if workers in all countries in the world increase their money wages and if the international competitive effects roughly cancel out"* ([Blecker, 1989](#), p.407). In addition, even with a wage-led regime, it is essential to keep goods and tradable services competitive and reduce imports' income sensitivity. A current account deficit implies that there is dissaving, reducing consumption, output, and employment.

[Bhaduri and Marglin \(1990\)](#) modified the standard Kaleckian model by treating investment as a function of the profit share and capacity utilisation. In some cases, an increase in the wage share may not only lower investment but also may even lower aggregate demand, so-called profit-led. However, they argued that an exogenous variation of the real wage rate might be feasible in an open economy through an adjustment exchange rate policy. A devaluation of the domestic currency would increase the cost of imported goods, thereby increasing the production cost and domestic price. As a result, it would be upward pressure on export prices and nominal wages. If the country maintains its price competitiveness, devaluation makes

domestic good cheaper and possibly improve the trade balance. This effect will depend on the responsiveness of export and import volume to prices, so-called "trade elasticities".

Identifying whether a country is wage-led or profit-led only provides information on the aggregate demand (sum of consumption, investment and net exports) and growth effects of changes in the wage share/the profit share. It still needs to indicate the country's sources and drivers of growth during specific periods. Contributing to this research question, the research on the macroeconomics of financialisation has proposed the notion of macroeconomic regimes in finance-dominated capitalism (Hein, 2012). Looking at the growth contributions of the main demand components to GDP growth and the financial balances of institutional sectors in the economy allows us to study the sources of GDP growth and how expenditures have been financed. The financial balance is the difference between a sector's income and expenditure. The financial balances approach directly addresses the question of current account imbalances, an indicator of macroeconomic instability (Behringer and van Treeck, 2019). Baccaro and Pontusson (2016) developed an analytical approach to comparative political economy that focuses on the relative importance of different components of aggregate demand, which are potential demand drivers of economic growth. They proposed three other alternatives to the traditional Fordist model of wage-led growth: (i) consumption-led growth financed by credit, (ii) investment-led growth and (iii) export-led growth.

Hein (2019) analysed the macroeconomic regimes under the dominance of finance before and after the global financial crisis and distinguished three broad types of regimes: (i) a debt-led private demand boom regime, (ii) an export-led mercantilist regime and (iii) a domestic demand-led regime. The first and third regimes are two opposed regimes: The "debt-led private demand boom" regime has private consumption as the main source of demand and growth, and consumption is financed by debt leading to a rise in private household debt-income ratios. In contrast, the export-led mercantilist regime relies on foreign demand and may lead to rising indebtedness of the foreign sectors. Hein and Martschin (2021) examined the growth contributions of main demand aggregates and sectoral financial balances of sectors, which allows an understanding of the demand sources of growth or stagnation, how these sources are financed, and potential financial instabilities and fragilities. They added one intermediate regime to the previous study and defined four demands and growth regimes (Table 1.2).

Three sectoral financial balances approach adopted by Godley and Zezza (1992a) is based on the GDP national accounting identity. According to the GDP accounting by demand

approach, aggregate demand comprises household consumption, private investment, public investment, public spending, and net exports. It is assumed that the sum of the private sector (households and business), government sector and the external balance must be zero. The private sector's financial balance exceeds its expenditures over its disposable income. The government deficit is the difference between revenues and expenditures. The external balance represents the country's current account.

Table 1.2: Summary of regime's main characteristics

Regime	Debt-led private demand	Export-led mercantilist	Weakly export-led	Domestic demand-led
Financial balances of external sector	+	-	-/+	-/+
Financial balances of domestic private sector	-	+	+/-	+
———— - of private household sector	-/ 0	+	+/-	+
———— - of the corporate sector	-	+/-	+/-	-
Growth contribution of trade balance	-	+	-/+	-/+

- : deficit/negative contribution; + : surplus/positive contribution

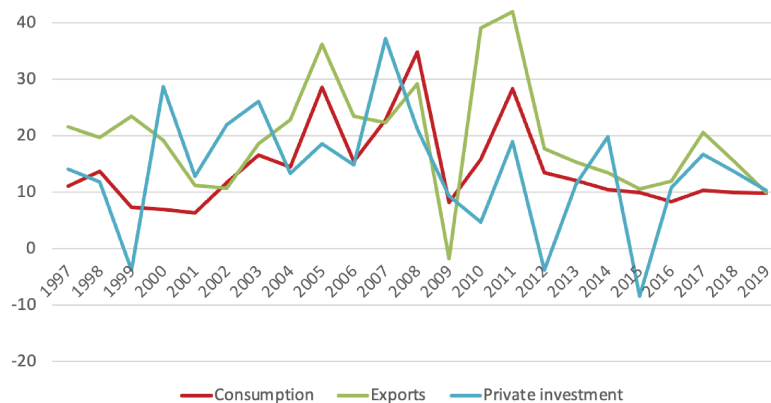
- ***a debt-led private demand boom regime***: is characterised by deficits of the private domestic sector as a whole, which are, on the one hand, driven by corporate deficits and, on the other hand, by negative or close to zero financial balances of the private household sectors. The latter implies that major parts of the private household sector have negative saving rates out of current income and finance these deficits by increasing their stock of debt or by decreasing their stock of assets. The deficits of the (private) domestic sector are mirrored by positive financial balances of the external sector, i.e. current account deficits. Demand growth is mainly led by private domestic demand, largely financed by credit, while the balance of goods and services negatively contributes to growth.
- ***an export-led mercantilist regime***: shows positive financial balances of the domestic sector as a whole, and by the private household sector in particular, that are matched by negative financial balances of the external sector, indicating current account surpluses. There are relevant growth contributions of the positive balance of goods and services, thus, rising net exports and current account surpluses, and small or even negative growth contributions of domestic demand.
- ***a weakly export-led regime***: shows either positive financial balances of the domestic

sector or negative financial balances of the external sector, and hence current account surpluses, but negative growth contributions of the balance of goods and services, and thus falling net exports and current account surpluses. Alternatively, we may have negative financial balances of the domestic sectors, positive financial balances of the external sector and hence current account deficits, but positive growth contributions of the balance of goods and services, thus improving net exports and falling current account deficits.

- ***a domestic demand-led regime***: is characterised by positive financial balances of the private household sector, while the government and, to some extent, the corporate sector are running deficits. After the crisis, in particular, the government sector has been the deficit sector in several countries following this regime. The external sector is roughly balanced with only small deficits or surpluses. Domestic demand contributes positively to demand growth (without relying on private household deficits), and there are slightly negative or positive growth contributions to the balance of goods and services.

1.3.2 Demand and growth regimes in Viet Nam

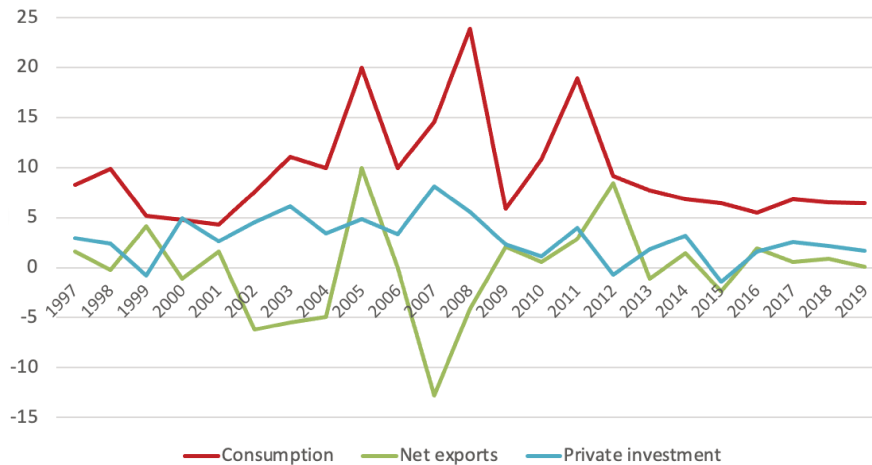
Figure 1.41 shows the average annual growth of different demand components: final consumption, private investment and exports. Viet Nam stands out as the country where exports grew on average the fastest compared to consumption and private investment. The share of exports in GDP has doubled in twenty years from around 50% in 1999 to 102% in 2019. The economy has become more export-oriented over the past three decades.



Source: GSO and author's calculation

Figure 1.41: Annual growth rates of GDP's components, %

The contribution of demand components to growth is calculated by multiplying the annual growth rate of that component by its share in GDP at $t - 1$ (Baccaro and Pontusson, 2016; Hein and Martschin, 2021). Figure 1.42 shows the contribution of consumption, private investment and net exports to the GDP growth. Final consumption plays a dominant role in Vietnamese economic growth. Private investment consistently contributes positively to GDP growth. During the period 2001-2009, the contribution of net exports to GDP growth was negative. Since 2009, the net exports have contributed positively. It is noted that the growth of net exports appears to have occurred at the expense of household consumption, such as during the period 2008-2009 or 2011-2012.



Source: GSO and author's calculation

Figure 1.42: Contribution of demand components to annual GDP growth, %

Following Hein and Martschin (2021), based on the set of macroeconomic indicators, we analyse and identify possible demand and growth regimes during three different periods of Vietnamese economic development (Table 1.3).

In the period 1997-2001, Viet Nam was characterised by a weakly export-led regime, with the negative financial balances of the private domestic sector as a whole, mainly consisting of high deficits in the private household sector and the public sector. It was mirrored by the positive financial balances of the external sector. There was a positive contribution of the balance of goods and services to economic growth. It indicated that improving exports will lead to the current account deficit falling. The second period is from 2001 to 2009, with a rapid global integration. There were various free trade agreements signed between Viet Nam and different countries. In 2007, Viet Nam became a member of the WTO.

Table 1.3: Indicators for demand and growth regimes in Viet Nam

	1997-2001	2002-2011	2012-2019
Financial balances of external sector as a share of nominal GDP, per cent	2.34	5.29	-1.27
Financial balances of domestic sector as a share of nominal GDP, per cent	-2.34	-5.29	1.27
– Financial balances of public sector as a share of nominal GDP, per cent	-4.02	-6.31	-4.55
– Financial balances of private sector as a share of nominal GDP, per cent	1.69	1.02	5.82
— Financial balances of private household sector as a share of nominal GDP, per cent	-3	1.08	7.87
— Financial balances of corporate sector as a share of nominal GDP, per cent	2.81	-4.52	-6.77
— Financial balances of banking sector as a share of nominal GDP, per cent	1.88	4.47	4.71
Real GDP growth, per cent	6.35	7.28	6.46
Growth contribution of domestic demand including stocks, percentage points	4.67	7.83	5.25
– Growth contribution of private consumption, percentage points	5.15	7.89	7.26
– Growth contribution of public consumption, percentage points	0.04	0.41	0.41
– Growth contribution of gross fixed capital formation, percentage points	2.27	2.20	0.97
Growth contribution of the balance of goods and services, percentage points	1.52	-0.86	1.09
– Growth contribution of exports, percentage points	6.32	8.27	8.81
– Growth contribution of imports, percentage points	- 4.57	-9.74	-7.81
Net exports of goods and services as a share of nominal GDP, per cent	-4.74	-8.94	2.63
REGIME	Weakly export-led	Debt-led private demand	Export-led mercantilist

Viet Nam has pursued an export-oriented industrialisation strategy to attract FDI. Between 2002-2011, Viet Nam was classified as a debt-led private demand boom regime with negative financial balances of domestic sectors driven by the corporate and public sectors. The household sector remained slightly positive. The deficit of the domestic sector was reflected by the positive finance balances of the external sector. The private domestic demand mainly leads to demand growth, financed mainly by credit. It corresponds to the period of rapid financial sector development in Viet Nam. In addition, the balance of goods and services negatively contributes to economic growth.

After the banking crisis of 2011-2012, Viet Nam can be classified as an export-led mercantilist regime from 2012 to 2019. It is characterised by the positive financial balances of the domestic sector as a whole but with positive financial balances of the private household and banking sectors. In contrast, the firm sector and public sector had a financing need. The external sector recorded a surplus. Domestic demand and the balance of goods and services contribute positively to economic growth.

1.4 Macroeconomic policy

Understanding macroeconomic policies is fundamental to understanding the dynamics of the economy. Macroeconomic policies have both short-run and long-run effects on macroeconomic performance and the macroeconomic regime.

1.4.1 Post-Keynesian macroeconomic policy regime approach

Policymakers should use several instruments to achieve their various objectives (Tinbergen, 1956). Some post-Keynesians have used the concept of a ‘macroeconomic policy regime’ to assess intertemporal comparative differences in the macroeconomic performances of the country. It describes the set of monetary, fiscal and wage or income policies and their coordination and interaction against the context of the economy, including the degree of openness or the exchange rate regime. The macroeconomic policy regime is linked to the changes in demand and growth regimes (Hein and Martschin, 2021). In order to have a stable domestic demand-led regime, the macroeconomic policy regime should have the following:

- Monetary policy: a nominal long-term interest rate should be slightly above the inflation rate but below nominal GDP growth or a slightly positive real interest rate below real GDP growth.
- Wage policy: nominal wages should rise according to the sum of the long-run average growth of labour productivity and the target inflation rate to keep mark-up pricing constant and stabilise income distribution.
- Fiscal policy should contribute to stabilising demand and improving productivity growth and, thus, potential growth in the long run, particularly through public investment.

1.4.2 Macroeconomic regimes in Viet Nam

Based on the indicators of macroeconomic policies mentioned above, we try to analyse the macroeconomic policy regime for Viet Nam during the period 1997-2019 (Table 1.4). For monetary policy, we use the interest rates of the SBV. For wage policy, we build indicators related to labour cost and income from the available data of GSO. For fiscal policy, we use only the indicator associated with public investment. The analysis of these indicators allows linking with the macroeconomic demand and growth regime.

Between 2001 and 2009, the macroeconomic policy regime could contribute to the shift from

the weakly export-led regime to the debt-led private demand boom regime. The expansionary monetary policy stance represented by the low real interest rate and the development of the credit system promoted credit access for business investment and household consumption or investment. However, this period experienced high inflation and high unit labour cost growth. Thus, the labour income share slightly increased relative to the previous period. The expansionary fiscal policy (high public investment to GDP ratio) contributed to the aggregate demand and economic growth. However, the high inflation and unit labour cost led to a slight, real appreciation and a small loss of price competitiveness. Vietnamese economy still held low non-price competitiveness in this period.

Table 1.4: Indicators for the macroeconomic policy regime

	1997-2001	2002-2011	2012-2019
Monetary policy			
– Short-term real interest rate (deposit rate with three months deposits), per cent	0.96	-3.11	2.39
– Short-term real interest rate (lending rate with less than one-year loans), per cent	6.1	0.13	5.26
– Long-term real interest rate, per cent	6.51	0.02	4.76
– Long-term real interest rate minus real GDP growth, percentage points	0.16	-7.26	-1.69
Wage policy			
– Nominal unit labour costs, annual growth, per cent	2.08	15.82	5.10
– Inflation rate (HCPI), per cent	2.49	9.66	4.12
– Labour income share, per cent	0.30	0.31	0.39
Fiscal policy			
– Public investment in per cent of GDP	6.06	8.03	9.34
Open economy			
– Change in real effective exchange rate, vis-à-vis USD	0.38	0.86	3.81
– OEC economic complexity index	-0.915	-0.55	-0.1845
– Real exports of goods and services, per cent of GDP	40.83	73.25	112.87
– Real imports of goods and services, per cent of GDP	42.28	78.17	117.12
+ : expansionary stance, - : contractionary stance, 0 : neutral			
Monetary policy stance	-	+	-
Wage policy stance	+	-/+	+
Fiscal policy stance	+	+	+
Open economy conditions	-	-	0
Demand regime	Weakly export-led	Debt-led private demand	Export-led mercantilist

The change in the macroeconomic policy regime over the period 2012-2019 has contributed to the shift of the debt-led private demand to the export-led regime. The monetary policy stance became restrictive, especially after the banking crisis in 2011. It was characterised by an increase in short-term and long-term interest rates. Thus, it led to lower real GDP growth and inflation than in the previous period. Regarding the wage policies, the nominal unit labour cost grew slower, inducing inflation. However, the labour income share continued to rise due to decreased unemployment. The expansionary fiscal policy from the high public investment continues to contribute to Vietnamese economic growth. The strong shift in the macroeconomic policy regime drove a strong increase in the REER, representing an appreciation of the VND and a decrease in the country's price competitiveness. The REER experienced substantial changes during the crisis period, such as the Asian financial crisis in 1997, the global financial crisis in 2007-2008 and especially the Vietnamese banking crisis in 2012-2013, a period of very high inflation. However, the appreciation of the VND could reduce the import price. Thus, it results in a positive contribution of trade to the growth, current account surpluses and external sector deficits associated with this export-led mercantilist regime.

1.5 Conclusion

Viet Nam, one of the emerging markets, has experienced remarkable economic growth, with an average 6-7% annual growth rate since the reform in 1986. Economic growth has markedly lifted the living standards of the Vietnamese people. The country became a lower middle-income country in 2010. The integration into the international economy has been one of the major determinants of the country's economic development over the last two decades. The degree of openness has continued to increase since the trade liberalisation. The country has become an attractive destination for FDI. The privatisation process in Viet Nam contributed to strengthening the private sector. The government made many efforts to promote political, financial and macroeconomic stability and a favourable environment for investment.

Moreover, the rapid development of the financial sector has contributed to productive sector growth. The Vietnamese central bank promotes price stability, financial system stability and development through the promotion of financial inclusion, oversight of the payments system and regulation of the banking system. However, the economy still relies on the external sector. Indeed, the export-led growth model must focus on developing the national/domestic

productive capacity. The trade depends mainly on foreign multinational corporations, FDI firms and joint venture companies.

In this chapter, the Post-Keynesian approach allows us to understand the main features, dynamics and interaction between domestic features of the Vietnamese economy and its external features. Post-Keynesian theory starts with an understanding of the nature of the subject matter and applies mathematical methods to suit (Dow, 2019). The SFC modelling approach, usually considered part of PKE, provides a general framework for representing the whole economic system. In addition, according to Bezemer (2010), accounting-based macroeconomic models can anticipate the credit crisis and economic recession. SFC models bring real and financial variables together in the same framework and are therefore best suited to address the challenges facing Viet Nam. Our study makes two main contributions to the literature. Firstly, as far as we know, we are the first to develop an empirical SFC model of the Vietnamese economy. Secondly, we contribute to the scarce literature on empirical SFC models for developing countries. To do so, the next chapter (Chapter 2) will introduce the SFC approach and the related literature.

CHAPTER 2

Stock-flow consistent modelling literature

2.1 Introduction

As mentioned in the previous chapter, our study aims to contribute to macroeconomic modelling in Viet Nam. Government institutions, research institutes and universities are using different types of macroeconomic models for modelling the Vietnamese economy and forecasting as well as policy analysis. Government institutions include the Ministry of Plan and Investment (MPI) with institutes such as the GSO, the Central Institute of Economic Management (CIEM), the National Center for socio-economic Information and Forecast (NCIF); the Ministry of Finance (MOF) and the SBV.

GSO uses input-output and regression-based econometric models to analyse and forecast indicators such as GDP, income and expenditures. CIEM has developed an annual macro-econometric model with the support of the German Development Agency (GIZ) to provide annual forecasts on GDP, investment, consumption and inflation. CGE - an accounting-based macroeconomic modelling approach is also developed at CIEM to deal with different research questions for the Vietnamese economy ([Abbott et al., 2007](#)). Time series models such as VAR, ARIMA, and structural macro-econometric models are also used at NCIF to produce forecasts for macroeconomic indicators. The MOF has based on CGE models, ARIMA/VAR or simple regression models to evaluate the impacts of different scenarios of tariffs. Regarding financial modelling, the SBV has developed models related to leading indicators such as inflation ([Tran, 2017](#)) and exchange rate ([Nguyen, 2014](#)) or assessing the effects of various monetary policies ([Bui and Tran, 2015](#)).

Regarding international organisations, the IMF has described the Vietnamese economy using its Forecasting and Policy Analysis System (FPAS) model ([Dizioli and Schmittmann, 2015](#)). It includes four main equations related to the aggregate demand curve, the price dynamic, the uncovered interest rate, and the monetary policy rule. The World Bank has developed a macroeconomic and fiscal model (MFMod) ([Andrew et al., 2019](#)). The model is used to generate country forecasts and simulate various policies. Each model has a similar structure and functional form, but the parameters are specific for each country due to the data

availability and economic specialisation. The model has different blocks, including the supply side, GDP demand side, price determination, labour market, fiscal accounts, the balance of payments and monetary policy.

Overall, there needs to be more attention paid to the financial sector/system in these general equilibrium models. Indeed, the global financial crisis in 2008 has revealed the critical need to pay more attention to the inefficient market hypothesis so that the integration of the financial sector (i.e. money, debt and assets) allows a proper understanding of observed dynamic behaviours in the real economy sector. The inefficient market hypothesis should indeed be understood as a radical uncertainty (and non-probabilistic) about the future. While giving a specific role to the financial sector, such uncertainty does not allow any reference to a unique optimal equilibrium. Taking into account some assumptions about the future, the radical uncertainty hypothesis directly impacts firms' and households' investments and, thus, the overall production. While they were marginalised during the golden age of the Great Moderation and Monetarism, SFC models assume that financial and real variables should be put together and analysed as a whole in the same model. They are, therefore, best suited to address the challenges posed by the recent crisis. This approach is used in the following chapters (Chapter 3 and 4) to build an empirical SFC model for the Vietnamese economy.

This chapter introduces the SFC methodology of macroeconomic modelling and the current SFC literature. There were four survey papers on the SFC literature. [Dos Santos \(2006\)](#) focused on macroeconomic closures of the same accounting framework with different strands of Keynesian "schools of thought". [Caverzasi and Godin \(2015\)](#) divided the SFC literature according to its subject and methodology. [Nikiforos and Zezza \(2017\)](#) provided a pedagogical, rigorous survey and was accessible to the non-specialist reader. They tried to make clear the links between the theoretical elements of the SFC methodology and macroeconomic debates. [Zezza \(2019\)](#) overviewed a number of contributions to macroeconomics which adopt the SFC approach to data for a particular country. Here, in this chapter, we aim to update these surveys in the context of the growing number of contributions adopting the SFC approach.

The rest of this chapter is organised as follows. Section 2.2 and 2.3 outline the origin and the main principles of the SFC approach. Section 2.4 introduces the theoretical SFC literature. Section 2.5 discusses the empirical SFC literature and the procedure for developing an empirical SFC model. Section 2.6 concludes.

2.2 Stock-Flow Consistent modelling

2.2.1 Origin of stock-flow consistent models

SFC models are a type of macroeconomic model of PKE. The methodological root of the SFC approach can be traced back to the work of [Copeland \(1949\)](#). It emphasised the important role of moneyflows in the organisation of economic activities and full employment. Measures of moneyflows will help us to answer the questions related to where the money comes from to finance total purchases in the economy, what becomes the money that is not spent, the role of cash balances, other liquid asset holdings and debts play in the cyclical expansion and contraction of moneyflows. He established a theoretical framework to link economic and financial flows with stocks by integrating the standard national income accounting identity with the flow of funds. This study assumed that the social accounting approach to the subject of money, credit and moneyflows rests on a quadruple-entry basis. Thus, four fundamental propositions in this work are also the main principles of the current SFC approach: "*(1) For any transactor for any period, total sources equal total dispositions of money. (2) A source of money for one transactor means a disposition of money by someone else and vice versa. (3) A loan fund receivable for one transactor means a loan fund payable by someone else and vice versa. (4) An increase in a loan fund balance receivable is a disposition of money by the holder; for someone else, it means a decrease in a loan fund balance receivable or an increase in payables and a source of money. The converse holds for this proposition too*" ([Copeland, 1949](#), p.257).

After Copeland (1949), Tobin and his research group ([Backus et al., 1980](#)), based at Yale University in the New Haven, have influenced today's SFC approach. They aimed at modelling the process of asset accumulation and economic activity and estimating a model for the US economy. The model emphasises that financial markets and institutions can be used to address the financial consequences of public policies. Other major contributions of Tobin are in his Nobel Memorial Lecture ([Tobin, 1982](#)). One of the key features of SFC models is the definition of portfolio equations. It means to link households' wealth-allocation decisions across different financial assets to their relative return rates, market price expectations and agents' liquidity preference. The flow of funds will allow matching the demand for financial assets with their supply to ensure the equality between financial assets and liabilities in the system. Other main features pointed out by Tobin influencing the macroeconomic models are

as follows:

- (i) Precision regarding time: Models must be dynamic. The economy's state at a certain time depends on the previous periods' states.
- (ii) Tracking of stocks: Stocks change over time by accumulating flows. The whole system is affected by their feedback on transactions-flows (e.g. consumption, investment and production decisions).
- (iii) Plurality of assets (liabilities) and return rates. There are many different financial assets (liabilities) in the system, each of which is possibly characterised by a different interest rate.
- (iv) Integration of real and financial sides. Not only is the financial sector made up of a plurality of financial assets in addition to cash money, but there is no long-run neutrality of money.
- (v) Walras' law and adding-up constraints: Portfolio equations must be subject to algebraic constraints to meet the stock-flow consistency criteria. In addition, for the Walrasian principle, one equation of the model is logically implied by all the others and must be dropped to avoid over-determination.

The Cambridge Economic Policy Group (CEPG), led by Wynne Godley, pursued this Tobin's approach. Wynne Godley worked for the Treasury for several years, then joined the University of Cambridge and created the CEPG. His work with Francis Cripps represented the most basic principles of SFC modelling (Godley and Cripps, 1974; Cripps and Godley, 1978; Godley and Cripps, 1983). These works tried to combine the real and financial sides of the economy and combine economic theory and policy.

After joining the Levy Economics Institute of Bard College, Godley applied the same approach to the US economy called "the Levy Macroeconomic Model", which contributed to successfully predicting the recession in 2001 and 2008 (Godley and Zezza, 1992b; Godley, 1999). Moreover, the integration of the financial and the real side of the economy allows for testing the Minsky's hypothesis related to financial fragility and its links to the real variables (Minsky, 1982). Many of Godley's models and analyses formalise Minskyan ideas. Since the publication of *Monetary Economics* in 2006 (Godley and Lavoie, 2007b), resulting from a long research project by Wynne Godley and Marc Lavoie, there has had a growing number of works adopting the SFC approach for examining a variety of economic questions such related to financialisation, income distribution and contributing to policy debates related to austerity policies, the balance of payment imbalances.

In the following parts, we overview the basic principles of SFC modelling. SFC models rely on two basic principles: accounting consistencies and closure/behavioural specifications ([Nikiforos and Zezza, 2017](#)).

2.2.2 Main principles of SFC modelling

Based on national accounts, SFC macroeconomic models will be developed in order to respect four main accounting principles. These accounting consistencies allow us to see how agents' decisions in the real economy will affect their assets/liabilities and how these changes in the balance sheet will provide feedback on their decisions above. However, it will impose several constraints and reduce the degree of freedom of the SFC models.

- The flow consistency means that there are no "black holes" in the economic system. Every monetary flow comes from somewhere and goes somewhere. Each payment/receipt of a sector implies a change in the assets/liabilities of that sector. In other words, we distinguish the horizontal consistency between institutional sectors (wages paid by firms and received by households) and the vertical consistency within each sector (households received incomes and then increased their deposits).
- The stock consistency implies that the financial liabilities of a sector are the financial assets of one or other sectors.
- The stock-flow consistency ensures that every flow implies a change in one or more stocks. The stock of financial liabilities indicates future interest payments or dividends to the corresponding sectors and will impact flow decisions such as consumption and investment.
- Every transaction involves a quadruple entry in accounting (inflow, outflow, changes in assets, changes in liabilities).

These principles will be represented in two matrices: the balance sheet - stock matrix and the transactions-flow matrix. The balance sheet represents the financial structure of the economy by displaying the tangible stocks, financial stocks and financial liabilities of each institutional sector at the end of each period. The transactions-flow matrix demonstrates the real transactions and financial flows implied from stocks of financial assets and sectoral budget constraints. In order to distinguish between non-financial and financial transactions, we consider the transactions-flow matrix for non-financial transactions and the flow of funds for financial transactions ([Cohen, 1986](#)). It combines the national income equations with the

sectoral flow of funds accounting. It means that each sector's net lending/borrowing position must correspond to the flows of investment and, hence, the stock (holdings) of net financial assets/liabilities.

We present here examples of balance sheet (Table 2.3), transactions-flow matrix (Table 2.1) and flow of funds (Table 2.2) to illustrate these accounting principles described above. These detailed matrices for the Vietnamese economy will be explained in Chapter 3. We consider a simple framework including four institutional sectors: firms, banks, government and households. A column in the accounting matrices will represent it. It incorporates real assets (tangible capital) and four financial assets (deposit, loan, bond and equity) with different rates of return. A row represents them on the BS.

Table 2.1: Example transactions-flow matrix

	Firms		Banks	Government	Households	Total
	Current	Capital				
Wages	$-WB$				WB	0
Taxes	$-T$			T		0
Consumption	$+C$				$-C$	0
Investment	$-I$	I				0
Interest on Deposits			$-DM$		DM	0
Interest on Loans	$-L$		L			0
Interest on Bonds				$-B$	B	0
Interest on Equity	$-p_E E$				$p_E E$	0
Net financing capacity	NFC^f		NFC^b	NFC^g	NFC^h	0

In the transactions-flow matrix (Table 2.1), the positive sign represents an inflow for the sector, while the negative sign represents an outflow of the sector. Each row represents a transaction between sectors. For example, wages (WB) are paid by firms and received by the household sector. Firms pay taxes (T) to the government. The sum of each row will be equal to 0 to assume the horizontal flow consistency.

The stock-flow consistency will be represented via the rows of interest payments. The stock of financial liabilities implies interest payments or dividends to the corresponding sectors. For example, firms borrow from banks and pay interest on loans to banks.

If the transactions-flow matrix records the income and expenditure flow of sectors, the flow of funds (Table 2.2) deals with financial flows (i.e. changes in financial assets) between sectors in the economy. These two flow matrices are linked via each sector's net financing capacity. It means that each sector with a financing capacity will allocate it among different financial assets. The sector with a financing need will have to borrow from other sectors to finance its financing need. For example, firms can finance by borrowing from banks or issuing equity held by households. The government can finance the public deficit by issuing bonds. Households will increase their deposits in banks with the money which has not been spent. Each payment/receipt of a sector implies a change in the assets/liabilities of that sector. It also represents the vertical consistency within each sector. For example, households received wages and then increased their deposits.

Table 2.2: Example flow of funds

	Firms	Banks	Government	Households	Total
Net financing capacity	NFC^f	NFC^b	NFC^g	NFC^h	0
Changes in deposits		ΔDM		$-\Delta DM$	0
Changes in loans	ΔL	$-\Delta L$			0
Changes in bonds			ΔB	$-\Delta B$	0
Changes in equity	$p_E \Delta E$			$-p_E \Delta E$	0
Sum	0	0	0	0	

In the balance sheet (Table 2.3), the positive sign represents an asset for the sector, while the negative sign represents a liability of the sector. For example, bank deposits are an asset of the household sector and a liability of the banks. Following the stock consistency, each row must sum to zero (except for the tangible capital). As a real asset does not imply the creation of liability, the row of tangible capital will not sum to zero.

The balance sheet matrix illustrates the accumulation of assets and liabilities of each sector in the economy. The stock of assets/liabilities corresponds to the stock of the preceding period plus the transactions of the current period and the revaluation effects due to changes in asset prices. These capital gains/losses can be recorded in a separate matrix (Table 2.4). Given that each financial asset has its financial liability, the changes in the value of financial instruments must sum to zero.

Table 2.3: Example balance sheet (BS)

	Firms	Banks	Government	Households	Total
Tangible capital	$p_K k^f$		$p_K k^g$		$p_K k$
Deposits		$-DM$		DM	0
Loans	$-L$	L			0
Bonds			$-B$	B	0
Equity	$-p_E E$			$p_E E$	0
Net Wealth	NW^f	NW^b	NW^g	NW^h	NW

For example, at the end of the period, the value of the stock of equities is given by:

$$p_E E = p_E E_{-1} + p_E \Delta E + \Delta p_E E_{-1}$$

Table 2.4: Example revaluation matrix

	Firms	Banks	Government	Households	Total
Tangible capital	$\Delta p_K k_{-1}^f$		$\Delta p_K k_{-1}^g$		$\Delta p_K k_{-1}$
Equity	$-\Delta p_E E_{-1}$			$\Delta p_E E_{-1}$	0

To sum up, by combining these stock and flow matrices, we derive all the accounting identities of the SFC model.

2.2.3 Closure and behavioural specifications

The closure or behavioural specifications are crucial in SFC models. It defines the direction of causality among the macroeconomic variables in the system. The SFC literature has developed mostly inside the Keynesian school (Nikiforos and Zezza, 2017). Presuppositions of most SFC models are also that of post-Keynesian economics (Lavoie, 2014; Carnevali et al., 2019; Passarella, 2022) as follows:

- Realism: the model will try to reflect the true structures and explain the causal mechanisms of the phenomena (Fullbrook, 2008). Caldwell (1989) argues that the post-Keynesians value explanation rather than prediction. In addition, "a theory cannot be

correct unless it starts from realist or realistic hypotheses, although it is recognised that assumptions are always abstractions or simplifications...".

- Organicism: the economic system is complex with the interactions between different agents in the economy.
- Reproduction conditions: in post-Keynesian models, resources are not scarce. The problem is related to something other than the optimal allocation of resources/production factors. Still, the question is how to increase production, growth rate, and capacity utilisation rate.
- Principle of effective demand: the economy is demand-driven in both the short and long run. Aggregate demand drives output and employment.
- Quantity adjustment: supplies adjust to demand quantities, not price adjustment.
- Reasonable rationality and fundamental uncertainty: agents rely on some rules or conventions because of uncertainty. There is no maximisation and no (hyper) rational expectations.
- Multiple equilibria and path-dependency: there is no natural level of output or employment. The long-run is just a sum of short runs. Today's position depends on past positions.
- Investment causes saving: investment generates saving, not vice versa
- Money endogeneity: money does not fall from the sky. Firms demand loans to finance production and fund investment plans. Loans generate deposits, not vice versa.
- Financial assets are not perfect substitutes: capital mobility is usually assumed, but there is no tendency for the rates of return to level out.
- No or limited substitutability of inputs: dedicate equipment, and we cannot replace nature with «capital».
- Power relations and income distribution: income distribution is not defined by marginal productivities. It depends on social, institutional and political factors
- Open system and pluralism: Decision-making in the economy requires multiple strands of argument. "*Argument therefore requires reason (which may be expressed mathematically) and evidence, but also conventional judgement, expert judgement, and intuition or animal spirits*" (Dow, 2019, p.9)

Nikiforos and Zezza (2017) classified five broad categories of behavioural assumptions in SFC models.

- Specify how the agents determine their expenditure: consumption function, investment function, and government expenditure function.
- Specify how the agents finance their expenditure and possible net borrowing positions: public debt, firm's debt structure or household's debt.
- Specify how sectors allocate their financing capacity/wealth among different financial assets.
- Specify the productivity growth, wages, inflation
- Specify the behaviour of the financial system, including the banking sector, central bank and monetary policy. These behaviours will impact the real economy.

Behavioural assumptions are crucial in determining a "steady state" (i.e. a long-run equilibrium of the economy. As mentioned above, the long-run in SFC models depends on the short-run. The model dynamic will be represented via the feedback of the stock of assets and liabilities of the previous period into the flows of the next period, which in turn define the stocks at the end of the period (path-dependence). Indeed, transactions between sectors will affect the redistribution of stocks held by each sector. Then, stocks in the current period will generate the flows in the next period. [Godley and Lavoie \(2007b\)](#) define "a steady-state" as a state where the ratios of variables (both flows and stocks) remain in a constant relationship to each other. When the levels of the variables are constant, the steady-state is a stationary state.

2.3 Methodological issues of stock-flow consistent modelling

[Caverzasi and Godin \(2015\)](#) introduced three debates on methodological and theoretical issues regarding SFC modelling, which are also the problem we have to deal with later.

a) Solving the model

There are three possible ways to solve the model: simulated, analytical and discursive solution. The simulated solution requires some fundamental questions related to the values of parameters (estimated vs calibrated) and initial endogenous variables; and how to use the results of the simulations. The econometrically estimated parameters will raise concerns about the implicit assumption of their constant value during the simulation period. "However, the further from last observed values, the less statistically significant are those predictions". This issue is called the "Lucas critique". In some cases, the modeller can assume some changes in parameters with

justifications for the choices and the right balance between model complexity and realistic behaviours. Another option is to calibrate the values for the parameters and initial values of endogenous variables using stylised facts or rules of thumb. Two approaches can obtain the results of the simulation: "(i) the model starts from a stationary/steady-state situation and is then shocked; or (ii) the model is run for a baseline scenario, without being constrained to a stationary/steady-state, and various scenarios are then run, changing certain parameters". Calibration allows to include of any specification to develop more realistic models but presents some drawbacks. Lavoie and Godley (2001) emphasised that "*the disadvantage is that we can only analyse local stability: we do not know if there are other equilibria, or if these other equilibria are stable*". Due to the large model leading to their mathematical complexity and the dependence on the value of parameters, the results of the simulation will certainly be sensitive to the value of parameters (Dos Santos and Silva, 2009; Lavoie and Godley, 2001). An analytical solution is for a much simpler model. Although it will be difficult to represent complex theories, it can still provide interesting economic insights and represent theoretical and didactical tools. A third possibility to solve SFC models is to use the accounting part of SFC models, and eventually the behavioural hypothesis, as a reference for a theoretical discursive paper. It allows us to understand how the economy behaves if it tends towards equilibrium or presents an explosive behaviour.

b) Time-related characteristics

As mentioned above, the long-run dynamics of SFC models consist of a path of short-run periods interconnected with each other via the stocks (Keynes, 1936; Robinson, 1956; Kalecki, 1971; Zezza and Santos, 2008). In other words, SFC models should exhibit path dependency, and the rationality of the stationary and steady-state to be questioned. While the stationary state is where all stocks and flows do not change over time, the steady-state is where all stocks and flows grow at the same rate. Zezza and Santos (2008) and Dos Santos and Silva (2009) show that it is doubtful that an economy reaches a steady-state. Still, the stationary state affects the dynamics of short-run realisations and allows for comparing the effects of different policies.

Furthermore, we believe that, in reality, behaviours are constantly changing, preventing the economy from ever reaching any steady-state or stationary state. Our simulation exercise also will show that the values of stocks or flows might not make any economic sense in some cases. Even the simulation is stopped due the mathematical issues. This characteristic related to path dependency is essential for SFC models. It will help to explain why the same set of

values of the parameters in the behavioural equations but different applied shocks can lead to different steady states.

c) Combination of SFC modelling and Agent-based modelling

Since the economy is a complex system with interactions between economic agents, agent-based modelling (ABM) is a methodological approach that specifies individual agents' behaviour. Even if it emerges from the agents' microeconomic behaviour, ABM can show how the macroeconomic variables are determined through the interaction of multiple heterogeneous agents with various distributions and networks within the economy. The combination of SFC modelling and ABM offers a better microfoundation for macroeconomic models. However, the complexity of interaction between agents causes difficulties in the model's tractability and explanation of the results or dynamics.

The literature categorised SFC models into three groups based on the extent of fitting the features of a real economy: theoretical, empirical and fully empirical. In the following sections, we will present two main categories: theoretical and fully empirical, also called empirical SFC models for whole countries (Zeza and Zeza, 2019).

2.4 Theoretical stock-flow consistent modelling

Theoretical SFC models are used to illustrate economic theories and not for projections; no attempt at fitting model variables to actual data, and parameter values are not obtained by either econometric estimates (Zeza and Zeza, 2019). The level of complexity of the model (number of institutional sectors and assets, closures and behavioural specifications) depends on the research question.

Caverzasi and Godin (2015) identified three main topics among several contributions of theoretical SFC models: financialisation, open economies and policy.

a) Financialiation

In recent years, financialisation has played an essential role in economic growth. It refers to “the increasing role of financial motives, financial markets, financial actors, and financial institutions in the operation of the domestic and international economies” (Epstein, 2005). Several papers tried to include several financial aspects in the model and financial assets in the balance sheet to analyse the effects of financialisation.

Lavoie (2008) simulated the changes in the financial behaviour of firms and households (i.e.

firms' equity issued and retained profits and households' desire to hold equities and demand for loans), and two simulations representing the current financial crisis (i.e. lower loans and profit margins of banks). [Zeza and Santos \(2008\)](#) also expands a previous paper ([Dos Santos and Zeza, 2004](#)) to include the new evidence emerging from the 2007 subprime mortgage crisis. An early SFC treatment of financialisation is [Skott and Ryoo \(2008\)](#), which demonstrates that the effects of financialisation critically depend on a labour-constrained "mature" economy or a "dual" economy.

The subject of financialisation and income distribution was addressed by [van Treeck \(2009\)](#). The model supposed that the determinants of investment decisions are Tobin's q , the retention rate and the leverage. Households become indebted to consume. To analyse the role of shareholder value orientation, the author considered two simulations: a change in the proportion of equity issued and an increase in the dividends payout rate. The results show a negative correlation between investment and shareholder orientation. However, the changes in parameters depend on the relative strength of the wealth and debt effects. In another work focusing on income inequality, [Dallery and van Treeck \(2011\)](#) developed a model to study the conflicting claims among workers, shareholders, and managers. While capital accumulation is the primary objective of managers (a "Fordist regime"), the maximisation of shareholder value is the primary goal in a "financialisation regime".

Several SFC contributions formalise Minskyan concepts - "financial instability hypothesis". [Dos Santos \(2005\)](#) and [Dos Santos and Silva \(2009\)](#) argue that the "formal Minskyan" literature can be better appreciated in a SFC accounting framework. Such a rigorous and flexible model will allow the analysis of fiscal and monetary policies. [Tymoigne \(2006\)](#) also develops a Minskyan PK-SFC model. The paper shows that the endogenous destabilising forces described by Minsky only materialise if the central bank tries to control the economy actively using its interest rate. The central bank interest rate should be kept low in order to maintain financial stability.

[Dafermos \(2017\)](#) develops a simple macrodynamic model that synthesises some key perspectives of the analytical frameworks of Wynne Godley (financial balances approach) and Hyman Minsky. According to the Minsky mechanism, the private sector's propensity to spend is driven by a stock-flow norm (the target net private debt-to-income ratio). It also includes two fiscal rules: a Maastricht-type fiscal rule (adjust the government expenditures based on a target net government debt ratio) and a Godley-Minsky fiscal rule (link government expenditures

with private indebtedness following a counter-cyclical logic). The simulation results show that "*(i) the interaction between the propensity to spend and net private indebtedness can generate cycles and instability; (ii) instability is more likely when the propensity to spend responds strongly to deviations from the stock-flow norm and when the expectations that determine the stock-flow norm are highly sensitive to the economic cycle; (iii) the Maastricht-type fiscal rule is destabilising while the Godley-Minsky fiscal rule is stabilising; and (iv) the paradox of debt can apply both to the private sector and to the government sector*" (p.1277).

b) Open economy

In the context of globalisation, theoretical models with closed economy seem not to be able to address open economies' issues (world imbalances, exchange rates, foreign reserves...). Caverzasi and Godin (2015) retained the three phases of open-economy modelling within the SFC framework. Firstly, it is related to Godley's work on world imbalances. The second phase consists of the papers constructing the formal/theoretical representation of open economies within the SFC literature (Godley & Lavoie 2007). Finally, several papers attempt to analyse particular points of the real world. Among these analyses, the European construction and its monetary union received much attention (Lavoie (2003), Godley and Lavoie (2007A), Duwicquet and Mazier (2010), Khalil and Kinsella (2010)).

Another strand of theoretical models regarding open economies focuses on exchange rate regimes and foreign reserve variations (Caverzasi and Godin, 2015). Lavoie and Zhao (2010), using a three-country (China, euroland and the USA) model, examine the Chinese reserve diversification with different exchange rate policies: fixed renminbi-dollar parity and a floating euro-dollar exchange rate. The results show that the diversification of Chinese reserves towards euros will be detrimental to euroland in any case but that a gradual diversification will imply a less harmful initial shock even if stabilising a worse situation for Europe. The path dependency represents an interesting feature of the model. Indeed, the exchange rate variation will affect the amount of euros held by the Chinese Central Bank. Mazier and Aliti (2012) built a model of three economies with different exchange rate regimes: fixed, managed and floating and allow inflation. They show that having flexible prices might mitigate the results obtained in Lavoie and Zhao (2010).

One of the crucial questions in an open-economy framework is the determination of the exchange rate. The performance of the economy, the agents' portfolio choice, and the policymakers' decisions are the main determinants of the exchange rate. In turn, the exchange

rate will affect the performance of exports and imports, but also the portfolio choice of the agents (since it will affect the price of foreign assets in domestic currencies). This is yet another channel where the real and financial sides of the economy are integrated within the SFC framework. For example, a change in the portfolio preferences of the agents will tend to change the exchange rate, which will feed back into the real economy. [Godley and Lavoie \(2007b\)](#), in Chapter 12, introduce a two-country model where the exchange rate is determined endogenously. They assume that private-sector demand for foreign financial assets is always satisfied, and international reserves close the model. The exchange rate is pinned down by the demand for and supply of the central bank's reserves. Despite other possibilities, it is a common closure for the exchange rate in the literature.

c) Public policy

Like any macroeconomic model, the SFC model is an analytical tool designed to examine the effects of monetary, fiscal, or other macroeconomic policies. Fiscal and monetary policy are the most being analysed in the literature. The government and the central bank are included in the model to show how fiscal and monetary policy affect the economy. It can be represented by an increase in public expenditures or an increase in the interest rate. A fiscal policy needs to incorporate some important elements such as public deficit and government debt rule in order to avoid instabilities and the role of tax rebates on income distribution ([Pucci and Tinel, 2010](#)).

[Godley and Lavoie \(2007a\)](#) deploy a simple SFC model in order to examine various contentions regarding fiscal and monetary policy. They show that *"if the fiscal stance is not set in the appropriate fashion, that is, at a well-defined level and growth rate—then full employment and low inflation will not be achieved in a sustainable way"*. They also point out two unconventional conclusions: *"first, that an economy (described within an SFC framework) with a real rate of interest net of taxes that exceeds the real growth rate will not generate explosive interest flows, even when the government is not targeting primary surpluses; and, second, that it cannot be assumed that a debtor country requires a trade surplus if interest payments on debt are not to explode"*.

[Zezza \(2009\)](#), presenting the main features of the "Levy macroeconomic model", show the effects of fiscal policy and its implications for the proposed fiscal stimulus on the U.S. economy. He also demonstrated that the New Cambridge hypothesis, which claimed that the private sector financial balance would be stable relative to income in the short run, does not hold for

the short term in our model. Still, it does hold for the medium/long term. This implies that the major impact of the fiscal stimulus, in the long run, will be on the external imbalance unless other measures are taken.

[Le Héron \(2012\)](#) studied the relation between fiscal and monetary policies by analysing the effects of the monetary policy, netting out the impact of the fiscal one. He concluded that the latter could never be neutral due to the high amount of transmission channels. [Arestis and Sawyer \(2012\)](#) enter this debate using the same methodology based on shocking the system to investigate how the modelled economy reacts to a fiscal, monetary or mixed policy. The results show the importance of fiscal policy, which they suggest should take a leading role in driving aggregate demand.

2.5 Empirical stock-flow consistent modelling

2.5.1 Empirical SFC models for whole countries

There is a growing interest in confronting the SFC approach with real empirical cases. Fully empirical SFC models (empirical SFC models for whole countries) replicate the main features of a particular economy. It begins with Godley's works in the 1970s which tried to model the link between the sectoral balance sheets and the GDP components. The so-called "New Cambridge" approach is considered an important contribution to macroeconomic modelling and heterodox applied macroeconomists. Godley adopted the GDP national accounting identity in terms of three sectoral balances (private, public and external). It is assumed that the private sector includes households and firms ([Lavoie and Zezza, 2012](#)). This relation allows us to understand the imports. The aggregate demand is the sum of consumption (C), investment (I), government expenditures (G) and exports (X). The supply is the sum of domestic production (Y) and imports (M). Assuming that the private sector pays taxes (T) to the government, the private balance will be given by:

$$PB = (C + I) - (Y - T)$$

where $C + I$ is the expenditures of the private sector, $Y - T$ is their disposable income. The public deficit is defined by:

$$GB = G - T$$

The external balance is calculated as follows:

$$XB = X - M$$

According to the national accounting identity, the three balances sum to zero.

$$PB + GB + XB = 0$$

Table 2.5 summarises the countries that SFC models have been developed for.

Table 2.5: Overview of empirical models for whole countries

Country	Authors
<i>Developed countries</i>	
1 United Kingdom	Godley and Cripps (1983), Burgess et al. (2016)
2 United States	Godley (1999), Godley and Zezza (2006)
3 Denmark	Godley and Zezza (1992b), Byrialsen and Raza (2020), Byrialsen, Raza, and Valdecantos (2022)
4 Greece	Papadimitriou, Zezza, and Nikiforos (2013), Papadimitriou, Nikiforos, and Zezza (2013), Papadimitriou, Nikiforos, and Zezza (2014)
5 Ireland	Kinsella and Aliti (2013), Kinsella and Aliti (2012)
6 Portugal	Sousa (2015)
7 Austria	Miess and Schmelzer (2016)
8 Italy	Passarella (2017), Zezza and Zezza (2020)
9 France	Mazier and Reyes (2022)
10 Iceland	Raza et al. (2019)
<i>Developing countries</i>	
1 Ecuador	Zezza and Zezza (2019)
2 Argentina	Valdecantos (2012), Valdecantos (2020), Michelena and Guaita (2019)
3 Colombia	Escobar-Espinoza (2016)
4 Moldova	Le Héron and Yol (2019)
5 South Africa	Makrelov et al. (2020)
6 Mexico	Nalin and Yajima (2020)

Godley and Cripps (1983), using this theoretical framework in an empirical case of the economy of the United Kingdom, found that the private sector's financial balance was generally small

and stable. It led to the "Twin Deficit Hypothesis" of the New Cambridge view. Due to a small and stable private sector balance, the trade deficit would equal the government deficit. In other words, an increase in the government deficit would lead to a rise in the trade deficit. Some parameters used in the model are estimated econometrically.

[Godley and Zezza \(1992b\)](#) have developed a model for Denmark. It includes a representation of stock variables which are interrelated with flow variables. The model is simulated to analyse how the real economy reacts to the financial side in reality and uses it to examine some medium-term forecasting.

After joining the Levy Economics Institute of Bard College, Godley applied the same approach to the US economy, which contributed to predicting the recession in 2001 and 2008. [Godley \(1999\)](#) analysed the source of US growth and examined fiscal policy, foreign trade, private income expenditure, and borrowing. Then, he identified seven unsustainable processes in the US economy: "*(1) the fall in private saving into ever deeper negative territory, (2) the rise in the flow of net lending to the private sector, (3) the rise in the growth rate of the real money stock, (4) the rise in asset prices at a rate that far exceeds the growth of profits (or of GDP), (5) the rise in the budget surplus, (6) the rise in the current account deficit, (7) the increase in the United States' net foreign indebtedness relative to GDP*" (p.4). The paper concluded that the US would likely enter an era of stagnation, and it will become necessary both to relax the fiscal stance and increase exports relative to imports.

[Godley and Zezza \(2006\)](#) pointed out that the US economy has relied too much on the growth of lending to the private sector to compensate for the negative effect on aggregate demand of the growing current account deficit. However, this growth in lending cannot continue indefinitely because the personal sector has been considered with different threats, such as falling house prices, the excessive burden of interest or a collapse in the dollar exchange rate.

The Levy Institute has published a series of papers that addressed the sustainability of driving US growth with increasing private and public deficits and policy responses to the financial crisis. More recently, this "New Cambridge" approach has been used by the Levy Institute's researchers for Greece ([Papadimitriou, Zezza, and Nikiforos, 2013](#)). They developed a SFC model for Greece by using the quarterly data from 2000 to 2012. The work explores the implications of different economic policies on the Greek economy. It allows us to take into account the determinants of income, the impact of spending and saving on the financial structure of the economy, and then, in turn, affect the decisions of each sector.

Papadimitriou, Nikiforos, and Zezza (2013) analyse the effect of austerity policies on the Greek economy using this model. They argue that prolonged austerity will result in a continuous fall in employment, GDP and higher public deficit and debt. In order to increase employment and growth, they show that a new kind of Marshall Plan for Europe, using funds from the European Investment Bank or another EU institution, can arrest the declines in GDP and employment, reverse the trend and facilitate the recovery. Papadimitriou, Nikiforos, and Zezza (2014) consider various additional expansionary policy options for the Greek economy. They examined four alternative scenarios for restoring growth and increasing employment: "(1) external help through Marshall Plan-type capital transfers to the government; (2) suspension of interest payments on public debt, instead using these resources for increasing demand and employment; (3) introduction of a parallel financial system that uses new government bonds; and (4) adoption of an employer-of-last-resort (ELR) program financed through the parallel financial system" (p.1). They show that the effectiveness of the different plans crucially depends on the price elasticity of the Greek trade sector. The ELR policy option seems to be the best benefit for recovery due to the low elasticity, which will immediately affect the Greek population's standard of living while containing the effects of foreign debt.

Another SFC model for the economy of Ecuador, adopting the three-sector (three balances) model, aims to examine the responses of the demand and supply of liquidity to the changes in the world price of oil and the changes in the exchange rate of Ecuador's competitors against the US dollar (Zezza and Zezza, 2019).

Kinsella and Aliti (2013) built a model for Ireland. They outlined the theoretical and technical issues associated with creating a SFC macroeconomic model for a small open economy like Ireland. Kinsella and Aliti (2012) used their SFC model for Ireland with the calibration method for parameter values to test alternatives to Ireland's austerity and assess the prospects for recovery. They show that a sharp, one-period reduction in public expenditure by 11.5% would lead to a decrease in the liabilities of Irish government securities other than shares of about 14%, with different effects like a decrease in household income reductions in consumption and a slowdown of growth. These results have been shown via Irish Financial Balance Sheet.

A SFC model of the Portuguese economy was developed by Sousa (2015). The model is a continuous time with endogenous money and an integrated financial sector. The work replicated the 2008-2013 events called the benchmark case. Then, they considered several changes in some variables and analysed the outcomes, comparing them with the benchmark

case. Several economic issues have been studied in the model, such as the trade-off between deficit reduction and GDP growth, the limited effect of looser credit standards on GDP growth in a small open economy, as in the case of Portugal, the effect of reduced sovereign interest rates in the government deficit or the ineffectiveness of cuts in government spending in achieving a deficit reduction. However, the model remains simple and has much room for improvement.

In a work in Austria, [Miess and Schmelzer \(2016\)](#) propose a model with a very detailed financial sector. They choose to calibrate parameters over the past period and then project during the simulation period. Like several other empirical SFC models for whole countries, the model Austria is then used for medium to long-term forecasting, scenario-based policy evaluation/simulation, and providing the basis for policy recommendations. This model is the first for Austria and among a few empirical SFC models internationally.

[Burgess et al. \(2016\)](#) developed a more complicated SFC model using national accounts data. Parameters are both calibrated and determined by econometric estimations. Several scenarios, including increases in banks' capital ratios, sudden stops, changes in investment, increases in house prices and fiscal expansions, are simulated with the model, which is considered a medium-term scenario analysis tool.

[Passarella \(2017\)](#) has built a medium-scale SFC dynamic model for the Italian economy using the theory-constrained but data-driven method. The model is inspired by [Godley and Lavoie \(2007b\)](#). The model then discusses alternative scenarios for Italian households' financial balance based on different government spending patterns. [Zezza and Zezza \(2020\)](#) developed a quarterly model for Italy with a detailed description of the private sector and the real and financial interactions between households, nonfinancial corporations, and banks.

The first version of the SFC model of Argentina was developed by [Valdecantos \(2012\)](#) in order to examine the macroeconomic performance of the developing country Argentina. The study tried to incorporate several important features in developing countries, such as credit constraints, high import elasticities, export-led growth strategies, exchange rate problems, and external debt. The work on Argentina has been pursued by [Valdecantos \(2020\)](#). The paper addresses to what extent the economic performance would have been better had other policy combinations been implemented. An empirical quarterly SFC model for the period 2007-2019 was developed for Argentina. The simulation results show that "the problem

keeping Argentina in stagflation goes beyond the domain of macroeconomics. In practice, two antagonistic macroeconomic programs were implemented, neither of them being able to produce a good and sustainable macroeconomic performance, is a first symptom that favours the case for that hypothesis". Another work on Argentina is by [Michelena and Guaita \(2019\)](#), who developed an empirical model based on a social accounting matrix previously built by [Michelena \(2019\)](#). The model intends to provide a benchmark for analysing economic performance under different economic policy scenarios and exogenous shocks. It consists of a single-good, open economy with five sectors (production, households, firms and banks, the government, and the rest of the world). The model provides an explicit description of price determination, the labour market, and portfolio choices. They analyse the effects of a negative exogenous shock in terms of trade and another shock where the growth of the rest of the world increases.

[Byrialsen and Raza \(2020\)](#) adopted the SFC approach to model the interdependencies between the real and financial sides of the economy in Denmark. The model is estimated using Danish data for the period 1995-2016. Then, they create a baseline scenario for the period 2017-2030 and simulate and analyse the effects of fiscal and interest rate shocks. Overall, the model can replicate the stylised facts of the Danish economy. The model structure explains several transmission mechanisms through which real economic behaviour can affect the balance sheets and simultaneously capture the feedback effects from the balance sheets to the real economy. A quarterly model for the Danish economy has been developed by [Byrialsen, Raza, and Valdecantos \(2022\)](#). The purpose of the model is always to build a platform for analysing the interdependencies between the real and financial sides of the economy with model parameters estimated using quarterly Danish data over the period 2005–2020. They use numerical model solving and compare the model results with the original data to ensure that the model can capture the economy's dynamics. They examine the effects of a standard shock on public spending and explore whether the economy's response is in line with what is predicted by the theory.

[Mazier and Reyes \(2022\)](#) developed an econometric SFC model of the French economy. The structure of the model is analogous to that of already existing national-level SFC models with demand-led dynamics, a Kaleckian accumulation behaviour and an indebtedness norm. A supply constraint results in a simple production function that determines potential output and allows for the computation of an output gap. The model provides examining of the effects

of unconventional monetary policy.

A mixed model of DSGE and SFC framework for South Africa has been published by [Makrelov et al. \(2020\)](#). South Africa's new SFC model is developed in which a financial sector with four financial instruments is integrated with the real sector. The paper analyses the implications of financial sector dynamics for fiscal expenditure multipliers in recessionary conditions. The fiscal policy will affect the economy through balance sheet effects. Higher government expenditure increases aggregate demand in the economy. Firstly, higher government expenditures contribute to reducing the perceived probability of default on financial institutions' loans, increasing asset valuations, and leading financial institutions to reduce interest rate spreads. Secondly, consumption grows due to the expectations of higher future wealth and a reduction in credit constraints. Thirdly, stronger balance sheets across institutions and lower interest rates increase investment. The positive relation between growth and balance sheet valuations creates financial accelerator effects through its impact on financial sector risk-taking.

[Escobar-Espinoza \(2016\)](#) has developed an applied SFC model for Colombia. The model is estimated using annual data for the last 15 years and follows the tradition of applied macroeconomic models developed by [Papadimitriou, Zezza, and Nikiforos \(2013\)](#). The author uses the model to explore the implications of alternative economic policies for Colombia.

[Le Héron and Yol \(2019\)](#) focus on the role of remittances, which contribute to the disposable income of the private sector in a small country, Moldova. They build a SFC model with parameters taken from other models in the literature or calibrated based on country data. The authors analysed the impact of a downturn in the income of destination countries of Moldova's migrants. The result simulations show the relevance of external shocks on household consumption and investment, with remittances being a major transmission channel.

[Raza et al. \(2019\)](#) develop a SFC model of Iceland to assess the role of the volatility of capital inflows for a small country with its own currency. The authors build on previous theoretical models for a small open economy already available in the literature. The model assumes explicitly that domestic banks also have foreign branches which attract foreign deposits. The authors use the model to simulate the consequences of a sudden stop in foreign lending and study the implications of introducing capital controls.

[Nalin and Yajima \(2020\)](#) built a SFC model, following the OPENFLEX model proposed by [Godley and Lavoie \(2007b\)](#), to empirically explore the balance sheet implications from

a theoretical perspective and theoretically analyse the exchange rate's role in Mexico's development for the period 2004–2019. The hypothesis was the balance sheet effect due to an increase in external debt in the non-financial corporate sector; higher foreign debt would affect private investment after episodes of real currency depreciation. They simulate the 2014 fall in the Mexican peso generated by the drop in oil prices to replicate stylised facts for Mexico for the period under investigation. They showed that currency undervaluation does not benefit investment, consumption, and output.

2.5.2 Developing empirical SFC models

The development of a "full empirical SFC model" certainly raises several methodological issues. However, only a few contributions cover the methodology for building an SFC empirical model for a whole country. [Passarella \(2019\)](#) shows how to develop a simple (medium-scale) empirical SFC dynamic model that enables accounting consistently for the evolution of financial stocks and flows across sectors. The pioneering theoretical work inspires by [Godley and Lavoie \(2007b\)](#). The model structure builds upon macroeconomic principles and available time series for macro variables rather than microeconomics' first principles.

Recently, [Zeza and Zeza \(2019\)](#) argued that the structure of an empirical SFC model should start from a careful analysis of the specificities of a country's sectoral balance sheets and flow of funds data, given the relevant research question at hand. It consists of a top-down approach. It is distinguished from a bottom-up approach, which starts with theoretical models and then selects country data to fit the theoretical model as close as possible. When building an empirical model, the first constraint is related to the availability and structure of the appropriate data. The paper shows how working with real-world data—flows can be consistently connected to stocks and deal with the data problem that emerges: "how to estimate a stock when only flow data are available, how to reconcile contradicting flows (such as estimates of net lending from different sources), and how to compute payments between sectors based on the available data for the stock of assets and liabilities of each sector". The second major contribution of this paper shows how to choose the level of detail and realism of the balance sheets of the various sectors since, in reality, every sector holds almost every asset and liability. The more assets one includes, the more realistic the model becomes and the more realistic features of an actual economy it can potentially capture. However, the model becomes more complicated and less intuitive.

In general, the development of an empirical SFC consists of five main steps (Nikolaïdi, 2017).

- Identify sectors/assets to be modelled
- Construct the stock matrix (balance sheet) and flow matrix of the economy
- Write down accounting identities (implied by the accounting)
- Write down behavioural equations (behaviour of the sectors)
- Simulation

After having the model, simulating an empirical SFC model usually will follow some steps as follows:

- Simulate the model
- Verify the redundant equation (model consistency) and fit it with the past data
- Check robustness of findings through sensitivity tests
- Create the baseline scenario
- Create alternative scenarios by shocking key coefficients and compare with baseline results

2.6 Conclusion

The present chapter introduced the methodology of SFC modelling and the general theoretical and empirical SFC literature. SFC modelling has three main characteristics. First, SFC models, including stocks and flows of the economy, are based on accounting consistency. Second, they consider both the real and financial side of the economy, and it also represents the main advantage of this approach. It includes the interactions between the real and financial sides, which are essential for the dynamic of the model showing path dependency. Finally, the closure or behavioural specifications, representing the behaviour of sectors in the economy, are post-Keynesian. This modelling approach is chosen in this thesis as it has several features above that will be appropriate in the context of Viet Nam, a small open economy and fully financially integrated into the global economy.

SFC models emerged in the last decade, especially after the GFC in 2008, as a popular methodological approach for researchers in macroeconomics. Theoretical SFC literature has grown up that attempts to address issues such as financialisation, open economies and policy. Although the empirical SFC literature is relatively large and varied, at the time of writing, few studies have developed for developing countries, especially none for Asian countries. Filling

this gap in the literature is one of our motivations for this research.

This chapter allows us to understand how to step-by-step develop an empirical SFC model for a whole country. It consists firstly of working with real data and coping with several issues to construct the accounting structure of the model adopting the standards of the SNA 2008. Secondly, the structure of the model will be designed with respect to SFC principles. Then, the closures of the model and behavioural specifications must respect the theoretical meaningfulness (economic theory) and take into account the structural characteristics of the economy. We are aware of the time-consuming of this approach to developing an empirical SFC model. It requires not only knowledge of economics but also national accounting principles and econometrics (Zezza and Zezza, 2019). However, we believe this model can allow us to address different subjects and become a useful macroeconomic analysis and policy simulation tool.

As mentioned above, the development of our model starts with the construction of the stock and flow matrices. Thus, the next chapter is devoted to the accounting structure for the SFC model for Viet Nam. Since there are not yet either stock accounts or non-financial accounts (transaction matrix) of institutional sectors, we have to "build from scratch" these matrices for our study. We follow international and national accounting system guidelines and collect data from different sources.

CHAPTER 3

Data and Accounting structure: Achievements and Limitations

3.1 Introduction

As mentioned in Chapter 2, the first step of developing an empirical SFC model is to construct the balance sheet and flow matrix. For most countries whose data are available, the balance sheet data are published in the financial accounts of institutional sectors. To the best of our knowledge, there are not yet institutional sector stock accounts or estimations of national wealth for the Vietnamese economy. Regarding the transaction flows data, a social accounting matrix (SAM) allows to capture of products and monetary (incomes and expenditures) flows of an economy in a year and respects the accounting consistency. The SAM methodology was introduced by Richard Stone ([Stone, 1986](#)) and was widely used for computable general equilibrium (CGE) models. As mentioned above, the CIEM, with the support of international organisations, constructed Vietnamese SAMs for the years 1999 ([Tarp et al., 2001](#)), 2000 ([Tarp, Henning, and Rand, 2004](#)), 2003 ([Henning and Finn, 2007](#)), 2007 ([Arndt et al., 2010](#)), 2011 ([Dang, Ho, and Tran, 2013](#)) and 2012 ([Dang et al., 2016](#)). However, these SAMs did not develop the details of financial institutions and transactions of agents' assets and liabilities.

Given that SFC models have to respect the accounting principles, in our model, we decide to rely on the international guidelines of the system of national accounts and collect the data from different sources to build the balance sheet and transaction flow matrix. The System of National Accounts, 2008 (SNA 2008) is a statistical framework that provides a comprehensive, consistent and flexible set of macroeconomic accounts for policymaking, analysis and research purposes. The SNA 2008 ([UN, 2009](#)) is intended for use by all countries, having been designed to accommodate the needs of countries at different stages of economic development. It also provides an overarching framework for standards in other domains of economic statistics, facilitating the integration of these statistical systems to achieve consistency with national accounts.

The aim of this chapter is twofold. Firstly, we attempt to explain how we base on SNA 2008

and the economic structure to develop the balance sheet and flow matrix and how to cope with two main issues that come up when combining different data sources. The first issue is about achieving the accounting consistency. [Zeza \(2018\)](#) proposed two strategies which may be adopted. The first solution could assume the sources which are measured more accurately, then add the discrepancy to other sources. The second solution is to treat the discrepancies as unexplained exogenous variables. However, such exogenous discrepancies projected for model simulations will increase the degree of arbitrariness of model projections. Another issue while dealing with data from different sources is how to estimate a stock when only flow data are available or how to compute payments between sectors based on the available data for the stock of assets and liabilities of each sector ([Zeza and Zeza, 2020](#)). Some simplification hypotheses are made to deal with this problem.

The second objective of this chapter, as the starting point for empirical SFC modelling, is a realist one - an understanding of the subject is to analyse some insights from the data, which will have implications for modelling the Vietnamese economy in the next chapter.

The outline of this chapter is as follows. After this introductory section, we first present some main principles of the SNA 2008 related to the sequence of national accounts and classification of institutional units in Section 3.2. Section 3.3 explains the data construction process. Section 3.4 shows some stylised facts from the data. Finally, Section 3.5 concludes this chapter.

3.2 National accounting

3.2.1 Stocks, flows and accounting rules

The SNA is a system of accounts designed to measure stocks and flows in the economy (SNA 2008). While stocks measure economic value at a point in time, flows measure changes in economic value over a period of time. Stocks appear on the balance sheets. The flow accounts in the full sequence of accounts for institutional sectors consist of the current accounts, which deal with production, income and use of income, and the accumulation accounts, which show all changes between two balance sheets. The accounting rules have been specified to ensure a consistent system. In other words, all flows must capture the changes in the value of stocks between two points in time.

Stocks are a holding of assets and liabilities at a point in time, recorded in a balance sheet compiled in respect of the beginning and end of the accounting period. Stocks result from the accumulation of flows during the period. According to the SNA, an asset is defined as a store of value representing a benefit or series of benefits accruing to the economic owner by holding or using the entity over a period of time. There are non-financial and financial assets. However, financial assets will have corresponding financial liability. A liability is defined as when the debtor is obliged to pay a payment or series of payments to the creditor.

SNA defined flows as the creation, transformation, exchange, transfer or extinction of economic value. Flows imply changes in the volume, composition, or value of an institutional sector's assets and liabilities. Economic flows consist of transactions and other flows. A transaction must be an interaction between institutional units. However, in reality, the value of an asset or a liability can be affected by other flows that do not realise between institutional sectors, such as the changes in value due to the price changes (revaluation effect).

The flows and stocks are grouped according to the classification hierarchy of the SNA. The sequence of accounts will be explained in detail in the following subsection. All entries in the accounts have to be measured in terms of money. Most business and government accounting refer to complete years. Flows and stocks must be recorded consistently with respect to the basic accounting framework of the SNA, which is quadruple accounting. Indeed, it is also the basic principle of SFC models.

In general, the SNA derives from broad bookkeeping principles. Three principles are as follows:

- (i) Vertical double-entry bookkeeping used in business accounting: each transaction leads to at least two entries, traditionally referred to as a credit entry and a debit entry. It implies that the total of all credit entries and that of all debit entries for all transactions are equal. Except for the revaluation flows, it will enter directly into changes in the net worth of the institutional sector. Regarding stocks, the total value of assets owned by an entity equals the total value of liabilities plus net worth. This principle allows us to check the consistency of accounts for a single unit.
- (ii) Horizontal double-entry bookkeeping: it represents the consistency between different institutional units (i.e. transaction by counterparties).
- (iii) Quadruple-entry bookkeeping results from both the vertical and horizontal double-entry

bookkeeping. Especially the SNA considers the rest of the world account as a pseudo-sector. The quadruple flows within the economy and with the rest of the world are completely balanced. The balance of payments accounts show the consolidated position of all domestic sectors relative to the rest of the world.

3.2.2 Sequence of accounts

As an economy is a general equilibrium system, all economic activities are interdependent, and all transactions between different institutional sectors are taking place continuously and simultaneously. Following the system of national accounting (SNA), the sequence of flow accounts representing economic activities within a given period of time (usually a year) is linked with the stock account - balance sheet, which records the stocks of assets and liabilities held by each institutional sector (Figure 3.1).

The flow accounts consist of current accounts and accumulation accounts. The sequence of current accounts shows how incomes are generated from production (and operating (generation of income) account), distributed (allocation of primary income account) and redistributed among institutional sectors (secondary distribution of income account), used by them for consumption and saving (use of income account). Saving allows the sector to accumulate both non-financial and financial wealth. The accumulation accounts, which consist of the capital account, financial account and revaluation account, record flows that affect the balance sheets of the sector. While the capital account represents the acquisitions and disposals of non-financial assets, the financial account records financial assets and liabilities. The financial account also shows how each sector finances its financing need, especially through financial intermediaries. Finally, the revaluation account records those changes in the values of assets and liabilities due to the changes in their prices.

In this chapter, we will describe each account's main items, which are also included in our accounting framework. Starting with the production account, the production process is defined as the activity that uses inputs (labour, capital and intermediate inputs) to produce outputs of goods and services. Gross value added is the value of output less the value of intermediate consumption. Thus, value-added represents the contribution of labour and capital to the production process.

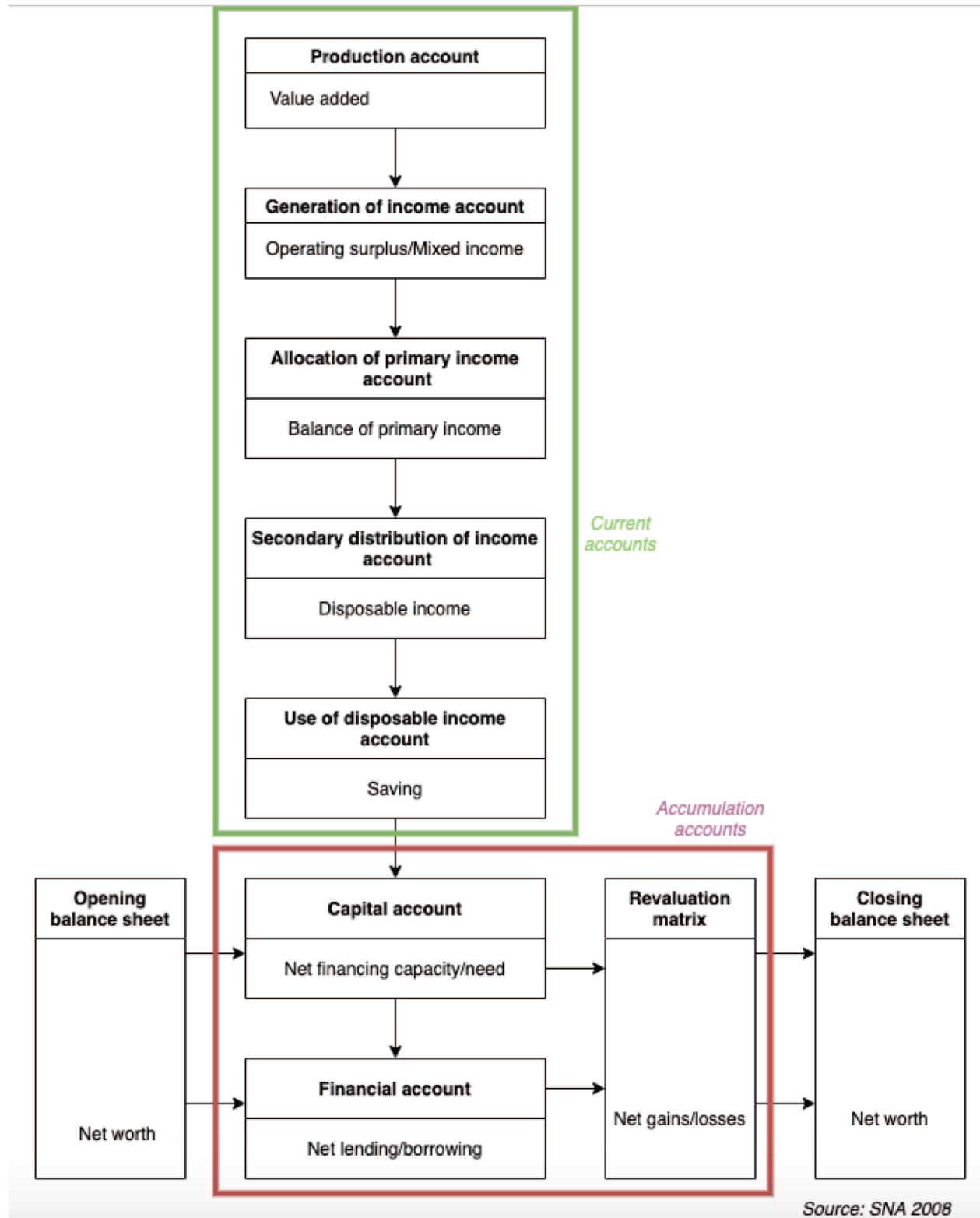


Figure 3.1: Sequence of accounts

According to the SNA 2008, the concept of gross domestic product (GDP) for the economy as a whole is that it should measure the total gross value added from all institutional units resident in the economy. It is related to the production measure of GDP. Indeed, GDP can be calculated by three approaches: production, expenditure and income. The production measure of GDP will include taxes on production. The generation of income account represents a further extension or elaboration of the production account, which records the uses of value added. The main charges of producers are compensation of employees payable to workers employed (wages), indirect taxes (taxes as a result of engaging in production), and labour contributions). After deducting different charges, we obtain the operating surplus or deficit accruing from production before considering any interest or charges related to financial assets/liabilities. Interest is a form of income receivable by the owners of certain kinds of financial assets, such as deposits and loans.

The secondary distribution (redistribution) of income account shows how an institutional sector's balance of primary incomes is transformed into its disposable income. This account consists of current transfers, which are transactions between institutional sectors. Three main kinds of current transfers are: (i) Current taxes on income, wealth, etc.; (ii) Social contributions and benefits; (iii) Other current transfers. The disposable income is the balancing item in the secondary distribution of the income account. It is the sum of the balance of primary incomes of an institutional sector and all current transfers receivable minus all current transfers payable by that sector. The allocation of disposable income of each sector between final consumption and saving will be recorded in their use of income account. The final consumption mainly takes place in the household and the government sector.

After the current accounts, we arrive at the accumulation accounts, which begin with the capital account. The capital account records transactions in non-financial assets, which implies changes in the values of assets held by institutional sectors. The financial account records transactions in financial assets and liabilities. The same convention is followed in the accumulation accounts. The sector's net financing capacity/need will correspond to that sector's net lending/borrowing position. If the amount is negative, it represents a financing need and net borrowing. It shows the amount of the resources remaining that need to be borrowed. As mentioned above, the effects of price changes are recorded in the revaluation account. These accumulation accounts impact the balance sheet by changing the net worth of an institutional sector from the beginning to the end of the accounting period.

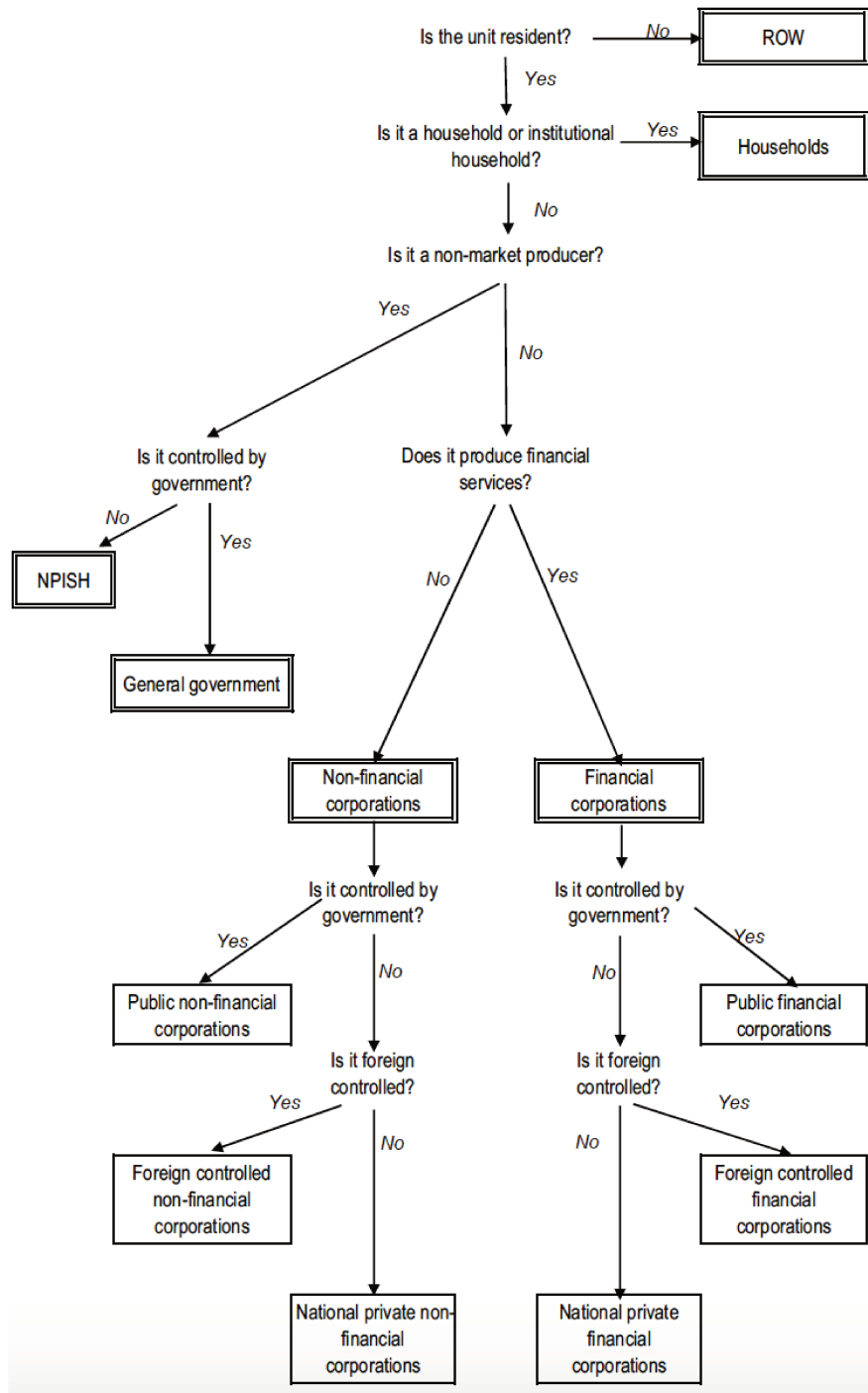
3.2.3 Institutional units

According to the definition of SNA, an institutional unit is defined as *"an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities"*. The SNA 2008 provides the conceptual basis for allocating a unit to the appropriate sector (Figure 3.2). The first notion is the residency of each institutional unit. The concept of economic territory in the SNA coincides with that of the BOP. Thus, we can use the data from the BOP for the rest of the world account. Once non-resident units/sectors are set aside, only resident sectors remain. Then, a question determines the household sector. The allocation continues with the unit being a market or non-market producer, controlled by the government and producing financial services. The government is unique with the principal functions of government of assuming responsibility for providing goods and services to the community, collecting taxes, and redistributing income. The financial sector consists of the central bank and other subsectors. The SNA 2008 defines the central bank as the national financial institution exercising control over key aspects of the financing system via monetary policies.

Following the classification and the availability of data, in our model, each resident institutional unit is classified into one and only one of these sectors:

- Non-financial corporations (Firms)
- Central Bank
- Commercial banks
- Government
- Households
- Rest of the World (ROW)

Non-financial corporations sector is principally engaged in producing market goods and non-financial services. It includes private corporations, cooperatives, and public producers. Commercial banks have the principal activity of production of financial services (financial intermediation and auxiliary financial activities). The government sector produces non-market services and redistributes income or wealth among different sectors. The household sector comprises consumers, individual entrepreneurs (market producers) and producers exclusively for their own final use. The rest of the world sector in our model includes non-resident transactions within our economy.



Source: SNA2008

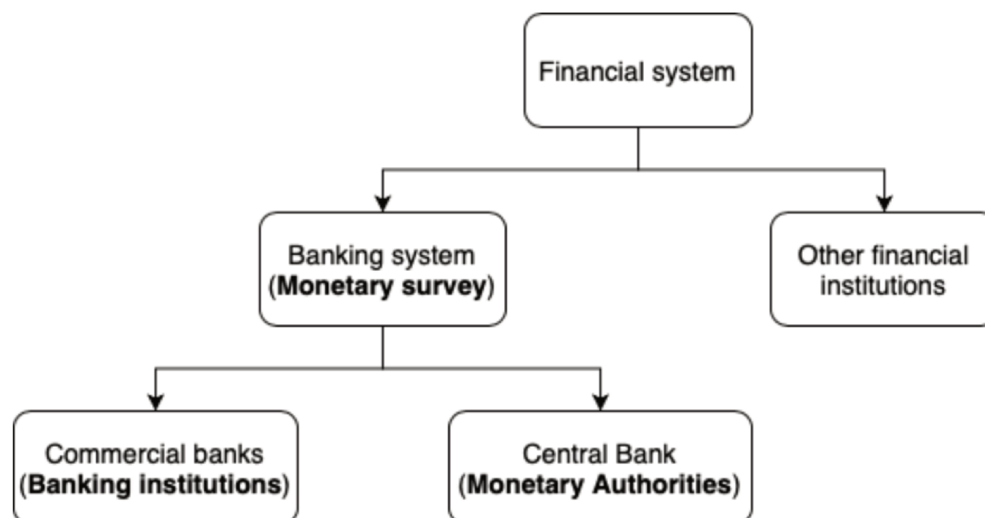
Figure 3.2: Classification of institutional sectors

3.3 Data

3.3.1 Balance sheet

Constructing the national balance sheet of our model is summarised in three main steps. First, we start with the balance sheet of the central bank and commercial banks. Then, we extend the balance sheet to other sectors based on the stock consistency principle explained in Chapter 2. Finally, we combine with other relevant financial instruments of sectors to obtain the national balance sheet.

We begin with the simplified balance sheet of the central bank and the commercial bank's sector by using the guidelines for the dataset of International Financial Statistics (IFS) and accounting principles. According to the IFS, the financial system consists of the banking system, which includes the Central bank and commercial banks and other financial institutions (Figure 3.3).



Source: SNA2008

Figure 3.3: Financial system structure

The financial sector intermediates and facilitates the resources flowing across economic sectors. It plays, to some extent, the role of a bridge between sectors in the economy. The financial sector creates saving vehicles that allow for the intertemporal allocation of consumption and money which has not been spent. It creates credit instruments for the investment. Financial

flow reflects the flow of real resources in the economy. The data of the banking system is the monetary survey of the IFS. Monetary statistics accounts are critical for analysing monetary conditions and formulating and implementing monetary policy. In other words, the link between the monetary sector and other economic sectors plays a vital role in the monetary policy design. The financial system has two components: one is associated with commercial banks named "Banking institutions" and one associated with the central bank named "Monetary Authorities".

According to the IMF, statistics are collected based on economic objectives, functions and behaviour. Thus, some functions of the central bank impact its balance sheet.

- Issuing of currency
- regulating the money supply (monetary policy)
- acting as the banker of the government
- holding the country's foreign reserves (exchange rate policy)

The simplified balance sheet of the central bank, according to the IFS dataset, is defined as follows:

Table 3.1: Central Bank's balance sheet

Assets	Liabilities
Domestic credit to government (L_{CB}^G)	Currency (C)
Domestic credit to commercial banks (L_{CB}^B)	Commercial bank deposits in Central bank (D_B^{CB})
Foreign reserves in Central bank (R_{CB})	

Currency item (C) is the amount of currency issued by the central bank. The domestic credit to the government (L_{CB}^G) represents the role of the central bank as the banker of the government. The domestic credit to commercial banks (L_{CB}^B) and the commercial bank deposits in the central bank (D_B^{CB}) allow control of the money supply. Finally, the foreign reserves held by the central bank (R_{CB}) contribute to the exchange rate policy.

The same convention is followed for the commercial banks sector. Their balance sheet reflects their functions (Table 3.2). Banks facilitate savings by offering deposits (T). Banks provide loans (L_B^P) to other sectors of the economy. That is why it represents an asset for banks. Commercial banks are an important channel transmission of monetary policy (D_B^{CB}).

Table 3.2: Commercial banks' balance sheet

Assets	Liabilities
Domestic credit to private sector (L_B^P)	Domestic credit from Central bank to banks (L_{CB}^B)
Foreign reserves in commercial banks (R_B)	Time deposits (T)
Commercial bank deposits in Central bank (D_B^{CB})	

To obtain the simplified balance sheet of the banking system, we add the simplified balance sheet of the central bank and commercial banks. It gives as follows:

$$L_{CB}^G + L_{CB}^B + R_{CB} + L_{CB}^P + R_B + D_B^{CB} = C + D_B^{CB} + L_{CB}^B + T$$

$$\rightarrow L_{CB}^G + L_B^P + R_{CB} + R_B = C + T$$

Then, we get :

$$\text{Net domestic credit from banking system (Net domestic assets)} = L_{CB}^G + L_B^P = L$$

Foreign reserves (Net foreign assets) = $R_{CB} + R_B = R$ (In the IFS, all foreign-currency-denominated assets and liabilities are converted into domestic currency units at market exchange rates.)

$$\text{Money supply} = C + T = M$$

Therefore, by definition, money is equal to the sum of domestic credit from the banking system and foreign reserves in the banking system.

Table 3.3: Banking system's simplified balance sheet

Assets	Liabilities
Domestic credit to domestic (L)	Money supply (M)
Foreign reserves (R)	

To extend to other sectors from the balance sheet of the central bank and commercial banks, we mainly use two technical solutions, which are *counterpart* and *residual* data. Both of them

lead to making simplified assumptions about creditors and debtors (from-whom-to-whom) of a financial instrument. It implies that for each financial instrument, the sum of the net acquisitions (including those of the rest of the world) must equal the sum of the net incurrence of liabilities. If data are unavailable, the accounting identity can give a residual sector, which ensures the total balance of the transactions or stocks in a financial asset/liability.

In order to compile financial statistics for all sectors of the economy, we need to use different macroeconomic data sources and other administrative records, survey data, and market data outside the aggregated macroeconomic database. However, these data for financial statistics usually only cover some flows and stocks for financial instruments and institutional sectors. The financial instruments of the balance sheet of the financial system above include International reserves (R), Cash (C), Banks' reserves (R_B), Deposits (T), Advances (D_B^{CB}) and Loans (L). Based on the macroeconomic analysis in Chapter 1 related to the balance of payments and the financial development of Viet Nam, we add some relevant financial instruments (Bonds, Foreign Loans, Equity and Foreign Direct Investment) for the economy to obtain the national balance sheet.

Table 3.4 represents the simplified balance sheet of Viet Nam. We change the notations for financial instruments to harmonise with that of variables in our model in the next chapter. The positive sign means an asset, and the negative one means a liability of the sector holder. The difference between assets and liabilities gives the net worth of the institutional sector. As mentioned above, according to the stock consistency principle, for each financial instrument, the sum of the value of assets should be equal to that of liabilities. As a consequence, the total net worth of the economy is equal to the value of the non-financial assets.

Regarding the *non-financial assets*, we distinguish the public and private capital stock. Then in private capital stock, we try to separate the capital stock of firms and that of households. We suppose that only firms accumulate inventories. In our model, the value of non-financial assets should evolve according to the perpetual inventory method. It means that the value of the current period (K_t) is defined by cumulating flows (I_t) to the value of the previous period (K_{t-1}) and adjusting for the depreciation of capital (δK_{t-1}) and the variation of capital prices ($\Delta p_K * k_t$).

$$K_t = K_{t-1} + I_t - \delta K_{t-1} + \Delta p_K * k_t$$

Regarding the variable *Inventories*, there is no data on the initial stock. We set it to 0 in 1987, just before the first available point in the database of the World Bank. Then, the stock

Table 3.4: Theoretical Balance Sheet of Viet Nam

	<i>Firms</i>	<i>Central Bank</i>	<i>Banks</i>	<i>Government</i>	<i>Households</i>	<i>RoW</i>	<i>Total</i>
Non-financial assets	$p_K k^f$			$p_K k^g$	$p_K k^h$		$p_K k$
Inventories	$p_{K_{12}} k_{12}$						$p_{K_{12}} k_{12}$
Intl. reserves		$RES_{us}xr$				$-RES_{us}xr$	0
Cash		$-H$			H		0
Bank's Reserves		$-MB^{cb}$	MB^{cb}				0
Governments's Deposits		$-GM^{cb}$	$-GM^b$	GM			0
Dong Deposits	DM^f		$-DM$		DM^h		0
Foreign deposits	$FM_{us}^f xr$			$FM_{us}^g xr$	$FM_{us}^h xr$	$-FM_{us} xr$	0
Bonds		B^{cb}	B^b	$-B$	B^h		0
Advances		LB^{cb}	$-LB^{cb}$				0
Loans	$-L^f$		L		$-L^h$		0
Foreign loans	$-FL_{us}^f xr$		$-FL_{us}^b xr$	$-FL_{us}^g xr$		$FL_{us} xr$	0
Equity	$-p_E E^f$		$-p_E E^b$		$p_E E^h$	$p_E E^r$	0
Foreign direct investment	$-p_{FDI} FDI_{us} xr$					$p_{FDI} FDI_{us} xr$	0
Other accounts r/p*	OTA^f	OTA^{cb}	OTA^b	OTA^g	OTA^h	OTA^r	0
Net Wealth	NW^f	NW^{cb}	NW^b	NW^g	NW^h	NW^r	$p_K k + p_{K_{12}} k_{12}$

*r/p: receivable/payable

of inventories (K_{12t}) is constructed following the perpetual inventory method. Moreover, we suppose that there is no depreciation in inventories.

$$K_{12t} = K_{12t-1} + i_{12t} + \Delta p_{INV} * K_{12t-1}$$

Non-financial assets are taken from The Investment and Capital Stock Dataset, International Monetary Fund.

International reserves are taken from International Financial Statistics. The central bank is supposed to hold all international reserves.

Cash is taken from International Financial Statistics as currency outside banking institutions. We suppose that households hold cash provided by the central bank.

Bank's Reserves come from International Financial Statistics. It means the reserves which commercial banks must hold in the form of deposits in the central bank.

Governments's Deposits are taken from International Financial Statistics. The government can have deposits at the central bank and commercial banks.

Dong Deposits are reported in the database of the SBV. In the Vietnamese economy, firms and households hold deposits in domestic currency in commercial banks.

Foreign deposits are obtained from International Financial Statistics. The data shows that both firms and government have foreign currency deposits in commercial banks.

Bonds are derived from International Financial Statistics. For simplicity, we suppose that government bonds are mainly held by commercial banks and the central bank.

Advances are taken from International Financial Statistics - Banking Institutions accounts. It means the credit from monetary authorities to commercial banks.

Loans come from International Financial Statistics - Account of banking institutions. It corresponds to the variable "Claims on Private Sector". We suppose that Vietnamese commercial banks provide loans for the private sector, which combines firms and households. However, household debt is obtained from the report of South East Asian Central Banks.

Foreign loans are derived from three main sources: Bank for International Settlements (BIS), World Development Indicators, World Economic Outlook and Lane-Milesi-Ferretti database (LMF). In our model, for simplicity, we suppose that firms, government and banks borrow from abroad. The BIS consists of data on assets and liabilities reported by banks vis-à-vis residents of other countries (banks and nonbanks). The foreign loans of the government are taken from the World Bank database.

Equity are taken from several sources. Equities issued by firms are reported on the Ho Chi Minh Stock Exchange. Bank's equities are derived from International Financial Statistics. We suppose that all equities in the economy are held by households and the foreign sector, which is considered the portfolio investment.

Foreign direct investment stock and flow are obtained from the United Nations conference for trade and development (UNCTAD).

The flow matrix in our model consists of the uses-resources table, which records non-financial transactions (Table 3.5), and the flow of funds which records financial transactions (Table 3.6).

3.3.2 Uses-resources table

In the uses-resources table, the plus sign denotes the sources of funds (inflows), and the minus one is for uses of funds (outflows). The horizontal flow consistency implies that for each type of transaction, the sources have to correspond to the uses of funds. In other words, the sum of each transaction row is equal to zero. In addition, the vertical flow consistency requires that the sum of each column of the table is also equal to zero. It means that the net financing capacity/need leads to the changes in different financial assets held by each institutional sector.

Input data for the uses-resources table are taken from the main sources as follows:

- i) The Social Accounting Matrix and the Input-Output tables for the years 1997, 2000, 2003, 2007, 2012, and 2015 were developed by GSO, CIEM and other international organisations.
- ii) The integrated economic accounts (IEA) published by GSO (1995-2002)
- iii) The State budget revenue and expenditure from the Ministry of Finance (MOF)
- iii) The State Bank of Viet Nam (SBV) dataset
- iv) The World Development Indicators (WDI)
- v) The International Financial Statistics (IFS)
- vi) The Balance of Payments from IMF. We note that the rest of the world account records the same transactions as the balance of payments. However, this account records from the perspective of the rest of the world, while the balance of payments records from the perspective of residents.

At the top of the uses-resources table, we represent all trade transactions, which consist of exports and imports. Then, we pass to all remaining accounts of the sequence of flow accounts. The value of exports and imports is taken from GSO. The export and import price are calculated from the nominal value of exports and imports (at current prices) and the volume of exports and imports (at a constant price in 2010).

We start with the production account, which shows the output of domestic production and inputs to it (intermediate consumption). The balancing item in the production account is the gross value-added. We have to estimate the serie of gross value-added from GDP. By

definition, GDP can be obtained by three approaches (SNA 2008).

- Demand approach: GDP is defined as the sum of household consumption, current government expenditures, private and public investment, net exports and changes in inventories.
- Income approach: GDP is defined as the sum of the income earned by all the factors of production in an economy, including the wages paid to the households, gross operating surplus, interest payments and taxes received by the government.
- Production approach: GDP is defined as the total value of economic output and deducts the cost of intermediate goods and the taxes on production.

Thus, the value-added is given by:

$$VA = GDP - TOP \quad (3.1)$$

where TOP are taxes on production (indirect taxes).

In order to obtain the value-added of each institutional sector, we have to base on the GDP by types of ownership and kinds of economic activity. We implicitly assume that financial services and public services are associated with the commercial banks sector and the government, respectively. The remaining sectors are produced by the private sector combining firms and households. The value-added of the household sector is taken from the GSO. The firm's sector is determined as a residual. The intermediate consumption and the output are deduced based on the SAMs.

We then pass to the operating account, which represents the contribution of labour and capital to the production process. This account indicates that the incomes of each sector are a consequence of their involvement in the production process. For example, wages and income from abroad are received by households in return for their labour input. The distribution of capital appears in the form of gross operating surplus or mixed income. Wages are deduced from the cell of value added by a factor of production - labour in the SAMs. Income from abroad is based on the balance of payments. Taxes variables are derived from the State Budget and the WDI.

The allocation of primary income account records the capital incomes paid and received by the various institutional sectors, which depend on their asset/liability structure. It includes interest payments and dividends from investments. The balancing item of this account is the

primary income balance. Because we do not have all financial flow data, interest payments are mainly derived from the stock data and the interest rate. The lending rate and deposit rate are taken from the IFS. The refinancing rate is the monetary policy-related interest rate. Given that interest payments of each period (INT_t) are generated by stocks of assets at the end of the previous period, it is determined by multiplying the interest rate relevant in the period t (r_t) by the stock of assets of $t - 1$ (A_{t-1}).

$$INT_t = r_t * A_{t-1}$$

The redistribution of income account is calculated by adding to and subtracting direct taxes (income taxes, profit taxes), social benefits and other current transfers from private to abroad and from abroad to public/private sectors to the primary income. Then, we get to the gross disposable income of each sector. Direct taxes and government transfers are taken from MoF's data on the State budget. The uses of income account shows how each agent uses their disposable income for current consumption and get the gross saving. Final consumption, investment, and changes in inventories come from GSO. The price of these elements is deduced from the nominal values and the volume variables.

Finally, the capital account in the sequence of accounts records the acquisition of non-financial assets through investments (in fixed capital and inventories). The balancing item of this account represents the Net financing capacity of the sector. We distinguish in this uses-resources table the current public expenditure, which is the government consumption, and the public investment, which corresponds to the net acquisition of non-financial assets.

Table 3.5: Theoretical Uses-resources table + flow of funds

	<i>Firms</i>	<i>Central Bank</i>	<i>Banks</i>	<i>Government</i>	<i>Households</i>	<i>RoW</i>	<i>Total</i>
Imports						$p_{IM}im$	$p_{IM}im$
Exports						$-p_x x$	$-p_x x$
Trade balance (X - IM)							$-TB$
Production	$p_y q^f$		$p_y q^b$	$p_y q^g$	$p_y q^h$		$p_y q$
Intermediate Consumption	$-\theta^f p_y v a^f$		$-\theta^b p_y v a^b$	$-\theta^g p_y v a^g$	$-\theta^h p_y v a^h$		$-p_y i c$
Value added	$p_y v a^f$		$p_y v a^b$	$p_y v a^g$	$p_y v a^h$		$p_y v a$
Wages + Compensation from abroad	$-\lambda^f w N$		$-\lambda^b w N$	$-\lambda^g w N$	$-\lambda^h w N$	$-WB^r$	0
Labor/social contributions	$-\alpha^f W B^f$		$-\alpha^b W B^b$	$-\alpha^g W B^g$	$-\alpha^h W B^h$	$+wN + WB^r$	0
Indirect taxes (VAT included)	$-\tau^r p_{IM} im$			$\tau^r p_{IM} im + TOP$			TOP
Gross operating surplus	F^f		F^b	F^g	F^h		FT
Interest on gov deposits		$-r_m G M_{-1}^{cb}$	$-r_m G M_{-1}^b$	$r_m G M_{-1}$			0
Interest on deposits	$r_m D M_{-1}^f$		$-r_m D M_{-1}$		$r_m D M_{-1}^h$		0
Interest on bonds		$r_b B_{-1}^{cb}$	$r_b B_{-1}^b$	$-r_b B_{-1}$	$r_b B_{-1}^h$		0
Interest on advances		$r_i^{cb} L B_{-1}^{cb}$	$-r_i^{cb} L B_{-1}^{cb}$				0
Interest on loans	$-r_l L_{-1}^f$		$r_l L_{-1}^b$		$-r_l L_{-1}^h$		0
Interest on foreign loans	$-r_{fl} F L_{us-1}^f x r_{-1}$		$-r_{fl} F L_{us-1}^b x r_{-1}$	$-r_{fl} F L_{us-1}^g x r_{-1}$		$r_{fl} F L_{us-1} x r_{-1}$	0
Dividends	$-\phi F_{-1}^f$					ϕF_{-1}^f	0
Central Bank's profits		$-F^{cb}$		F^{cb}			0
Primary income balance	$Y P^f$		$Y P^b$	$Y P^g$	$Y P^h$		$Y P$
Income taxes	$-\tau^f Y P_{-1}^f$		$-\tau^b Y P_{-1}^b$	DT	$-\tau^h Y P_{-1}^h$		0
Social benefits				$-\gamma_{SBE} Y P^h$	$\gamma_{SBE} Y P^h$		0
Cur. tr. from abroad (public)				$T R_g^r$		$-T R_g^r$	0
Cur. tr. to abroad (private)					$-T R_p^r$	$T R_p^r$	0
Cur. tr. from abroad (private)					$T R_p^r$	$-T R_p^r$	0
Gross disposable income	$Y D^f$		$Y D^b$	$Y D^g$	$Y D^h$		$Y D$
Consumption					$-p_c c$		$-p_c c$
Public current expenditure				$-p_c g$			$-p_c g$
Gross savings	S^f		S^b	S^g	S^h		S
Gross fixed capital formation	$-p_K i^f$			$-p_K i^g$	$-p_K i^h$		$-p_K i$
Changes in inventories	$-p_{\kappa_{12}} i_{12}^f$						$-p_{\kappa_{12}} i_{12}$
Net fin. capacity	NFC^f	0	NFC^b	NFC^g	NFC^h	NFC^r	0

3.3.3 Flow of funds

The flow of funds account describes the transactions in assets. It shows how each sector allocates its financing capacity of finances its financing needs. In contrast to the uses-resources table, the signs attached to the ‘flow of funds’ entries are counter-intuitive. The negative sign represents the acquisition of a financial asset cumulating to the existing stock of assets. The

positive sign represents the acquisition of liabilities.

For some flow components, it relies on period-to-period changes in the stock or from-whom-to-whom assumptions when flow data are not available. There is a mismatch between Net financing capacity, calculated from the real side, and Net lending/borrowing, calculated from the stock data. This discrepancy could be explained by the difficulties of measuring and obtaining the data related to the financial market. We add residual variables "Other accounts r/p" to solve this issue.

Table 3.6: Flow of funds

	<i>Firms</i>	<i>Central Bank</i>	<i>Banks</i>	<i>Government</i>	<i>Households</i>	<i>RoW</i>	<i>Total</i>
Net fin. capacity	NFC^f	0	NFC^b	NFC^g	NFC^h	NFC^r	0
Δ val. in Intl. reserves		$-\Delta RES_{us}xr$				$\Delta RES_{us}xr$	0
Δ val. in Cash		ΔH			$-\Delta H$		0
Δ val. in Bank's Reserves		ΔMB^{cb}	$-\Delta MB^{cb}$				0
Δ val. in Gov's Deposits		ΔGM^{cb}	ΔGM^b	$-\Delta GM$			0
Δ val. in Dong Deposits	$-\Delta DM^f$		ΔDM		$-\Delta DM^h$		0
Δ val. in Foreign deposits	$-\Delta FM_{us}^f xr$			$-\Delta FM_{us}^g xr$	$-\Delta FM_{us}^h xr$	$\Delta FM_{us} xr$	0
Δ val. in Bonds		ΔB^{cb}	ΔB^b	ΔB	ΔB^h		0
Δ val. in Advances		$-\Delta LB^{cb}$	ΔLB^{cb}				0
Δ val. in Loans	ΔL^f		$-\Delta L$		ΔL^h		0
Δ val. in Foreign loans	$\Delta FL_{us}^f xr$		$\Delta FL_{us}^b xr$	$\Delta FL_{us}^g xr$		$-\Delta FL_{us} xr$	0
Δ val. in Equity	$p_E \Delta E^f$		$p_E \Delta E^b$		$-p_E \Delta E^h$	$-p_E \Delta E^r$	0
Δ val. in FDI	$p_{FDI} \Delta FDI_{us} xr$					$-p_{FDI} \Delta FDI_{us} xr$	0
Δ val. in Other accounts r/p ^(**)	ΔOTA^f	ΔOTA^{cb}	ΔOTA^b	ΔOTA^g	ΔOTA^h	ΔOTA^r	0
Net lending/Borrowing	NLP^f	0	NLP^b	NLP^g	NLP^h	NLP^r	0

(**) The term Changes in other accounts r/p is used to balance the difference between Net financing capacity, which is calculated from the real side, and Net lending/borrowing, which is calculated from the stock data

3.3.4 Integration of matrices

The following table shows the integration of the balance sheet, the changes in values of assets/liabilities of each sector due to flows from the previous period to the current period and the revaluation effects due to the price variation.

The first row represents the initial net wealth of each institutional sector which corresponds to that of the previous period. The net wealth at the end of the current period is given by adding to the beginning net wealth the change in assets/liabilities from transactions and the

change from revaluations. Each sector can raise its net wealth by acquiring non-financial or financial assets. We assume p_K - the price of tangible capital, and we do not distinguish between public and private capital for simplification. $p_{K_{12}}$ is the price of inventories.

In our model, regarding the financial assets, we assume that the prices of equities issued by firms and commercial banks can change. For other assets, mainly in foreign currency, the revaluation effects come from the change in the exchange rate. Specifically, the change in the value of FDI is made up of a change in price and exchange rate. For the sake of simplicity and given that the dollar stays dominant in foreign transactions, we consider the exchange rate of the US Dollar to the Vietnamese Dong in our model.

Table 3.7: Full-integration matrix

	<i>Firms</i>	<i>Central Bank</i>	<i>Banks</i>	<i>Government</i>	<i>Households</i>	<i>RoW</i>	<i>Total</i>
Previous net wealth	NW_{t-1}^f	NW_{t-1}^{cb}	NW_{t-1}^b	NW_{t-1}^g	NW^h	NW_{t-1}^r	$\mathbf{p}_{K_{t-1}} \mathbf{k}_{t-1}$
Non-financial assets	$p_K \Delta k^f$			$p_K \Delta k^g$	$p_K \Delta k^h$		$p_K \Delta k$
Inventories	$p_{K_{12}} \Delta k_{12}$						$p_{K_{12}} \Delta k_{12}$
Intl. reserves		$-\Delta RES_{us,xt}$				$\Delta RES_{us,xt}$	0
Cash		ΔH			$-\Delta H$		0
Bank's Reserves		ΔMB^{cb}	$-\Delta MB^{cb}$				0
Gov's Deposits		ΔGM^{cb}	ΔGM^b	$-\Delta GM$			0
Dong Deposits	$-\Delta DM^f$		ΔDM		$-\Delta DM^h$		0
Changes in assets from transactions							
Foreign deposits	$-\Delta FM_{us,xt}^f$			$-\Delta FM_{us,xt}^g$	$-\Delta FM_{us,xt}^h$	$\Delta FM_{us,xt}$	0
Bonds		ΔB^{cb}	ΔB^b	ΔB	ΔB^h		0
Advances		$-\Delta LB^{cb}$	ΔLB^b				0
Loans	ΔL^f		$-\Delta L$		ΔL^h		0
Foreign loans	$\Delta FL_{us,xt}^f$		$\Delta FL_{us,xt}^b$	$\Delta FL_{us,xt}^g$		$-\Delta FL_{us,xt}$	0
Equity	$p_E \Delta E^f$		$p_E \Delta E^b$		$-p_E \Delta E^h$	$-p_E \Delta E^r$	0
FDI	$p_{FDI} \Delta FDI_{us,xt}$					$-p_{FDI} \Delta FDI_{us,xt}$	0
Other accounts r/p	ΔOTA^f	ΔOTA^{cb}	ΔOTA^b	ΔOTA^g	ΔOTA^h	ΔOTA^r	0
Revaluation							
Non-financial assets	$k_{t-1}^f \Delta p_K$			$k_{t-1}^g \Delta p_K$	$k_{t-1}^h \Delta p_K$		$k_{t-1} \Delta p_K$
Inventories	$k_{12,t-1} \Delta p_{K_{12}}$						$k_{12,t-1} \Delta p_{K_{12}}$
Intl. reserves		$RES_{us,t-1} \Delta x$				$-RES_{us,t-1} \Delta x$	0
Foreign deposits	$FM_{us,t-1}^f \Delta x$			$FM_{us,t-1}^g \Delta x$		$-FM_{us,t-1} \Delta x$	0
Foreign loans	$-FL_{us,t-1}^f \Delta x$		$-FL_{us,t-1}^b \Delta x$	$-FL_{us,t-1}^g \Delta x$		$FL_{us,t-1} \Delta x$	0
Equity	$-E_{t-1}^f \Delta p_E$		$-E_{t-1}^b \Delta p_E$		$E_{t-1}^h \Delta p_E$	$E_{t-1}^r \Delta p_E$	0
FDI	$-FDI_{us,t-1} (x_{t-1} \Delta p_{FDI} + p_{FDI,t-1} \Delta x)$					$FDI_{us,t-1} (x_{t-1} \Delta p_{FDI} + p_{FDI,t-1} \Delta x)$	0
Net Wealth	NW^f	NW^{cb}	NW^b	NW^g	NW^h	NW^r	$\mathbf{p}_K \mathbf{k} + \mathbf{p}_{K_{12}} \mathbf{k}_{12}$

3.3.5 Input-Output table

Considering the research questions in the next part of this thesis, it is necessary to disaggregate the production account into the different sectors. It allows analysing of the sectoral composition of the economy. The details of the production, especially the intermediate consumption, will be represented through the technical coefficient matrix, which shows the interlinkages between productive sectors such as agriculture, energy, industry, financial services, public services and non-financial services.

Table 3.8: Example of production account by activity

	<i>Agriculture</i>	<i>Energy</i>	<i>Industry</i>	<i>Fin. services</i>	<i>Pub. services</i>	<i>Non-fin. services</i>	<i>Total</i>
Production	$p_{QI_{AGR}}$	$p_{QI_{ENER}}$	$p_{QI_{IND}}$	$p_{QI_{FIN}}$	$p_{QI_{GOV}}$	$p_{QI_{SER}}$	p_{QI}
Intermediate Consumption	$p_{ICiC_{AGR}}$	$p_{ICiC_{ENER}}$	$p_{ICiC_{IND}}$	$p_{ICiC_{FIN}}$	$p_{ICiC_{GOV}}$	$p_{ICiC_{SER}}$	p_{ICiC}
Value added	$p_{YVA_{AGR}}$	$p_{YVA_{ENER}}$	$p_{YVA_{IND}}$	$p_{YVA_{FIN}}$	$p_{YVA_{GOV}}$	$p_{YVA_{SER}}$	p_{YVA}

The simplified Input-Output table (Table 3.9) is a “sector-by-sector” table. It shows the flows of intermediate goods between sectors. The “sector” in our model represents the type of goods and services produced by the producers, which can be the private sectors (firms, banks, households) or the government.

Table 3.9: Intermediate consumptions

	Agriculture	Energy	Industry	Fin. services	Pub. services	Non-fin. services
	(1)	(2)	(3)	(4)	(5)	(6)
Agriculture (1)	IC_{11}	IC_{12}	IC_{13}	IC_{14}	IC_{15}	IC_{16}
Energy (2)	IC_{21}	IC_{22}	IC_{23}	IC_{24}	IC_{25}	IC_{26}
Industry (3)	IC_{31}	IC_{32}	IC_{33}	IC_{34}	IC_{35}	IC_{36}
Fin. services (4)	IC_{41}	IC_{42}	IC_{43}	IC_{44}	IC_{45}	IC_{46}
Pub. services (5)	IC_{51}	IC_{52}	IC_{53}	IC_{54}	IC_{55}	IC_{56}
Non-fin. services (6)	IC_{61}	IC_{62}	IC_{63}	IC_{64}	IC_{65}	IC_{66}

Then, Table 3.10 represents the input coefficients for each activity sector. It represents the scale of each sector used to contribute to the production in other sectors. a_{ij} is defined as the input of sector i required to produce one unit of production of sector j . This coefficient is

determined by dividing the intermediate consumption of sector i by the production of sector j .

$$a_{ij} = \frac{IC_{ij}}{p_Q q_j}$$

Table 3.10: Input coefficients

	Agriculture	Energy	Industry	Fin. services	Pub. services	Non-fin. services
	(1)	(2)	(3)	(4)	(5)	(6)
Agriculture (1)	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	a_{16}
Energy (2)	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	a_{26}
Industry (3)	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	a_{36}
Fin. services (4)	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}	a_{46}
Pub. services (5)	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	a_{56}
Non-fin. services (6)	a_{61}	a_{62}	a_{63}	a_{64}	a_{65}	a_{66}

3.4 Dynamics of sectoral financial balances and wealth accumulation

3.4.1 Sectoral financial balances

Three financial balances

As mentioned in Chapter 2, the "three financial balances" approach pioneered by Wynne Godley allows us to analyse the implications of different components of aggregate demand in terms of the financial balances of the leading institutional sectors to economic growth. We consider three sectors: the private sector (firms, commercial banks and households), the government sector and the external sector. The accounting identity is given by:

$$PB = GB + BP$$

where PB is the net acquisition of financial assets of the private sector as a whole; GB is the government deficit, and BP is the external balance.

Figure 3.4 shows our estimates for the three financial balances in the economy. A downward trend in the financial balance represents the contribution of that sector to aggregate demand.

The private sector, which combines firms, banks and households, had a positive financing capacity corresponding to the government financing need and the current account. Over the period 2006-2009, the private sector balance turned negative and was mirrored by an increase in the external balance. Since 2010, the private sector balance has turned positive, meaning that the private sector has become a net borrower against the rest of the world. The government has remained negative, and the external balance has deteriorated. In other words, public expenditures and investments consistently contributed to economic growth.

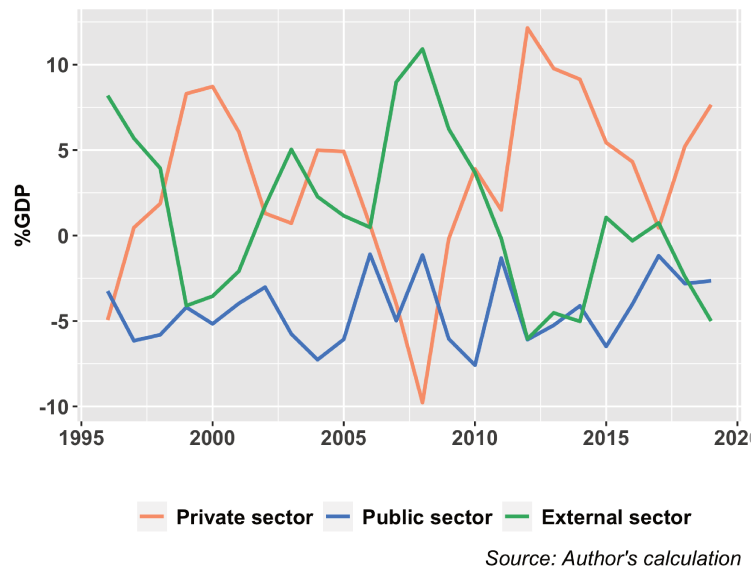


Figure 3.4: Three financial balances, %GDP

Private sector balance

We turn to examine the detailed financial balance of the private sector and its determinants which are also GDP components. The investment of firms increased before 2008, which led to a negative financial balance in the sector. The same evolution was observed in the household's investment. During the banking crisis in 2011-2012, there was a decline in the financing capacity of the banks. Household consumption was also high before 2006, then reduced due to the global financial crisis and the banking crisis. The financing capacity during these periods turned positive. Households re-increased their consumption from 2014 and implied a fall in their financial balance.

External Balance

The external imbalances reflect the financing need of the economy to fund domestic consump-

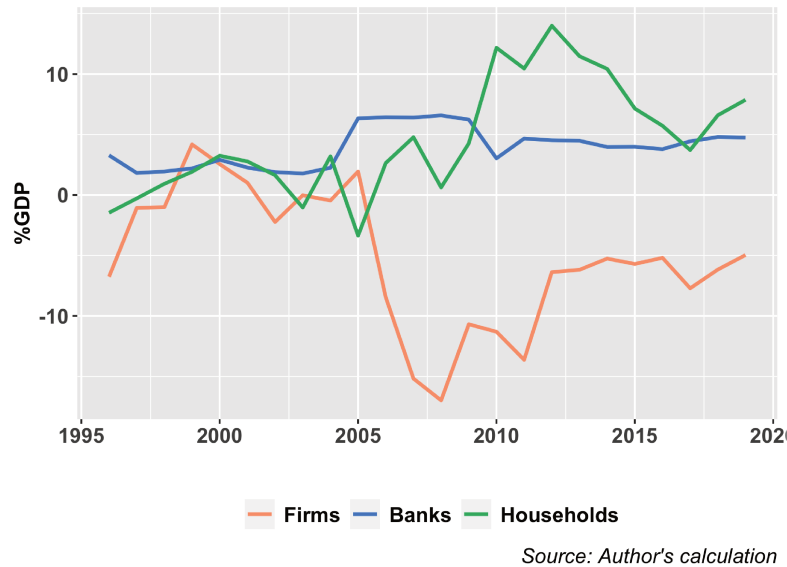
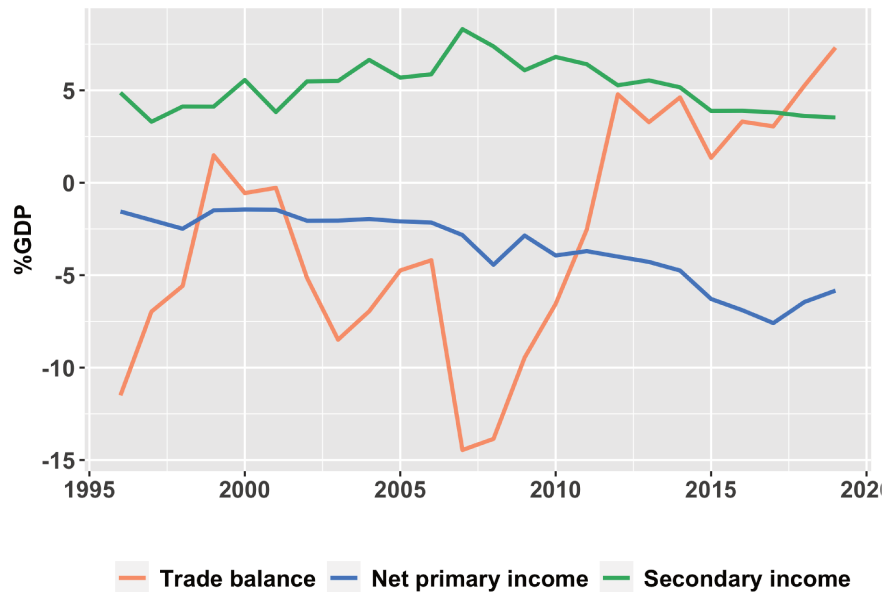


Figure 3.5: Private sector balance, %GDP

tion and investment. Before 2005-2006, Viet Nam had registered a negative current account, mainly driven by a deficit in trade balance (Figure 3.6). The high domestic demand had been satisfied by imports. Moreover, the global financial crisis of 2007-2008 caused a reduction in world demand, decreased Vietnamese exports, and led to a bigger trade deficit. However, after 2012, the current account became positive, which resulted from a trade balance and a secondary income surplus, offsetting the deficit in the primary income balance.



Source: Balance of Payments, IFS

Figure 3.6: Current account, %GDP

3.4.2 National wealth accumulation

As mentioned above, following the definition of SNA, the net worth in the balance sheet of each sector is defined as "the value of all the assets owned by an institutional unit or sector less the value of all its outstanding liabilities". In other words, the net wealth of each sector, by definition, is equal to the sum of its non-financial and financial assets minus its liabilities.

We present here the stock of assets and liabilities of each sector as a percentage of GDP over the period 1995–2019. For the whole economy, the sum of all sectors' net wealth is considered "national wealth".

The accumulation of non-financial and financial flows, as well as the net wealth and the distribution among sectors, can be seen in the country's balance sheet (Figure 3.7). The high economic growth and world integration can explain the balance sheet expansion during the period from 1997 until before the global crisis of 2007-2008. The 2008 global financial crisis had a strong effect leading to a slow-down growth of the balance sheet. Households weigh the biggest part of total national wealth. We turn now on each sector's balance sheet.

Firms

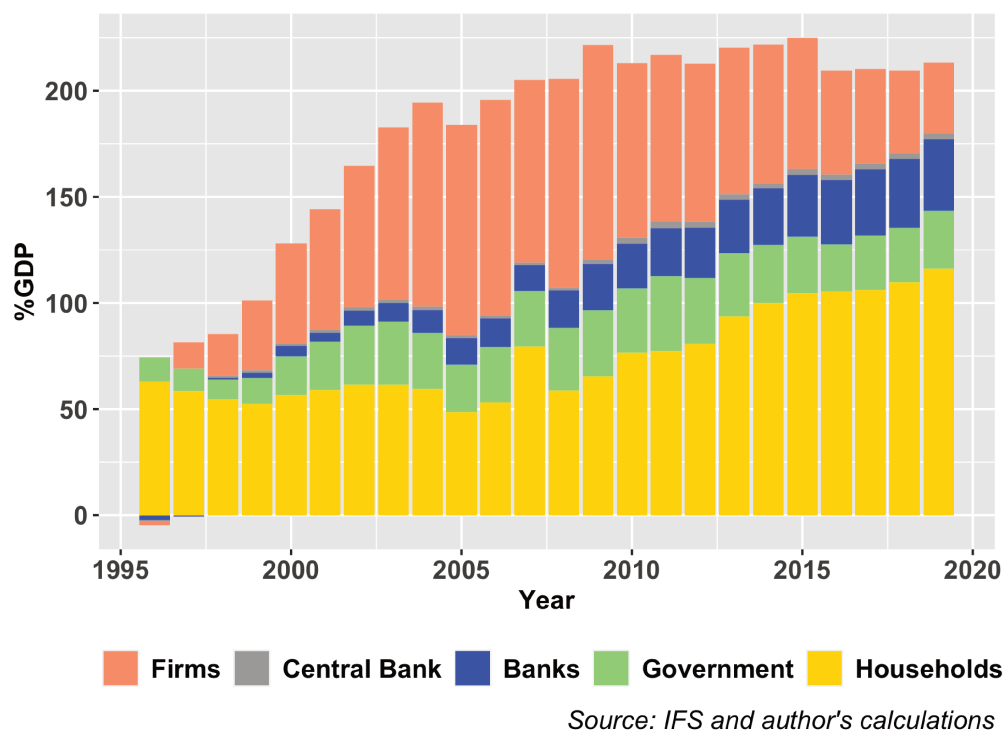
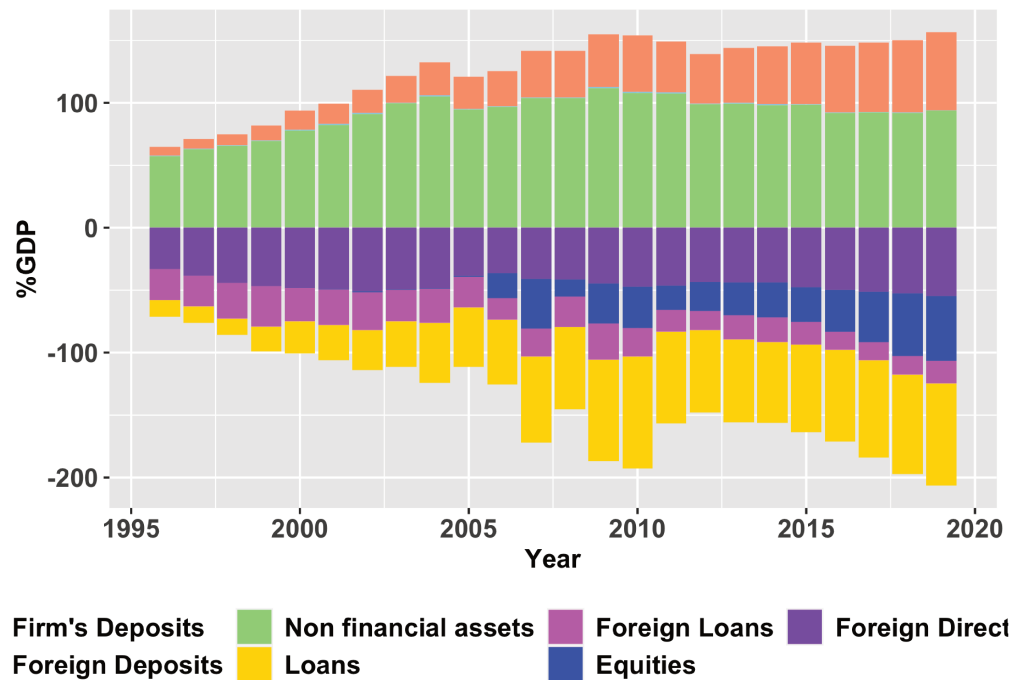


Figure 3.7: National wealth, %GDP

Figure 3.8 shows the balance sheet structure of firms. The stocks of both financial assets and liabilities have experienced an expansion since the 2000s. Non-financial assets of firms are financed mainly by loans, equity and FDI. The financial development process in Viet Nam began in 2000. The banking sector and equity market have been rapidly developed in recent years and have contributed to firms' financing. In other words, the balance sheet expansion after the global financial crisis in 2008 was primarily driven by equities and loans. The capacity of capital mobilisation through the equity market reached more than 50 % of GDP roundly in 2019. FDI and foreign loans remained relatively stable. Recently, the accumulation of liabilities exceeds that of assets, and thus, the firm's financial net wealth is mostly negative.



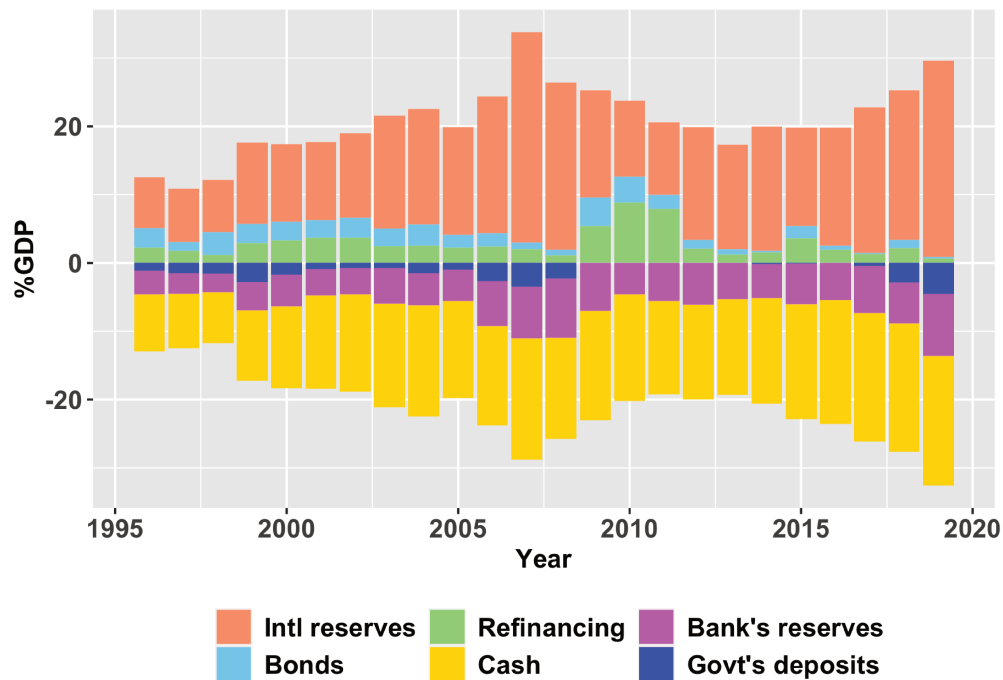
Source: IFS and author's calculations

Figure 3.8: Balance sheet for firms, %GDP

Central bank

Figure 3.9 shows the balance sheet structure of the central bank. An increase in the balance sheet size was noted from the 2000s until 2007. However, the banking crisis in 2011 caused a strong contraction of the central bank's balance sheet during the period 2011-2014. The international reserves remained a principal asset of the central bank. It represents the exchange rate policy of the central bank.

On the liability side, cash remains the main component which represents the role of issuing currency of the central bank. The second important liability is the bank's reserves which serve as a monetary policy channel transmission. The central bank can control the money supply by managing the bank's reserves.

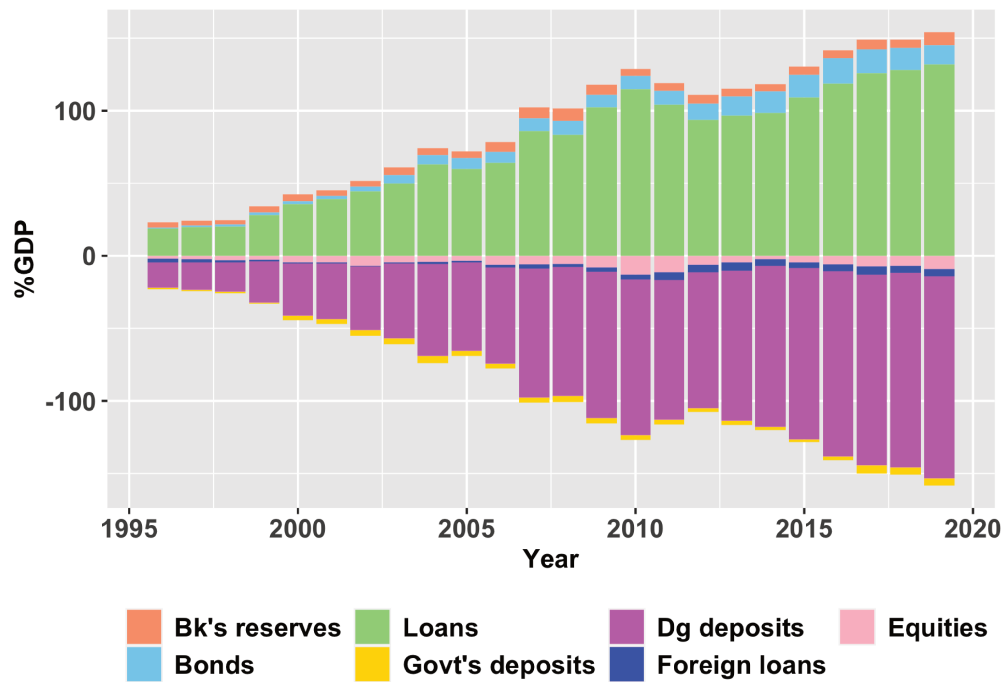


Source: IFS and author's calculations

Figure 3.9: Balance sheet for the central bank, %GDP

Banks

Figure 3.10 shows the balance sheet structure of commercial banks. They have experienced a persistent expansion of the balance sheet, which is consistent with the process of financialisation. Commercial banks play an important role by creating deposits and credits to satisfy the financing requirements of the economy. Thus, while credits have increased on the asset side, deposits have led to the expansion on the liability side. A banking crisis in Viet Nam in 2011-2012 explained the sharp decrease in credits during that period. Foreign loans and equities remained relatively stable.



Source: IFS and author's calculations

Figure 3.10: Balance sheet for commercial banks, %GDP

Government

Figure 3.11 displays the balance sheet of the public sector. Public investment goes mainly into non-financial assets (infrastructures) and is financed by issuing bonds or borrowing from abroad. However, during the period from 1996 to 2012, the external debt had the largest part. Since 2013, the domestic debt has become the biggest one, with 62% in 2019 compared to 38% for the foreign debt of the total public debt. The slight decrease in the external debt relative to the domestic debt reflects the prudential policy of the government in order to avoid any currency risk.

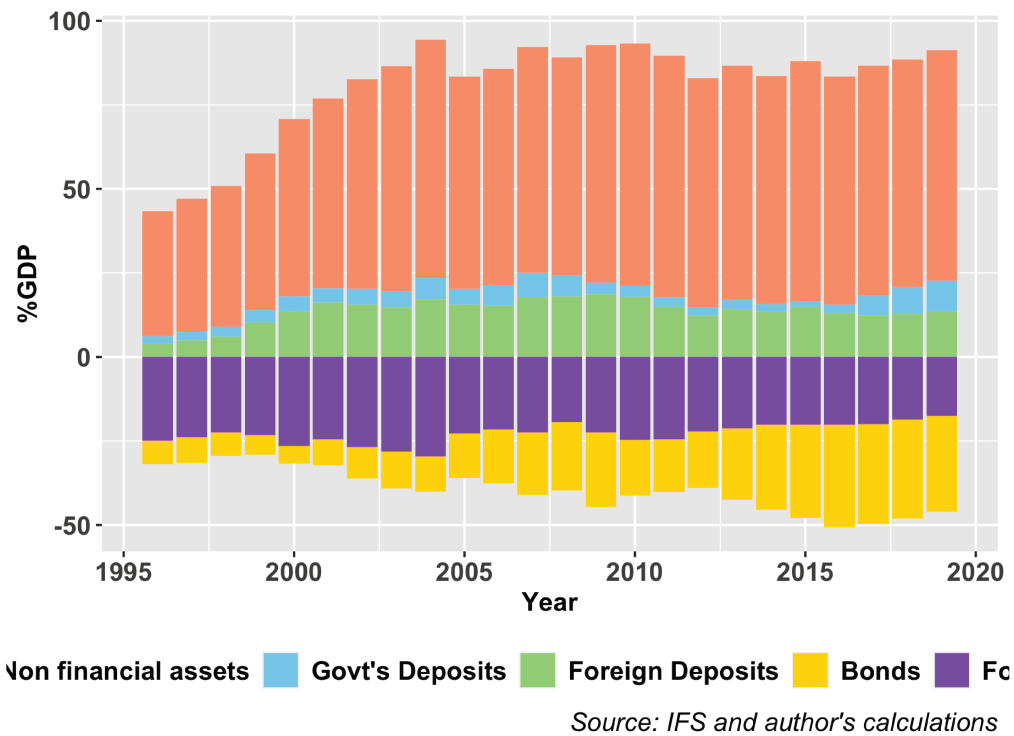
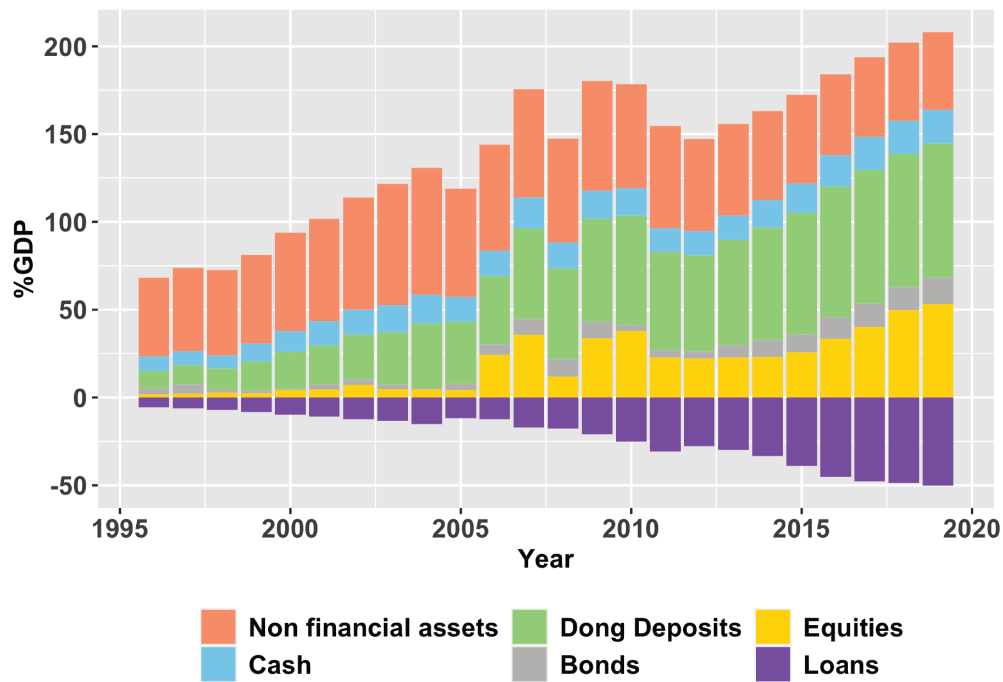


Figure 3.11: Balance sheet for the government, %GDP

Households

Turning to the household sector, Figure 3.12 shows the balance sheet of households with a low level of debt before 2010 and grew consistently except for the year of the global financial crisis, 2008. On the asset side, their financial assets are distributed among different types, but a large preference for liquid form prevails, such as cash and deposits (70% of the net wealth in 2019). However, the stock of equities has increased since 2016. It can be explained by the improvement of the conditions in the financial market. It also coincides with the rise of loans recently. Overall, the net financial wealth of the household sector has been positive.

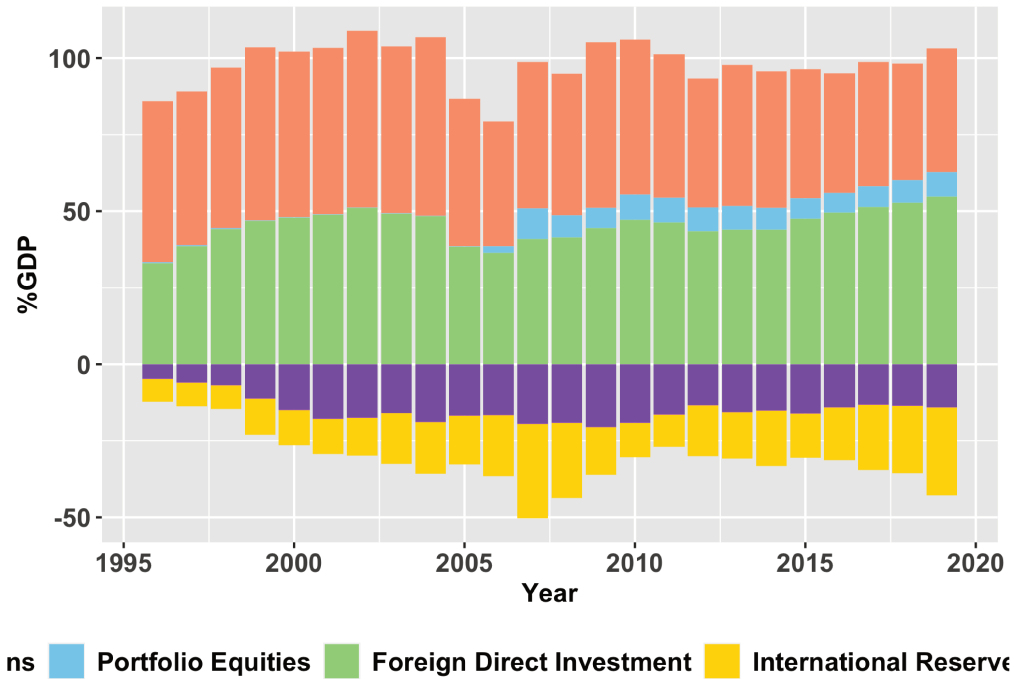


Source: IFS and author's calculations

Figure 3.12: Balance sheet for households, %GDP

Rest of the world

Regarding the balance sheet for the rest of the world (Figure 3.13), the high degree of openness led to a persistent negative net wealth. On the asset side, FDI and foreign loans play a central role in the economic growth of Viet Nam. From 2011 onwards, the stock of foreign loans fell slightly relative to the FDI stock. Portfolio investments have been stable since 2007. On the liability side, Viet Nam accumulated international reserves during the period of the global financial crisis and in recent years.



Source: IFS and author's calculations

Figure 3.13: Balance sheet for the rest of the world, %GDP

3.5 Conclusion

The present chapter detailed the construction of the accounting structure of our empirical SFC model of the Vietnamese economy. We mainly base it on the international guidelines of the SNA 2008. The development of the national balance sheet consists of three main steps. We began with the balance sheet of the central bank and commercial banks, then extended to other sectors and finally, combined with other relevant financial instruments. The flow matrix is based on the sequence of national accounts and the accounting principles of SFC modelling described in Chapter 2.

The lack of data compiled for the different institutional sectors challenged the development of our empirical SFC model. We have to merge different data sets to link the income flows in the transaction matrix to the respective assets/liabilities in the balance sheet of each sector. It also imposed us to make some simplification assumptions. It is noted that the discrepancy between the net lending/borrowing position from the financial side and the net lending computed from the real side is quite large. It can be explained by the difficulties

in properly measuring the market value of financial instruments at a time of rapid financial innovation (Zeza and Zeza, 2019). Our completed accounting structure sheds some light on several dynamics of the Vietnamese economy, allowing us to better understand the economy. Thus, it feeds the development of our model in the next chapter.

After finishing the construction of stock and flow matrices, we continue the development of our empirical SFC model by writing the equation system (accounting and behavioural equations) in the next chapter.

CHAPTER 4

SFCVN - An empirical stock-flow consistent model for Viet Nam¹

4.1 Introduction

As mentioned in General introduction, the ultimate goal of this thesis is to understand the macroeconomic interactions of different sectors in the Vietnamese economy under globalisation and, thereby, to build an empirical SFC model intended for scenario analysis and policy simulations. Chapter 1 described the main features and macroeconomic dynamics of the Vietnamese economy since the crucial reform in 1986. Chapter 2 introduces the SFC methodology of macroeconomic modelling and the procedure for developing an empirical SFC model. Then, in this chapter, we will present our empirical SFC macroeconomic model based on the accounting structure developed in Chapter 3.

The aim of this model is twofold. First, the model provides a theory-consistent representation of the general structure of the Viet Nam economy. Second, it offers policy/scenario simulation capabilities to the needs of policymakers. It constitutes a means of evaluating the impact/feedback effects of different policies or shocks on the Vietnamese economy. As shown in Chapter 2, to the best of our knowledge, we are the first to develop an empirical SFC model of the Vietnamese economy. It would expand the literature on empirically grounded SFC macro-modelling.

The modelling procedure has sought to account for the structure of Viet Nam's economy, the availability of data, the accounting structure and the degree of stability of time-series estimates of parameters during the country's transition process. The present model seeks to provide a mechanism to link policies and an easy and adaptable means of simulating the interrelationships between macroeconomic variables. We believe that no one theory or dynamic specification can provide a complete description of the Vietnamese economy. What is essential is that key features of the economic and financial process are represented in

¹This chapter is an updated version of a working paper presented at the International Conference on Economic Modeling and Data Science – EcoMod2021, (July 7-9, 2021)

the system used to characterise the economy. The resulting system proposes a framework that links the financial and real sectors of the economy and an interpretation of the channel transmission through which economic policies can affect these transactions.

Two main components of an empirical SFC model are (i) accounting equations implied by the accounting framework and (ii) behavioural equations representing the behaviour of the sectors. The balance sheet, displaying tangible assets and financial assets/liabilities and the flow matrix (with the real and financial flows associated with budget constraints of each sector), allows for deriving the first set of model equations: namely, accounting identities. As mentioned in Chapter 2, there are five main categories of behavioural assumptions. The first category will specify how each sector determines its expenditure (household's consumption, firm's investment, household's investment, public investment, exports and imports). The second one is related to how each sector finances its financing need. They will face different possible ways to finance. The third category of behavioural assumptions specifies how agents allocate their wealth among various assets. The fourth one is related to the financial system, which includes the monetary policy of the central bank, the behaviour of commercial banks and other interest rates or rate of return. Finally, we will describe the specification of wages, inflation and the price system. In addition, as our model is empirical, these equations should be statistically validated.

After estimating some parameters, we simulate the model. We compare simulated results with the actual data to examine the model's overall performance. It allows evaluating whether the model is able to explain/replicate the dynamics of the data to some extent before proceeding to simulate the model for the future.

The rest of this chapter is organised as follows. Section 4.2 explains the structure of the model. Section 4.3 details the estimations of the behavioural equations. Section 4.4 shows the overall performance with actual data. Finally, Section 4.5 concludes this chapter.

4.2 The model

4.2.1 Overall structure

The simplified structure of the model is summarised by Figure 4.1. Our model contains six institutional sectors ². Each institutional sector plays a key role in the system. They contribute directly to the aggregate demand. The model allows the representation of real and financial transactions. Accounting consistencies allow us to see how sectors' decisions in the real economy will affect their assets/liabilities and how the changes in their balance sheet will provide feedback on their choices above. It makes the model dynamic. In our model, we try to model the main prices, interest rates and the exchange rate, which are assumed to have important effects on the sectors' decisions.

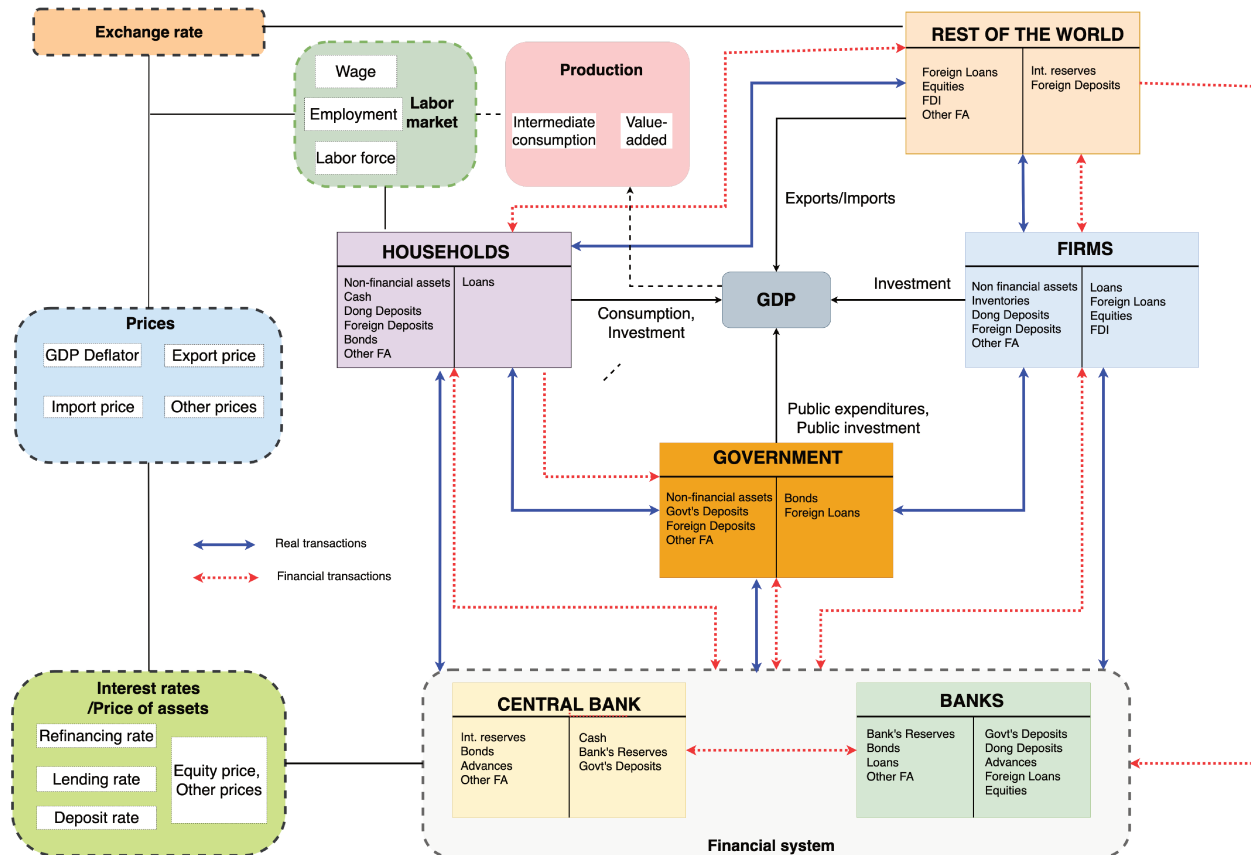


Figure 4.1: Simplified structure of the model

²Each sectoral variable is indicated by a subscript: firms (f), central bank (cb), commercial banks (cb), government (g), households (h) and rest of the world (r)

The second set of equations is the behavioural equations coupling with equilibrium conditions to close the model. The development of behavioural equations for each sector relies mainly on post-Keynesian theories and the analysis of the Vietnamese economy in Chapter 1.

Following a coherent way of thinking about the macroeconomy in terms of both theory and economic policies (Arestis, 2013), the model will be divided into different blocks as follows:

- **Output determination:** The model is supposed to have a single product. The production is determined by demand, including domestic demand (public and private investment, public and private final consumption and change in inventories of firms) and foreign demand (net exports). We consider possible supply-side constraints. A supply constraint is introduced through a simple Cobb-Douglas production function that determines the production capacity of productive sectors and affects production decisions.
- **Investment and financing of firms:** Firms have to decide how much to produce, how much to invest and how it will be financed by using retained profits, borrowing from banks or abroad, issuing equities or attracting FDI.
- **Consumption, Investment and Portfolio choices of Households:** The decisions of households essentially will deal with consumption, investment and accumulation of financial assets in the form of deposits, government bonds, firms' equities or other financial assets. Households can also borrow from commercial banks to meet their financing needs.
- **Government and fiscal policy:** The government collects taxes, receives other transfers or payments, and then consumes and invests. The government's current expenditures and public investment are exogenous as policy instruments. The public deficit can be financed by issuing bonds or borrowing from abroad.
- **Central bank and monetary policy:** The State Bank of Viet Nam (SBV) determines the refinancing rate as a monetary policy tool, provides advances to the commercial banks and manages international reserves. The central bank contributes to regulating financial markets.
- **Commercial banks and financial system:** Commercial banks provide credits to firms and households, but they also impose credit rationing on firm and household loans based on loan-to-value (LTV) and debt-to-income (DTI), respectively. They decide both the lending rate and the deposit rate based on a premium over the central bank's interest

rate. Commercial banks also hold part of the government's bonds.

- **Rest of the world and external dependence:** Exports and imports depend on demand, relative prices and other relevant factors for the Vietnamese economy. The rest of the world contributes to financing the domestic economy through FDI, portfolio investment or foreign loans.
- **Prices:** The general price is a cost-push function (wage and import price). Price is affected by the demand via the output gap, which is represented as the ratio of actual output and potential output. Other prices in the system mainly depend on this general price.
- **Asset prices:** This block specifies the determination of different interest rates and rates of return of different financial assets in the model.
- **Labour market:** Wage and employment will be explained in this model block. Nominal wage affects prices and, therefore, inflation.

Main closures

In order to guarantee the accounting principles for each sector's financial account and the whole system, we have to decide on a financial instrument to close the capital account of each institutional sector (Table 4.1). It also allows us to link the financial and real sides of the economy.

The main closures of the model are the following:

- Firms finance all remaining their financing needs via FDI.
- Households will keep all remaining money once they have planned their consumption expenditures, investment and other financial assets. Households will buy all remaining equities from firms and banks.
- Central bank buys the bulk of the remaining government bonds. The changes in assets will correspond to the changes in liabilities of the central bank.
- The refinancing from the central bank balances the banks' accounts. In other words, refinancing acts as the residual buffer for banks. Banks increase the deposits with respect to the demand for dong deposits of firms and households. Banks provide credits demanded by firms and households.
- Government finance their public deficit (net financing needs) by debt. It can be domestic (bonds) or foreign debt.

- Rest of the world: The change in other net financial assets is determined by the net borrowing/lending position. The rest of the world satisfies all foreign loans demanded by the domestic sectors.

Table 4.1: Theoretical Balance Sheet of Viet Nam

	<i>Firms</i>	<i>Central Bank</i>	<i>Banks</i>	<i>Government</i>	<i>Households</i>	<i>RoW</i>	<i>Total</i>
Non-financial assets	$p_K k^f$			$p_K k^g$	$p_K k^h$		$p_K k$
Inventories	$p_{K12} k_{12}$						$p_{K12} k_{12}$
Intl. reserves		$RES_{us}xr$				$-RES_{us}xr$	0
Cash		$-H$			H		0
Bank's Reserves		$-MB^{cb}$	MB^{cb}				0
Governments's Deposits		$-GM^{cb}$	$-GM^b$	GM			0
Dong Deposits	DM^f		$-DM$		DM^h		0
Foreign deposits	$FM_{us}^f xr$			$FM_{us}^g xr$	$FM_{us}^h xr$	$-FM_{us} xr$	0
Bonds		B^{cb}	B^b	$-B$	B^h		0
Advances		LB^{cb}	$-LB^{cb}$				0
Loans	$-L^f$		L		$-L^h$		0
Foreign loans	$-FL_{us}^f xr$		$-FL_{us}^b xr$	$-FL_{us}^g xr$		$FL_{us} xr$	0
Equity	$-p_E E^f$		$-p_E E^b$		$p_E E^h$	$p_E E^r$	0
Foreign direct investment	$-p_{FDI} FDI_{us} xr$					$p_{FDI} FDI_{us} xr$	0
Other accounts r/p	OTA^f	OTA^{cb}	OTA^b	OTA^g	OTA^h	OTA^r	0
Net Wealth	NW^f	NW^{cb}	NW^b	NW^g	NW^h	NW^r	$p_K k + p_{K12} k_{12}$

■ Close the sector's account (column)

■ Close the asset's line

Practical details

Before tackling the equation system, two main elements are essential for the model simulation: the buffers and the redundant equation. According to Godley and Lavoie (2007b), the buffers are the essential flexible elements which enable the whole system to function in a world of uncertainty. For example, we assume that their deposits play the role of the buffer for the households sector. It means that households overestimate their disposable income and spend more than they should. Their financing capacity will be smaller than expected and affect their stock of deposits. This buffering item "generates a kind of autopilot whereby unexpected (and unwanted) stocks of money result in a corrective mechanism which comes into play during subsequent periods" (Godley and Lavoie, 2007b, p.292). In our model, we have to choose, for the financial account of each sector, one financial instrument to "close" the capital account of

the corresponding sector.

The redundant equation or "unwritten" equation is important for the model function. This equation arises from the fulfilment of every other equation of the model. It need not be incorporated into the computation. Otherwise, the model would be overdetermined. However, this equation will be used to check whether the model is correct, i.e. respect all accounting consistencies.

Given a large amount of technical details of the model and thus, in order to make the reading of our system of equations easier, we present all accounting identities and behavioural equations of a block of output, then sector by sector, block of prices (real and financial) and finally block of the labour market. The behavioural equations with estimated parameters will be noted as "EQ.B.x". The exact functional form of these equations will be detailed later in Section 4.3.

4.2.2 Output determination

For simplicity, in our model, we suppose that the economy has a single good that can be used for intermediate consumption, final consumption, exports, and capital goods. The economy is demand-led. In other words, the demand determines production. The production decision of the productive sector is based on adaptive expectations. They decide their production level considering the sales expectations. However, given that they have a limited production capacity, a production constraint impacts their production decision. In addition, the integration of supply constraint into the model allows taking into account in further research different questions related to:

- resources constraints (land, water, ...)
- emissions by sectors (climate change problem)
- technical coefficients
- structural change
- interaction between supply and demand

The productive sector will produce what is demanded if the expected demand is lower than its capacity of production. On the contrary, they cannot produce what exceeds their capacity. Thus, the level of expected output is given by:

$$q_t^e = \min\left(\frac{va_{st}^e}{\gamma_{va}}, \frac{va_{dt}^e}{\gamma_{va}}\right) \quad (\text{EQ.1})$$

where γ_{va} is the part of value-added in the production, $va_{d_t}^e$ is the expected demand and $va_{s_t}^e$ is the supply constraint.

Expected value-added could be adaptive and, thus, depends on past value-added. Firms are supposed to take into account the labour productivity growth (gr_t), which is represented as the ratio of value-added and the number of workers. The higher productivity growth leading to higher income per capita will increase global demand (Shaikh, 2016).

$$va_{s_t}^d = va_{t-1} * (1 + prod_{gr_t}) \quad (\text{EQ.2})$$

In our model, the economy is demand-led. The real GDP (y_t) is defined as the sum of household consumption (c_t), government current expenditures (g_t), private and public investment (i_t^f, i_t^g, i_t^h), net exports ($x_t - im_t$) and changes in inventories (i_{12_t}).

$$y_t = c_t + g_t + i_t^f + i_t^g + i_t^h + i_{12_t} + x_t - im_t \quad (\text{EQ.3})$$

The economic growth rate (gr_{y_t}) can be written by:

$$gr_{y_t} = \frac{y_t - y_{t-1}}{y_{t-1}} \quad (\text{EQ.4})$$

The nominal GDP is calculated as follows:

$$Y_t = y_t * p_{Y_t} \quad (\text{EQ.5})$$

where p_{Y_t} is GDP deflator. According to the production approach, the total nominal value-added is determined as the nominal GDP minus taxes on production.

$$p_{Y_t} va_t = Y_t + TOP_t \quad (\text{EQ.6})$$

The demand will be satisfied by a part of imports.

$$q_t = q_t^e - \gamma_{IM} * im_t \quad (\text{EQ.7})$$

The supply constraint is represented by a simple Cobb-Douglas production function.

$$va_{s_t}^e = A_t k^\alpha L_t^{1-\alpha} \quad (\text{EQ.8})$$

By using the approximated linear relationship between the capital to labour ratio and the income share of labour, we estimate α

$$y_t = A_t k^\alpha L_t^{1-\alpha}$$

$$\begin{aligned} \rightarrow \frac{y_t}{L_t} &= \frac{A_t k^\alpha L_t^{1-\alpha}}{L_t} \\ \rightarrow \frac{y_t}{L_t} &= A_t \left(\frac{k_t}{L_t} \right)^\alpha \\ \rightarrow \ln \left(\frac{y_t}{L_t} \right) &= \ln(A_t) + \alpha * \ln \left(\frac{k_t}{L_t} \right) \end{aligned}$$

OLS estimation gives: $\alpha = 0.404$

We assume that the value-added is split among the different institutional sectors. Thus, the value-added of each institutional sector is defined as the share of the total value-added.

Value-added of firms

$$va_t^f = \gamma_{VA}^f * va_t \quad (\text{EQ.9})$$

Value-added of banks

$$va_t^b = \gamma_{VA}^b * va_t \quad (\text{EQ.10})$$

Value-added of government

$$va_t^g = \gamma_{VA}^g * va_t \quad (\text{EQ.11})$$

Value-added of households will be a residual.

$$va_t^h = va_t - va_t^f - va_t^b - va_t^g \quad (\text{EQ.12})$$

The intermediate consumption is determined as the difference between output and value-added.

$$IC_t = Q_t - VA_t \quad (\text{EQ.13})$$

Given that Viet Nam has to import several intermediate goods to produce, the imported intermediate goods are defined as a part of total intermediate goods.

$$IC_t^{im} = \gamma_{ic}^{im} * IC_t \quad (\text{EQ.14})$$

4.2.3 Investment and financing of firms

The gross operating surplus (i.e. profits) of firms (F_t^f) are defined as the difference between the nominal value added from the production (VA_t^f) and wages (WB_t^f) and labour contributions (SOC_t^f), and to this, we have to deduct import taxes (suppose that all imports are of firms TIM_t).

$$VA_t^f = p_{y_t} va_t^f \quad (\text{EQ.15})$$

Wages paid to workers by firms are defined as a share of the total wage bill.

$$WB_t^f = \lambda^f WB_t \quad (\text{EQ.16})$$

Labour contributions paid by firms

$$SOC_t^f = \alpha^f \gamma_{SOC} * WB_t^f \quad (\text{EQ.17})$$

Custom and other import duties are assumed to be a fraction of imports.

$$TIM_t = \tau^r p_{IM_t} im_t \quad (\text{EQ.18})$$

Profit of firms is given by:

$$F_t^f = VA_t^f - WB_t^f - SOC_t^f - TIM_t \quad (\text{EQ.19})$$

In terms of financial assets, firms hold dong deposits in banks and deposits in foreign currency. Thus, the interests on dong deposits received by firms annually are calculated as follows:

$$ITDM_t^f = r_{m_t} DM_{t-1}^f \quad (\text{EQ.20})$$

Interest on a firm's foreign deposits paid by banks

$$ITFM_t^f = r_{f_{m_t}} FM_{us_{t-1}}^f xr_{t-1} \quad (\text{EQ.21})$$

Regarding the liability side, firms borrow both from domestic banks and from abroad. They have to pay the interest on it. The interest payments on debt paid by firms to commercial banks are given by:

$$ITL_t^f = r_{l_t} L_{t-1}^f \quad (\text{EQ.22})$$

Interest on foreign debt paid by firms to ROW

$$ITFL_t^f = r_{f_{l_t}} FL_{us_{t-1}}^f xr_{t-1} \quad (\text{EQ.23})$$

Dividends are supposed to be paid by firms to the rest of the world as a proportion (ϕ) of corporate profits lagged one period.

$$DIV_t = \phi F_{t-1}^f \quad (\text{EQ.24})$$

Following the same sequence of SNA accounts, the primary income of firms is determined by:

$$YP_t^f = F_t^f + ITDM_t^f + ITFM_t^f - ITL_t^f - ITFL_t^f - DIV_t \quad (\text{EQ.25})$$

Profit tax paid by firms

$$FT_t^f = \tau^f YP_{t-1}^f \quad (\text{EQ.26})$$

Firm's saving is given by:

$$S_t^f = YP_t^f - FT_t^f \quad (\text{EQ.27})$$

Firms use their saving to acquire fixed assets and inventories. Thus, the net financing need of firms is determined by the difference between the firm's savings, their investment in non-financial assets, and changes in inventories.

$$NFC_t^f = S_t^f - I_t^f - I_{12t} \quad (\text{EQ.28})$$

Firms' *net* investment is here represented as a fixed capital accumulation rate ($\frac{\Delta k^f}{k_{t-1}^f}$). It is modelled as a function of a constant which reflects animal spirits, the real lending rate ($r_t - \pi_t$) representing the financial condition or cost of borrowing and the capacity utilisation rate (Bhaduri and Marglin, 1990) which is proxied by the ratio of the actual GDP to the potential GDP. A high capacity utilisation rate will lead firms to raise their capital stock by increasing investment. The cost of financing investment by bank loans has a negative impact on capital accumulation. The accumulation of capital also depends on the profit rate (Kalecki, 1971), which is defined as the gross operating surplus divided by the previous stock of capital ($\frac{F_{t-1}^f}{K_{t-2}^f}$) and the financial profitability is represented as the change in the equity price ($\frac{\Delta p_{E_t}}{p_{E_{t-1}}}$). On the one hand, the profit rate is essential for capital accumulation, given that profit is the primary objective of the firm's investment.

On the other hand, the Kaleckian concept of macroeconomic demand emphasises the period of financialisation in modern capitalism. Financialisation has had effects on (1) income distribution, (2) investment in capital stock, (3) consumption and (4) current account imbalances (Hein, 2012). Financialisation has coincided with lower investment in capital stock.

Investors tend to shift from long-run growth objectives to short-term profitability through financial activities. Thus, financialisation decreases investment.

$$\frac{\Delta k^f}{k_{t-1}^f} = f \left(\frac{\Delta k_{t-1}^f}{k_{t-2}^f}; \frac{y_{t-1}}{y_{t-1}^*}; r_{l_t} - \pi_t; \frac{F_{t-1}^f}{K_{t-2}^f}; \frac{\Delta p_{E_t}}{p_{E_{t-1}}} \right) \quad (\text{EQ.B.1})$$

(+)

The real stock of firm's fixed capital is defined by the perpetual inventory method.

$$k_t^f = (1 - \delta_{K_t}^f) k_{t-1}^f + i_t^f \quad (\text{EQ.29})$$

To estimate the potential GDP, we use the production function approach (IMF, 2019). In this approach, the production function is given as follows.

$$y_t^* = TFP_t k_{t-1}^{1-\alpha} L_t^{*\alpha} \quad (\text{EQ.30})$$

where TFP_t is the total factor productivity; L_t^* is the active population and k_{t-1} is the capital stock of the previous period. Capital stock is the sum of private and public capital.

$$k_t = k_t^f + k_t^g + k_t^h \quad (\text{EQ.31})$$

The nominal investment of firms in non-financial assets

$$I_t^f = p_{K_t} i_t^f \quad (\text{EQ.32})$$

The real stock of inventories is supposed to be an exogenous part of past sales

$$k_{12_t} = \gamma_{INV} * s_{t-1} \quad (\text{EQ.33})$$

The total sales are given by:

$$s_t = c_t + i_t^f + i_t^g + i_t^h + g_t + x_t + ic_t \quad (\text{EQ.34})$$

Given that the real stock of inventories is determined as the accumulation of inventories over the past, the changes in inventories are calculated as follows:

$$i_{12_t} = k_{12_t} - k_{12_{t-1}} \quad (\text{EQ.35})$$

The nominal changes in inventories

$$I_{12_t} = p_{K_{12_t}} i_{12_t} \quad (\text{EQ.36})$$

Table 4.2: Non-financial firms' balance sheet

	Assets (+)	Liabilities (-)
Non-financial assets	$p_K k^f$	
Inventories	$p_{K_{12}} k_{12}$	
Dong Deposits	DM^f	
Foreign deposits	$FM_{us}^f xr$	
Loans		L^f
Foreign loans		$FL_{us}^f xr$
Equity		$p_E E^f$
Foreign direct investment		$p_{FDI} FDI_{us} xr^{(*)}$
Other accounts r/p	OTA^f	
Net Wealth		NW^f

(*) Item closes the sector's account

On the asset side, we suppose that the demand for dong deposits held by non-financial firms increases with an exogenous growth rate.

$$DM_t^f = DM_{t-1}^f * (1 + \gamma_{DM}^f) \quad (\text{EQ.37})$$

Thus, the change in dong deposits held by firms can be determined by:

$$\Delta DM_t^f = DM_t^f - DM_{t-1}^f \quad (\text{EQ.38})$$

We assume that deposits in foreign currency held by non-financial firms are for trade. The stock in foreign deposits is therefore calculated as a share of the value of imports (IM_t) and exports (X_t).

$$FM_t^f = \gamma_{FM}^f * (IM_t + X_t) \quad (\text{EQ.39})$$

The stock of foreign deposits (in USD) is determined by the following:

$$FM_{ust}^f = \frac{FM_t^f}{xr_t} \quad (\text{EQ.40})$$

The change in foreign deposits held by non-financial firms is for trade (in USD).

$$\Delta FM_{ust}^f = FM_{ust}^f - FM_{ust-1}^f \quad (\text{EQ.41})$$

The change in foreign deposits (in VND) is determined by the following:

$$\Delta FM_t^f = \Delta FM_{ust}^f * xr_t \quad (\text{EQ.42})$$

In our model, firms can finance their investment by issuing equities held by households and the ROW, borrowing from domestic banks or abroad and via FDI.

The foreign debt of firms is a function of the interest rate differential corrected by the exchange rate variation. It also depends on firms' investment. Thus, the demand for foreign debt by firms can be written as follows:

$$\Delta \ln(FL_t^f) = f \left(\begin{array}{c} r_{lt} - r_{lt}^{us} \\ (+) \end{array} ; \begin{array}{c} \frac{\Delta xr_t}{xr_{t-1}} \\ (+) \end{array} ; \begin{array}{c} \frac{\Delta y_t}{y_{t-1}} \\ (+) \end{array} \right) \quad (\text{EQ.B.2})$$

The stock of foreign loans of firms (in USD) is determined by the following:

$$FL_{ust}^f = \frac{FL_t^f}{xr_t} \quad (\text{EQ.43})$$

The changes in foreign loans of firms (in USD) are defined by:

$$\Delta FL_{ust}^f = FL_{ust}^f - FL_{ust-1}^f \quad (\text{EQ.44})$$

The changes in foreign loans of firms (in VND) are defined by:

$$\Delta FL_t^f = \Delta FL_{ust}^f xr_t \quad (\text{EQ.45})$$

Firms can also finance their investment needs by borrowing from commercial banks. The demand for loans from banks depends mainly on the cost of borrowing, which is the lending rate (r_{lt}). It also depends on the degree of indebtedness which is represented by the ratio between the loan amount and the firm's net wealth ($\frac{L_{t-1}^f}{NW_{t-1}^f}$)

$$\Delta \ln(L_t^{fD}) = f \left(\begin{array}{c} r_{lt} \\ (-) \end{array} ; \begin{array}{c} \frac{L_{t-1}^f}{NW_{t-1}^f} \\ (-) \end{array} \right) \quad (\text{EQ.B.3})$$

As commercial banks impose credit rationing for firms' loans, they decide the level of the lending amount to firms based on a loan-to-value (LTV) ratio. It measures the relationship between the loan amount and the value of non-financial and financial assets securing the loan.

As LTV increases, it creates more risks for the firms. According to several commercial banks in Viet Nam, it limits LTV^f to 70%. It means that commercial banks will satisfy the demand of firms for loans under 70% of their net wealth value.

The effective LTV is then determined by:

$$LTV_t^f = \min \left(0.7, \frac{L_{t-1}^f + \Delta L_t^{fD}}{NW_{t-1}^f} \right) \quad (\text{EQ.46})$$

The effective firm's loan amount is calculated as follows:

$$\Delta L_t^f = LTV_t^f * (p_{K_{t-1}} * k_{t-1}^f + p_{K_{12t}} k_{12t} + DM_t^f + FM_t^f) \quad (\text{EQ.47})$$

The newly issuing equities of firms depend on the financing need from their investment and the lending rate, which is the borrowing cost.

$$\Delta E_t^f = \begin{pmatrix} i_t^f \\ (+) \end{pmatrix}; \begin{pmatrix} r_{t-1} \\ (-) \end{pmatrix} \quad (\text{EQ.B.4})$$

The stock of firm's equities is given by:

$$E_t^f = E_{t-1}^f + \Delta E_t^f \quad (\text{EQ.48})$$

We assume that the change in other net financial assets (ΔOTA_t^f) is projected exogenously. Firms finance their remaining financing need by FDI.

$$p_{FDI_t} \Delta FDI_{us_t} x r_t = NFC_t^f - \Delta DM_t^f - \Delta FM_{us_t}^f x r_t + \Delta FL_{us_t}^f x r_t + p_{E_t} \Delta E_t^f + \Delta L_t^f - \Delta OTA_t^f \quad (\text{EQ.49})$$

The stock of FDI is given by:

$$p_{FDI_t} FDI_{us_t} x r_t = p_{FDI_{t-1}} FDI_{us_{t-1}} x r_{t-1} + p_{FDI_t} \Delta FDI_{us_t} x r_t + p_{FDI_{t-1}} FDI_{us_{t-1}} \Delta x r_{t-1} \quad (\text{EQ.50})$$

Finally, a firm's wealth is defined as the sum of all its assets and liabilities.

$$NW_t^f = p_{K_t} k_t^f + p_{K_{12t}} k_{12t} + DM_t^f + FM_{us_t}^f x r_t + OTA_t^f - L_t^f - FL_{us_t}^f x r_t - p_{E_t} E_t^f - p_{FDI_t} FDI_{us_t} x r_t \quad (\text{EQ.51})$$

4.2.4 Consumption, Investment and Portfolio choices of Households

Vietnamese households use their disposable income to consume, invest and accumulate financial assets in dong deposits, foreign deposits, government bonds, firm equities or other financial assets. Households also can borrow from commercial banks to finance their financing needs.

The gross disposable income of households (YD_t^h) consists of mixed income which is the difference between the nominal value-added (VA_t^h) and the paid wage (WB_t^h); domestic wages which is defined as a product of the wage rate and the total number of workers; compensation of employees from abroad denominated in local currency which is exogenous (WB_t^r); government transfers which is projected as a exogenous part of GDP (SBE_t), remittances (TR_{pt}^r), received interest on financial assets ($ITDM^h, ITB^h$); less social contribution (SOC_t^h); income taxes which are a proportion of income (ICT_t), profit taxes (FT_t^h) which are levied in a proportion of households' profit, interest paid on loans (ITL_t^h) and transfers to abroad (TR_{rt}^p). The nominal value-added of the household sector is calculated as follows:

$$VA_t^h = p_{Y_t} va_t^h \quad (\text{EQ.52})$$

The wage paid by the household sector

$$WB_t^h = \lambda^h WB_t \quad (\text{EQ.53})$$

The income from abroad paid to Vietnamese households is considered exogenous and is defined as a ratio of the world GDP (Y_t^*).

$$WB_t^r = \gamma_{WBR} Y_t^* \quad (\text{EQ.54})$$

Social contributions paid by the household sector are a part of the wages they pay.

$$SOC_t^h = \alpha_{soc} * \gamma_{soc}^{wb} WB_t^h \quad (\text{EQ.55})$$

The operating surplus and mixed income of households (F_t^h) are defined as the surplus from production before taking account of other capital income.

$$F_t^h = VA_t^h - WB_t^h + WB_t + WB_t^r - SOC_t^h \quad (\text{EQ.56})$$

As households hold deposits in Viet Nam dong in commercial banks and government bonds, they will receive interest on dong deposits.

$$ITDM_t^h = r_{mt} DM_{t-1}^h \quad (\text{EQ.57})$$

Households also hold deposits in foreign currency; they will receive the interest on foreign deposits.

$$ITFM_t^h = r_{f_{mt}} FM_{us_{t-1}}^h x r_{t-1} \quad (\text{EQ.58})$$

They will also get the interest on bonds paid by the government.

$$ITB_t^h = r_{b_t} B_{t-1}^h \quad (\text{EQ.59})$$

Because households borrow from commercial banks, they have to pay the interest.

$$ITL_t^h = r_{l_t} L_{t-1}^h \quad (\text{EQ.60})$$

The SNA defines the primary income as income resulting from their involvement in the production and their ownership of assets. Thus, the primary income of households is calculated as follows:

$$YP_t^h = VA_t^h - WB_t^h + WB_t + WB_t^r + ITDM_t^h + ITB_t^h - ITL_t^h \quad (\text{EQ.61})$$

Households have to pay taxes on their primary income. We distinguish the taxes paid by individual entrepreneurs (FT_t^h) and the taxes on wages (ICT_t).

$$FT_t^h = \tau^h YP_{t-1}^h \quad (\text{EQ.62})$$

Personal income tax

$$ICT_t = \tau_w \gamma_{ict}^{wb} WB_{t-1} \quad (\text{EQ.63})$$

Transfers from the private sector abroad are supposed to be exogenous. It is represented as a part of the nominal GDP.

$$TR_{r_t}^p = \gamma_{rp} * Y_t \quad (\text{EQ.64})$$

Regarding remittances, [Lucas and Stark \(1985\)](#) distinguished three main motives of migrants to send remittances: pure altruism, pure self-interest and tempered altruism or enlightened self-interest. According to the altruistic model, migrants care about the well-being of those who stayed in the origin country (especially in the case of recession). Remittances contribute to the disposable income of the households and then increase their consumption ([Vargas-Silva and Huang, 2006](#)). The pure self-interest motive argument relies on the theory of portfolio choice. Remittances are considered a part of the family's wealth. People who receive in the host country can use remittances to invest and look for a return on investment ([Adenutsi,](#)

2014). They tend to send more in the optimistic economic situation in the origin country. The third reason for remittances can be mixed with the two motives above. However, from a macroeconomic point of view, some macroeconomic determinants of remittances are related to socio-demographic, economic and institutional factors (Rahman and Wadud, 2014; Hagen-Zanker and Siegel, 2007). The migrant stock is considered a crucial determinant of remittances. The higher the number of workers abroad is, the greater the remittances. The exchange rate, the deposit rate and the level of financial development affect the remittance flows (Adenutsi, 2014; Raju Singh, Lee, and Goff, 2010; Freund and Spatafora, 2008). The exchange rate has a positive impact on remittances. An increase in the deposit rate will motivate the migrants to send more remittances to accumulate financial assets. Thus, we tried to model remittances denominated in local currency as a function of the exchange rate (xr_t), the deposit rate (r_{m_t}), the level of financial development (proxied by the ratio of domestic credit to GDP and the stock of international migrants which is represented as the percentage (%) of the total population) ($\frac{MIGRANT}{POP}$).

$$TR_{p_t}^r = f \left(\begin{matrix} xr_t; r_{m_t}; \frac{MIGRANT}{POP} \\ (+) \quad (+) \quad (+) \end{matrix} \right) \quad (\text{EQ.B.5})$$

The total social benefits received from the government are supposed to be exogenous.

$$SBE_t = \gamma_{sbe} Y_t \quad (\text{EQ.65})$$

The disposable income of the household sector is given by:

$$YD_t^h = YP_t^h - FT_t^h - ICT_t - TR_{r_t}^p - SOC_t^h + SBE_t + TR_{p_t}^r \quad (\text{EQ.66})$$

In our model, due to data availability, we suppose that there are no distributed dividends from the firm's profits earned in the previous period to the households who hold the firm's equities. However, we considered the capital gain on equities in the revaluation matrix. As a result, this capital gain will affect the net wealth of the household sector and, in turn, affects the consumption and investment of households.

Following Keynes (1936) and Kalecki (1971), household consumption is partially induced and includes two components: consumption out of wages and consumption out of profits. Thus, in our model, we propose one consumption which consists of three parts. The first term corresponds to the autonomous component. The two others represent induced elements that

depend on the real current disposable income and the real accumulated wealth of households over the past. Econometrically, we estimate the long-run coefficients and short-run coefficients separately. We expect that households' consumption depends positively on their disposable income and net wealth of the past period in the long run. In the short run, the consumption growth rate also depends positively on the change in disposable income. However, we don't find the positive effect of the change in household wealth on the consumption growth rate.

$$c_t = f \left(\begin{array}{c} YD_{t-1}^h \\ p_{C_{t-1}} \\ (+) \end{array}; \begin{array}{c} NW_{t-1}^h \\ p_{C_{t-1}} \\ (+) \end{array} \right) \quad (\text{EQ.B.6})$$

The nominal consumption is given by:

$$C_t = c_t * p_{C_t} \quad (\text{EQ.67})$$

Households' saving represents the disposable income which is not used for consumption.

$$S_t^h = YD_t^h - C_t \quad (\text{EQ.68})$$

[Crockett and Friend \(1967\)](#) found that income is the most crucial determinant of a household's investment behaviour. In the report on household investment and accumulation surveys, the Centre for Agricultural Policy Consulting of the Institute of Policy and Strategy for Agriculture and Rural Development (CAP-IPSARD) pointed out that income and non-financial and financial wealth accumulation impacted the household investment decision. Thus, our household investment is modelled as a function of their disposable income, net wealth, and real interest rate, representing the cost of borrowing. We expect that the higher disposable income or net wealth will increase the household's investment. Following an increase in the real lending rate, households will reduce their investment.

$$\frac{\Delta k^h}{k_{t-1}^h} = f \left(\begin{array}{c} YD_{t-1}^h \\ p_{C_{t-1}} \\ (+) \end{array}; \begin{array}{c} r_t \\ (-) \end{array}; \begin{array}{c} F_{t-1}^h \\ K_{t-2}^h \\ (+) \end{array} \right) \quad (\text{EQ.B.7})$$

The nominal household's investment is given by:

$$I_t^h = i_t^h * p_{K_t} \quad (\text{EQ.69})$$

In our model, the stock of non-financial assets should evolve according to the perpetual inventory method. It means that the stock of the current period is defined by cumulating flows of the previous period and adjusting for capital depreciation.

$$k_t^h = (1 - \delta_{K_t}^h) k_{t-1}^h + i_t^h \quad (\text{EQ.70})$$

If the household's investment is larger (less) than its savings, it represents a financing need (capacity) which is one of the factors driving the household's financial asset allocation. The net financing capacity of households is defined by the following:

$$NFC_t^h = YD_t^h - C_t - I_t^h \quad (\text{EQ.71})$$

Table 4.3: Households' balance sheet

	Assets (+)	Liabilities (-)
Non-financial assets	$p_K k^h$	
Cash	H	
Dong Deposits	$DM^{h(*)}$	
Foreign Deposits	FM^h	
Bonds	B^h	
Loans		L^h
Equity	$p_E E^h$	
Other accounts r/p	OTA^h	
Net Wealth		NW^h

(*) Item closes the sector's account

Households allocate their wealth between the different assets. Following [Godley and Lavoie \(2007b\)](#), dong deposits take on a buffering role of households account. Households can hold cash, dong deposits, foreign deposits, government bonds, and equities as assets.

[Keynes \(1936\)](#) argues that households hold cash for three distinguished motives: "(i) the transactions-motive, i.e. the need of cash for the current transaction of personal and business exchanges; (ii) the precautionary-motive, i.e. the desire for security as to the future cash equivalent of a certain proportion of total resources; and (iii) the speculative-motive, i.e. the object of securing profit from knowing better than the market what the future will bring forth". Thus, in our model, Vietnamese households use mainly cash for transactions related to their consumption and deposit rate. The demand for cash H_t is given by :

$$\Delta \ln(H_t) = f \left(\underset{(+)}{C_t}; \underset{(+)}{r_{m_t}} \right) \quad (\text{EQ.B.8})$$

We suppose that households desire to purchase an exogenous fraction (γ_B^h) of the supplied government bonds.

$$B_t^h = \gamma_B^h B_t \quad (\text{EQ.72})$$

The changes in foreign deposits of households depend on the different foreign flows received by the households, which include the compensation of employees from abroad, the remittances net the transfers from households to the rest of the world. Thus, the changes in foreign deposits of households denominated in local currency are given by:

$$\Delta FM_t^h = \gamma_{FM}^h * (WB_t^r + TR_{pt}^r - TR_{rt}^p) \quad (\text{EQ.73})$$

We assume that households absorb the supply of equity from firms and banks in excess of demand by the rest of the world:

$$E_t^h = E_t^f + E_t^b - E_t^r \quad (\text{EQ.74})$$

The change in other financial assets is supposed to be exogenous. As mentioned above, the dong deposits are defined as the buffer stock of the household sector.

$$\Delta DM_t^h = \Delta L_t^h - \Delta H_t - p_{E_t} \Delta E_t^h - \Delta OTA_t^h - NFC_t^h \quad (\text{EQ.75})$$

The household's loans demand is a function of the lending rate, which represents the cost of borrowing. Suppose that households borrow from commercial banks to finance their financing need to invest; the household debt also depends on the household's capital accumulation.

$$L_t^{hD} = f \left(\begin{array}{c} r_{t-1} \\ (-) \end{array}; \begin{array}{c} \frac{\Delta k_{t-1}^h}{k_{t-2}^h} \\ (+) \end{array} \right) \quad (\text{EQ.B.9})$$

Commercial banks impose credit rationing on households. The level of credit rationing depends on the debt-to-income (DTI) ratio, which is calculated as the ratio of the interest payments and the new debt to the primary income. In our model, we suppose that banks will not provide loans to households if the DTI is higher than 0.4, which means 40% of primary income.

$$DTI_t^h = \min \left(0.4, \frac{ITLH + \Delta L_t^{hD}}{YP_t^h} \right) \quad (\text{EQ.76})$$

The new loans provided by banks to households are expressed as follows:

$$\Delta L_t^h = DTI_t^h * YP_t^h - ITLH \quad (\text{EQ.77})$$

The household's net wealth is defined as:

$$NW_t^h = p_{K_t} k_t^h + H_t + B_t^h + DM_t^h + FM_{ust}^h xr_t + p_{E_t} E_t^h + OTA_t^h - L_t^h \quad (\text{EQ.78})$$

4.2.5 Government and fiscal policy

The government collects taxes, receives other transfers or payments and then consumes and invests. From 2000 to 2019, the state revenue increased by an average of 17% per year. Domestic revenue accounts for the most significant part of state budget revenue which contributes to the stability of government revenue. However, adopting an expansionary countercyclical fiscal policy due to a slowing of economic growth in recent years led to a lower tax and tariff rate, reducing state revenue. The personal income tax is increasing, but their part in total is still moderate due to difficulties in tracking personal earnings of the private sector, while the informal sector remains important. From 2008 to the present, oil revenue decreased due to the lower oil price and stagnant crude oil production. In terms of expenditure, the government's expenditures increased annually by roughly 17% from 2000 to 2019. Current spending, which includes expenses on social and economic activities (education, health, society, welfare...) and administration, remains the most significant part of total public spending. The State budget deficit remains at a high level which causes the rising of public debt and becomes one of the biggest macroeconomic risks facing Viet Nam. There was a considerable increase in public debt in 2008 and 2012. However, since 2016, the government has engaged in improving the budget deficit with a target of under 4% during the period 2016-2020. The public deficit can be financed by issuing bonds or borrowing from abroad.

The public deficit is the difference between the government's revenues and total expenditures in the model.

$$NFC_t^g = GOV_{REV_t} - GOV_{EXP_t} \quad (\text{EQ.79})$$

The total government revenues are determined by the government value-added from the production, taxes (taxes on production, taxes on imports, VAT, profit taxes, personal income taxes), and property incomes.

$$GOV_{REV_t} = p_{y_t} va_t^g + SOC_t + TOP_t + FT_t + ICT_t + TIM_t + ITGM_t^{cb} + ITGM_t^b \quad (\text{EQ.80})$$

Taxes on production

$$TOP_t = \tau_{TOP} * Y_t \quad (\text{EQ.81})$$

Social contributions

$$SOC_t = SOC_t^f + SOC_t^b + SOC_t^g + SOC_t^h \quad (\text{EQ.82})$$

Profit taxes from productive sectors

$$FT_t = FT_t^f + FT_t^b + FT_t^h \quad (\text{EQ.83})$$

Interest on government deposits

$$ITGM_t^{cb} = r_{m_t} GM_{t-1}^{cb} \quad (\text{EQ.84})$$

$$ITGM_t^b = r_{m_t} GM_{t-1}^b \quad (\text{EQ.85})$$

The total government expenditures are the sum of the government's current spending, public investment and interest payments.

$$GOV_{EXP_t} = GOV_{CE_t} + p_{K_t} i_t^g + ITB_t^{cb} + ITB_t^b + ITB_t^h + r_{f_t} FL_{t-1}^g \quad (\text{EQ.86})$$

The government's current spending consists of government wages ($\lambda^g WB_t$), labor contributions ($\alpha^g WB_t^g$), taxes on production ($\tau_p^g p_{Q_t} q_t^g$), transfers to abroad ($\gamma_{RG} Y_t$), social benefits for households (SBE_t) and public consumption ($p_{G_t} g_t$).

$$GOV_{CE_t} = WB_t^g + SOC_t^g + \tau_p^g p_{Q_t} q_t^g + \gamma_{RG} Y_t + SBE_t + p_{G_t} g_t \quad (\text{EQ.87})$$

Wages paid by the government sector

$$WB_t^g = \lambda^g WB_t \quad (\text{EQ.88})$$

Social contributions

$$SOC_t^g = \alpha_{soc} * \gamma_{soc}^{wb} WB_t^g \quad (\text{EQ.89})$$

Interests on bonds paid by the government and received by the central bank

$$ITB_t^{cb} = r_{b_t} B_{t-1}^{cb} \quad (\text{EQ.90})$$

Banks holding bonds receive interest paid by the government.

$$ITB_t^b = r_{b_t} B_{t-1}^b \quad (\text{EQ.91})$$

Current transfers from abroad to the government

$$TR_{gt}^r = \gamma_{RG} * Y_t \quad (\text{EQ.92})$$

We suppose that the public expenditures (g_t) and public investment (i_t^g) are exogenous. The public expenditures and public capital increase at an exogenous growth rate.

$$g_t = g_{t-1} * (1 + \gamma_G) \quad (\text{EQ.93})$$

$$k_t^g = k_{t-1}^g * (1 + \gamma_{IG}) \quad (\text{EQ.94})$$

The public investment is given by:

$$i_t^g = k_t^g - (1 - \delta_{K_t}^g)k_{t-1}^g \quad (\text{EQ.95})$$

We suppose that the government's deposits are exogenous and that banks are projected as

Table 4.4: Government's balance sheet

	Assets (+)	Liabilities (-)
Non-financial assets	$p_K k^g$	
Governments's Deposits	GM	
Foreign Deposits	$FM_{us}^g xr$	
Bonds		$B^{(*)}$
Foreign loans		$FL_{us}^g xr^{(*)}$
Other accounts r/p	OTA^g	
Net Wealth		NW^g

(*) Item closes the sector's account

an exogenous variable represented as a part of nominal GDP.

$$GM_t^b = \gamma_{GM}^b * Y_t \quad (\text{EQ.96})$$

The changes in government deposits are:

$$\Delta GM_t^b = GM_t^b - GM_{t-1}^b \quad (\text{EQ.97})$$

The changes in government deposits in the central bank are exogenous. The stock of government deposits in the central bank is the accumulation of government deposits over the past.

$$GM_t^{cb} = GM_{t-1}^{cb} + \Delta GM_t^{cb} \quad (\text{EQ.98})$$

Thus, the total of the government's deposits is given by:

$$GM_t = GM_t^{cb} + GM_t^b \quad (\text{EQ.99})$$

The stock of foreign deposits denominated in local currency held by the government depends on their foreign loans.

$$FM_t^g = \gamma_{FM}^g * FL_t^g \quad (\text{EQ.100})$$

As with other sectors in our model, the change in other financial assets is supposed to be exogenous.

The government's net borrowing/lending position determines the change in public debt. Given the financing need of the government, the new public debt is determined by:

$$\Delta DEBT_{G_t} = NFC_t^g - \Delta OTA_t^g - \Delta GM_t^{cb} - \Delta GM_t^b - \Delta FM_{ust}^g xr_t \quad (\text{EQ.101})$$

The government can borrow from abroad or issue bonds to finance its financing need. As analysed in Chapter 3, the slight decrease in the external debt relative to the domestic debt reflects the prudential policy of the Vietnamese government in order to avoid any currency risk. Thus, we assume that the stock of foreign loans of the government, as a policy tool, is expressed as an exogenous part of the public debt of the past period.

$$FL_t^g = \gamma_{FL}^g * DEBT_{G_{t-1}} \quad (\text{EQ.102})$$

The new issued bonds of the government are given by:

$$\Delta B_t = \Delta DEBT_{G_t} - \Delta FL_t^g \quad (\text{EQ.103})$$

The stock of public debt is calculated by:

$$DEBT_{G_t} = DEBT_{G_{t-1}} + \Delta DEBT_{G_t} + FL_{ust-1}^g * \Delta xr_t \quad (\text{EQ.104})$$

The net wealth of commercial banks can be written as:

$$NW_t^g = p_{K_t} k_t^g + OTA_t^g + GM_t + FM_{ust}^g xr_t - B_t - FL_{ust}^g xr_t \quad (\text{EQ.105})$$

4.2.6 Central Bank and monetary policy

According to the Law on the State Bank of Viet Nam in 2010, the State Bank of Viet Nam (SBV) performs (i) the state management of monetary and banking activities and foreign exchange, (ii) the issuance of money, and acts as the bank of credit institutions and provides monetary services for the Government and (iii) the state management of public services under the jurisdiction of the State Bank. The objectives of SBV are inflation control, stabilisation of the macro-economy, supporting economic growth and ensuring the liquidity of credit institutions. In order to achieve these objectives, the SBV can use a set of tools, including interest rates tools, exchange rates, reserve requirements, open market operations and other tools, depending on the macroeconomic conditions. In our model, we suppose that the central bank determines the refinancing rate as a monetary policy tool and the bank's reserves. They provide advances to commercial banks. The central bank plays the role of a lender of the last resort by purchasing all remaining government bonds. The central bank intervenes in the foreign exchange market to respond to changes in the exchange rate.

The central bank provides loans for commercial banks and therefore receives the interest from banks ($ITLB_t^{cb}$). The central bank's profit can be written as follows. We assume that this profit is fully transferred to the government.

$$F_t^{cb} = ITB_t^{cb} + ITLB_t^{cb} - ITGM_t^{cb} \quad (\text{EQ.106})$$

International reserves are considered a central bank's tool to manage the exchange rate. Following the [IMF \(2019\)](#), the SBV daily announces the target exchange rate vis-à-vis the US dollar. The SBV actively intervenes in the foreign exchange market by accumulating/decumulating its international reserves to keep the exchange rate within the predetermined band around the target. Thus, we suppose that the change in international reserves will be a function of the nominal exchange rate and the ratio between the previous level of international reserves and the level of nominal GDP. As the reserves intervention by the SBV should influence the FX rate simultaneously, the reserve-to-GDP ratio is used as an instrumental variable. The effect of this ratio can be interpreted as the SBV will hesitate to intervene in the foreign exchange market when they do not have sufficient international reserves.

$$\Delta \ln(RES_t) = f \left(\underset{(+)}{xr_t}; \underset{(+)}{\frac{RES_{t-2}}{Y_{t-2}}} \right) \quad (\text{EQ.B.10})$$

Table 4.5: Central Bank's balance sheet

	Assets (+)	Liabilities (-)
Intl. reserves	$RES_{us}^{cb.xr}$	
Cash		H
Bank's Reserves		MB^{cb}
Government's Deposits		GM^{cb}
Bonds	$B^{cb(*)}$	
Advances	LB^{cb}	
Other accounts r/p	OTA^{cb}	
Net Wealth		NW^{cb}

(*) Item closes the sector's account

The State Bank of Viet Nam determines the reserves requirement for commercial banks as a proportion of their dong and foreign deposit liabilities. In post-Keynesian economics, the bank's reserves are endogenous and demand-led.

$$MB_t^{cb} = \gamma_{MB}(DM_t + FM_t + GM_t^b) \quad (\text{EQ.107})$$

The change in banks reserves is defined by the following:

$$\Delta MB_t^{cb} = MB_t^{cb} - MB_{t-1}^{cb} \quad (\text{EQ.108})$$

The central bank absorbs the remaining supply of government bonds in excess of demand by banks and households.

$$B_t^{cb} = B_t - B_t^b - B_t^h \quad (\text{EQ.109})$$

The change in other financial assets is supposed to be exogenous.

The net wealth of the central bank can be written as:

$$NW_t^{cb} = RES_{us}^{cb.xr_t} + B_t^{cb} + LB_t^{cb} - H_t - MB_t^{cb} - GM_t^{cb} + OTA_t^{cb} \quad (\text{EQ.110})$$

The system's unwritten identity is the central bank's accounting equilibrium.

$$NFC_t^{cb} = -\Delta RES_t + \Delta H + \Delta MB_t^{cb} + \Delta GM_t^{cb} - \Delta B_t^{cb} - \Delta LB_t^{cb} - \Delta OTA_t^{cb} \quad (\text{UNWRITTEN})$$

4.2.7 Commercial banks and financial system

The Vietnamese financial system has developed since the 1990s with the transformation of the banking system from one-tier to two-tier, including the SBV as a central bank and commercial banks, the development of equity and bond markets to facilitate access to finance for firms in the economy. The ratio of deposits to GDP and credit to GDP have increased sharply since 1999. The market capitalisation rose dramatically in 2007. However, there was a reduction during the global financial crisis in 2008-2009 and the Vietnamese banking crisis in 2011, but it has rapidly recovered since 2012. Commercial banks finance the economy by offering credits to firms and households in our model. We also try to model the credit rationing on firm and household loans, representing a financial constraint to the sectors. The lending and deposit rates are determined on the basis of the central bank's interest rate. Using the same definition in the case of firms, the operating surplus can be written as:

$$F_t^b = p_{y_t} v a_t^b - W B_t^b - S O C_t^b - T P_t^b \quad (\text{EQ.111})$$

The wages paid to workers of banks are defined as a share of the total wage bill.

$$W B_t^b = \lambda^b W B_t \quad (\text{EQ.112})$$

Social contributions of banks

$$S O C_t^b = \alpha_{soc} * \gamma_{soc}^{wb} W B_t^b \quad (\text{EQ.113})$$

Banks have to pay interest on dong deposits for firms and households.

$$I T D M_t = I T D M_t^f + I T D M_t^h \quad (\text{EQ.114})$$

Interest on refinancing (advances) of the central bank

$$I T L B_t^{cb} = r_t^{cb} L B_{t-1}^{cb} \quad (\text{EQ.115})$$

Banks can borrow from abroad, and the interest payments are as follows:

$$I T F L_t^b = r_{f t} F L_{t-1}^b \quad (\text{EQ.116})$$

Interest on loans paid by households and firms to banks

$$I T L_t = I T L_t^f + I T L_t^h \quad (\text{EQ.117})$$

The primary income of banks is given by the bank's profit (value-added ($p_{Y_t}va_t^g$) less wages paid (WB_t^b), labour contribution (SOC_t^b) less interest paid plus interest received from other sectors.

$$YP_t^b = F_t^b - ITGM_t^b - ITDM_t + ITB_t^b - ITLB_t^{cb} - ITFL_t^b + ITL_t \quad (\text{EQ.118})$$

Taxes on the profits of banks are calculated as follows

$$FT_t^b = \tau^b YP_{t-1}^b \quad (\text{EQ.119})$$

Bank's disposable income results from their primary income after paying profit taxes.

$$YD_t^b = YP_t^b - FT_t^b \quad (\text{EQ.120})$$

Bank's saving is also their disposable income and represents the bank's financing capacity

$$S_t^b = YD_t^b = NFC_t^b \quad (\text{EQ.121})$$

Table 4.6: Commercial Banks' balance sheet

	Assets (+)	Liabilities (-)
Bank's Reserves	MB^{cb}	
Governments's Deposits		GM^b
Dong Deposits		DM
Bonds	B^b	
Advances		$LB^{cb(*)}$
Loans	L	
Foreign loans		$FL_{us}^b xr$
Equity		$p_E E^b$
Other accounts r/p	OTA^b	
Net Wealth		NW^b

(*) Item closes the sector's account

On the asset side, commercial banks' assets accumulate the reserves requirement, which is determined by the central bank (EQ.107). Commercial banks decide to hold a part of the

remaining government bonds in excess of the household's demand. Thus, it is given by:

$$B_t^b = \gamma^{bb} * (B_t - B_t^h) \quad (\text{EQ.122})$$

We assume that the commercial bank may finance the demand for loans in the domestic economy by borrowing from abroad. Banks' level of foreign debt is thus a function of the difference between the lending rate and the interest on foreign loans and the level of domestic credit demand. The wider the spread between interest rates on loans and foreign debt, representing a higher profit, the more banks are motivated to increase their foreign debt.

$$FL_t^b = f \underset{(+)}{(r_{l_{t-1}} - r_{fl_{t-1}}), \underset{(+)}{L_t}} \quad (\text{EQ.B.11})$$

Commercial banks finance their financing needs by issuing equities. Thus, the stock of banks' equity is given by:

$$E_t^b = \gamma_{EB} * L_t \quad (\text{EQ.123})$$

The change in other financial assets is supposed to be residual.

$$\Delta OTA_t^b = -(\Delta OTA_t^f + \Delta OTA_t^{cb} + \Delta OTA_t^g + \Delta OTA_t^h + \Delta OTA_t^r) \quad (\text{EQ.124})$$

The central bank plays the role of a lender of last resort via refinancing for commercial banks. In other words, commercial banks obtain refinancing from the central bank to cover all the remaining financing needs of commercial banks.

$$\Delta LB_t^{cb} = -(NFC_t^b - \Delta MB_t^{cb} + \Delta GM_t^b + \Delta DM_t - \Delta B_t^b - \Delta L_t + \Delta FL_t^b + p_{E_t} \Delta E_t^b - \Delta OTA_t^b) \quad (\text{EQ.125})$$

The net wealth of commercial banks can be written as:

$$NW_t^b = MB_t^{cb} + B_t^b + Lt + OTA_t^b - GM_t^b - DM_t - LB_t^{cb} - FL_{us_t}^b x r_t - p_{E_t} E_t^b \quad (\text{EQ.126})$$

4.2.8 Rest of the world and external dependence

The external imbalances reflect the financing need of the economy to fund domestic consumption and investment through different forms of financial flows. Before 2005-2006, Viet Nam registered a negative current account mainly driven by a trade deficit. The high domestic demand was satisfied by imports. Moreover, the global financial crisis of 2007-2008 caused a

reduction in world demand, which decreased Vietnamese exports and led to a more significant trade deficit. However, since 2012, the current account has become positive, resulting from a trade balance and a secondary income surplus offsetting the deficit in the primary income balance.

In our model, the rest of the world accounts in the uses-resources tables consist of three components: the goods and services account, allocation of primary income account, and redistribution of the income account. They correspond to the three accounts of the balance of payments: the goods and services account, primary income account and secondary income account of the balance of payments.

The volume of exports is assumed to be determined by the total volume of imports of main commercial partners of Viet Nam, FDI, and the country's competitiveness (proxied by the ratio of domestic price to foreign price, which is represented as the world GDP deflator). As analysed in Chapter 1, FDI plays a vital role in Vietnamese exports. This specification reflects the dependence of Viet Nam on the rest of the world not only in terms of the real side but also on the financial side.

$$x_t = f \left(\underset{(+)}{im_t^{PTN}}; \underset{(+)}{FDI_{t-2}} + \underset{(+)}{\frac{p_x}{p_x^*}} \right) \quad (\text{EQ.B.12})$$

The volume of imports is defined by domestic demand, FDI and the ratio between the import price and the domestic price ($\frac{p_{IM}}{p_Y}$). In the long run, the domestic demand has a positive impact on imports (EQ.B.13.1). However, the fall of domestic prices relative to import prices will reduce Vietnamese imports. The growth rate of imports is strongly determined by changes in domestic demand (EQ.B.13.2). There is no price effect on the growth rate of imports.

$$im_t = f \left(\underset{(+)}{DMD_{t-1}}; \underset{(+)}{\frac{p_{IM_{t-1}}}{p_{Y_{t-1}}}} \right) \quad (\text{EQ.B.13})$$

Domestic demand is the sum of intermediate consumption and final consumption.

$$DMD_t = ic_t^{im} + c_t + i_t^f + i_t^g + i_t^h + g_t \quad (\text{EQ.127})$$

Trade balance is calculated as:

$$TB_t = x_t - im_t \quad (\text{EQ.128})$$

The primary income account records compensation of employees paid by the rest of the world (WB_t^r) and net property income from abroad, which include interests on foreign loans ($ITFL_t$), dividends (DIV). The interests in foreign loans are the sum of the interest paid by firms, banks and the government.

$$ITFL_t = ITFL_t^f + ITFL_t^b + ITFL_t^g \quad (\text{EQ.129})$$

The secondary income account registers all transfers of both private and public sectors with the rest of the world ($TR_{gt}^r, TR_{rt}^p, TR_{pt}^r$). Current transfers TR_{gt}^r, TR_{rt}^p are supposed to be dependent on GDP.

$$TR_{rt}^p = \gamma_{PR} * Y_t \quad (\text{EQ.130})$$

The net financing capacity of the rest of the world, which corresponds to the current account balance in the balance of payments, is the sum of the three balance items above (trade balance, primary income, and secondary income).

$$NFC_t^r = p_{IM_t} im_t - p_{X_t} x_t - WB_t^r + ITFL_t + DIV_t + TR_{pt}^r - TR_{rt}^p - TR_{rt}^g \quad (\text{EQ.131})$$

Moreover, the rest of the world's net financing capacity (need) should equal the net domestic financing capacity (need). In other words, the model has to verify this equation.

$$NFC_t^r = -(NFC_t^f + NFC_t^b + NFC_t^g + NFC_t^h)$$

Rest of the world

Table 4.7: Rest of the world's balance sheet

	Assets (+)	Liabilities (-)
Intl. reserves		$RES_{us}xr$
Foreign Deposits		$FM_{us}xr$
Foreign loans	$FL_{us}xr$	
Equity	$p_E E^r$	
Foreign direct investment	$p_{FDI} FDI_{us}xr$	
Other accounts r/p	$OTAR^{(*)}$	
Net Wealth		NW^r

(*) Item closes the sector's account

The financial account represents the financial side of the current account. A large deficit current account can face the critical question of external debt sustainability and be exposed to the risk of sudden stops. In Viet Nam, capital flows into the country mainly in the form of FDI and portfolio equity investment. Viet Nam has received FDI since the 1980s and has been considered an essential factor in Vietnamese economic growth. Up to 31/12/2019, Viet Nam has accumulated 30943 FDI projects with a total registered capital of 363,309 Billion USD.

Given that the portfolio investment is exogenous, the change in other financial assets held by the rest of the world closes the rest of the world's account. Thus, it can be written as:

$$\Delta OTA_t^r = NFC_t^r + \Delta RES_t + \Delta FM_t - \Delta FDI_t - \Delta FL_t - p_{E_t} \Delta E_t^r \quad (\text{EQ.132})$$

The net wealth of the rest of the world denominated in local currency can be written as:

$$NW_t^r = FL_{us_t} x r_t + p_{E_t} E_{us_t}^r x r_t + FDI_{us_t} x r_t + OTA_t^r - RES_{us_t} x r_t - FM_{us_t} x r_t \quad (\text{EQ.133})$$

4.2.9 Price determination

The GDP deflator is a function of the wage rate and the price of imports. In other words, the inflation incorporates the cost-push determinants such as the wage rate and the price of imports, representing the cost of imported goods used for intermediate consumptions for production. The import price deflator is also used as a proxy for foreign price inflation (Bhattacharya, 2014). The level of capacity utilisation is given by the ratio between the real GDP and the potential GDP ($\frac{y_{t-1}}{y_{t-1}^*}$). A capacity utilisation lower than 1 means that the actual GDP is less than the potential GDP. The level of the capacity utilisation is considered to be important for determining inflationary pressures in the economy. Lower capacity utilisation can lead to lower inflation.

$$p_{Y_t} = f \left(\begin{array}{c} w_{t-1}; p_{IM_{t-1}}; \frac{y_{t-1}}{y_{t-1}^*} \\ (+) \quad (+) \quad (+) \end{array} \right) \quad (\text{EQ.B.14})$$

The price of exports is determined by the domestic price, which proxies cost pressures, and the world price of imports as Viet Nam is a price taker.

$$p_{X_t} = f \left(\begin{array}{c} p_{Y_{t-1}}; p_{X_{t-1}}^* \\ (+) \quad (+) \end{array} \right) \quad (\text{EQ.B.15})$$

Like the price of exports, the price of imports depends on the world price of imports and the exchange rate.

$$p_{IM_t} = f(xr_{t-1}; p_{IM_{t-1}}^*) \quad (\text{EQ.B.16})$$

(+)

For simplicity, we suppose that the price index of output, consumption, fixed capital, public expenditures, and inventories are a function of the GDP deflator.

The price of government expenditure is defined by:

$$p_{G_t} = f(p_{Y_{t-1}}) \quad (\text{EQ.B.17})$$

(+)

The price of capital is determined as follows:

$$p_{K_t} = f(p_{Y_{t-1}}) \quad (\text{EQ.B.18})$$

(+)

The price of inventories is defined as:

$$p_{INV_t} = f(p_{Y_{t-1}}) \quad (\text{EQ.B.19})$$

(+)

The price of output is estimated as follows:

$$p_{Q_t} = f(p_{Y_{t-1}}) \quad (\text{EQ.B.20})$$

(+)

The price of consumption is determined by the nominal and real consumption:

$$p_{C_t} = \frac{Y_t - G_t - I_t - I_{12t} - X_t + IM_t}{y_t - g_t - i_t - i_{12t} - x_t + im_t} \quad (\text{EQ.134})$$

4.2.10 Asset prices

The refinancing rate or the interest rate of refinancing from the central bank to commercial banks is considered one of the monetary policy tools. Indeed, the State Bank of Viet Nam determined the objectives and the major measures on monetary policy management as follows:

"manage the monetary policy proactively and flexibly in close association with the fiscal policy to control inflation, stabilise macro-economy, support economic growth at a reasonable level, and ensure the liquidity of credit institutions. Flexibly manage the reasonable interest and exchange rates in accordance with macro-economic and monetary developments, especially

inflation; and ensure the value of Viet Nam dong, continue to restrict the dollarisation and goldarisation". Therefore, the refinancing rate is a function of inflation and the exchange rate. Moreover, the interest rate of the United States impacts the interest rate of developing countries. When the Fed raises interest rates, investors tend to sell assets denominated in foreign currencies and buy dollar-denominated assets. The wider the spread between U.S. interest rates and interest rates in other countries, the more investors are likely to move from foreign-denominated to dollar-denominated assets. This increased demand for dollars raises the dollar exchange rate, and other countries' currency exchange rates tend to weaken. It raises the prices of imports to those countries, pushing up inflation. A falling exchange rate can also make it difficult for companies and governments to service dollar-denominated debt. The central bank may decide to support their currency exchange rates by raising interest rates to solve this problem.

$$r_t^{cb} = f(\underbrace{\pi_t}_{(+)}; \underbrace{xr_{t-1}}_{(+)}; \underbrace{r_{t-1}^{us} - r_t^{cb}}_{(+)}) \quad (\text{EQ.B.21})$$

The refinancing rate is also a monetary policy mechanism via commercial banks. In other words, this interest rate is the base rate of interest which impacts different interest rates in the financial system (Godley and Lavoie, 2007b). The banks determine the lending rate based on it. Then, the lending rate will affect the investment of sectors and then impact the global demand of the economy.

$$r_t = f(\underbrace{r_t^{cb}}_{(+)}) \quad (\text{EQ.B.22})$$

Then, the deposit rate depends on the lending rate.

$$r_{mt} = f(\underbrace{r_t}_{(+)}) \quad (\text{EQ.B.23})$$

In our model, we suppose that the interest rate on foreign deposits (r_{fm}) is 0%. This is one of the essential tools for SBV to manage monetary policy to concretise the anti-dollarization target of the Government and help stabilise the exchange rate and the foreign currency market.

Le (2015) shows that three theoretical approaches can explain the exchange rate. One of the approaches to defining the exchange rate is the Balance of Payment. The nominal exchange rate is determined mainly by the disequilibrium of foreign exchange demand and supply. When the demand is higher than the supply, the nominal exchange rate will increase and vice versa. The second approach is the monetary and portfolio approach which assumes that economic agents will choose the assets having a higher expected return from a portfolio

of domestic and foreign assets. This difference in expected return can be expressed as the difference between the domestic and foreign interest rates.

$$xr_t = f \left(\frac{D_{t-1}^{FX} - S_{t-1}^{FX}}{S_{t-1}^{FX}}; r_{t-1}^{us} - r_{t-1}^{cb} \right) \quad (\text{EQ.B.24})$$

The foreign exchange demand is given by:

$$D_t^{FX} = im_t * p_{IM_t} + ITFL_t + DIV_t + TR_{r_t}^p + \Delta FM_t - \Delta RES_t \quad (\text{EQ.135})$$

The foreign exchange supply is given by:

$$S_t^{FX} = x_t * p_{X_t} + WB_t^r + TR_{g_t}^r + TR_{p_t}^r + \Delta FL_t + \Delta E_t^r * p_{E_t} + \Delta FDI_t + \Delta OTA_t^r \quad (\text{EQ.136})$$

The price of equity is defined as a function of the US price of equity, the lending rate, which represents the borrowing cost of firms and the exchange rate.

$$p_{E_t} = f(p_{E_t}^{us}; r_{t-1}^{cb}) \quad (\text{EQ.B.25})$$

The interest rate on foreign loans is assumed to be determined by the US interest rate.

$$r_{fl_t} = f(r_{t-1}^{US}) \quad (\text{EQ.B.26})$$

The rate of return of bonds is a function of the refinancing rate and the public deficit in % of GDP (Peiris, 2013).

$$r_{b_t} = f \left(r_{t-1}^{cb}; f \left(\frac{NFC_{t-1}^g}{Y_{t-1}} \right) \right) \quad (\text{EQ.B.27})$$

The price of FDI is determined by the price of domestic equity. The exchange rate implicitly impacts the price of FDI via the price of domestic equity.

$$p_{FDI_t} = f(p_{E_{t-1}}; xr_t) \quad (\text{EQ.B.28})$$

4.2.11 Labour market

The wage rate growth depends on the unemployment rate and the growth of the consumption price, and that of labour productivity, which is proxied by the ratio of the real GDP to the total number of workers.

$$w_t = f \left(\underset{(+)}{p_{C_{t-1}}}; \underset{(-)}{U_{t-1}}; \underset{(+)}{\frac{y_t}{NBW_t}} \right) \quad (\text{EQ.B.29})$$

Unit labour cost is supposed to be determined as the ratio between the sum of the wage bill and social contribution and the real output.

$$ULC_t = \frac{WB_t + SOC_t}{q_t} \quad (\text{EQ.137})$$

There is a positive impact from demand, i.e. the number of workers employed by firms. The higher the level of a firm's value-added, the higher the demand for workers.

$$NBW_t^f = f(\underset{(+)}{va_t^f}; \underset{(+)}{pop_{ACTIV_t}}) \quad (\text{EQ.B.30})$$

Suppose that the total number of workers is split among different institutional sectors using fixed shares. The total number of workers is calculated by:

$$NBW_t = \lambda_n * NBW_t^f \quad (\text{EQ.138})$$

Bloom (1986) examines, on the supply side of the labour market, the lagged effect of population growth on the labour supply.

$$pop_{ACTIV_t} = f(\underset{(+)}{pop_{t-1}}) \quad (\text{EQ.B.31})$$

The total population is assumed to grow at an exogenous rate.

$$pop_t = pop_{t-1} * (1 + pop_{grt}) \quad (\text{EQ.139})$$

4.3 Estimations

4.3.1 Estimation strategy

This section presents our estimation strategy in behavioural equations of the model. All behavioural equations are linear regressions. We mainly use Vector Error Correction Models (VECMs), which lead to the corresponding Error Correction Mechanisms (ECMs) for each specification, or OLS regression. VECM estimates give a long-run interpretation, whereas ECM estimates give a short-run interpretation. The short- and the long-run are linked via speeds of adjustment (the coefficients of the corresponding cointegration vectors lagged one period (vc_{-1})). This estimation method consists of three main steps. First, we test our variables for a unit root using the augmented Dickey-Fuller (ADF) and test where our variables are cointegrated. The second step is the OLS estimation of the long-run. The residual of this regression has to be stationary. It can be verified by using the ADF test. Then, we estimate the short-run relationship by using the OLS method and integrating the lagged residual of the long-run estimation. Its coefficient has to be negative. Regarding the equations with OLS regression, we did standard tests on the residual using the Jarque-Bera test for normality test, the Breusch-Pagan test for heteroskedasticity test, and the Ljung-box test for autocorrelation test.

The specifications of variables can be different in logarithms based on other criteria. First, the explanatory variables have to be chosen with respect to the theoretical meaningfulness (economic theory). Second, it should also base on statistical validity. However, in some cases, we still keep the variables with the right signs of the estimated coefficients, even if the latter is not significant. It attempts to find a balance between empirics and theory ([Byrialsen and Raza, 2020](#)). Third, the specification has to satisfy the system-wide implications. In some cases, the econometric specification gives the best fit with the serie, but the integration into the equation system is not satisfied. We have precisely the same problem highlighted in [Zeza \(2018\)](#). We had to go back and forth in estimating relations and checking the implications with simulation exercises. It allows us to modify and reshape each equation in order to have more meaningful and realistic results. Our objective is not only to have a best fit with past data but also to have reasonable projected results.

While estimating these behavioural equations, in order to fit the simulated values (fitted

values) to the actual data, we have to deal with the outliers. According to [Hendry and Mizon \(2011\)](#), outliers can come from the sudden behavioural shifts or data measurement errors. The sudden behavioural shifts can come from major events in the economy. During the period 1996-2019, the Vietnamese economy experienced several structural events (Figure 1.1) such as the Asian crisis in 1997, the wage reform in 2004-2005, WTO accession in 2007, the global financial crisis in 2008 and the banking crisis in 2011-2012. In addition, financial data and flow data certainly have measurement errors. The solution from econometric methods is to add the event-specific dummy variables. It allows removing outliers by including as many dummies as necessary to get a better fit to the observed series.

We present the equations in different groups of variables. Thus, it is not in the same order in which they appear in the model described above. All estimated parameter and their t-statistics are shown for each equation.

- Demand components: Investment, Consumption, Exports, Imports
- Financial assets and liabilities of each sector
- Prices
- Interest rates, rates of return, price of financial assets
- Labour market

4.3.2 Demand components

Firm's investment (EQ.B.1)

$$\frac{\Delta k_t^f}{k_{t-1}^f} = \zeta_0 + \underset{(+)}{\zeta_1} * \frac{\Delta k_{t-1}^f}{k_{t-2}^f} + \underset{(+)}{\zeta_2} * \frac{y_{t-1}}{y_{t-1}^*} + \underset{(-)}{\zeta_3} * (r_{l_t} - \pi_t) + \underset{(+)}{\zeta_4} * \frac{F_{t-1}^f}{K_{t-2}^f} + \underset{(-)}{\zeta_5} * \frac{\Delta p_{E_t}}{p_{E_{t-1}}} \quad (\text{EQ.B.1})$$

Table 4.8: Firm's real investment

<i>Dependent variable:</i>	
	$\frac{\Delta k_t^f}{k_{t-1}^f}$
ζ_1	0.502*** (0.058)
ζ_2	0.054*** (0.005)
ζ_3	-0.001*** (0.0004)
ζ_4	0.001*** (0.0002)
ζ_5	-0.015*** (0.003)
Observations	22
R ²	0.999
Adjusted R ²	0.999
Residual Std. Error	0.004 (df = 14)
F Statistic	2,118.190*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The firm's investment decision is represented as the net physical accumulation rate, i.e. the ratio of the net flow of non-financial assets to the stock of the past period. The firm's investment mainly depends positively on the past accumulation rate and the profit rate. The

cost of borrowing from commercial banks has a negative impact on capital accumulation. The investment of firms is also driven by an accelerator effect of the capacity utilisation proxied by the ratio of actual GDP and potential GDP. Firms should increase their investment when the capacity utilisation is high. When demand is strong, firms will increase production by increasing their investment. The estimation result found a negative effect of an increase in equity price representing the financial profitability of the real investment. Indeed, the literature on financialisation demonstrated the crowding-out effect of financialisation on real investment (Hein and van Treeck (2010), Hein (2012)). The growing importance of financial revenues and profits vis-à-vis the revenues and earnings from real investments will induce firms to invest in financial assets and reduce their investment in non-financial assets. Firms will sacrifice long-term investment to increase short-term profits. It is called "managerial myopia" (Samuel 2000) or "rent-seeking behaviour", which focuses mainly on short-term profitability.

Consumption (EQ.B.6)

$$\ln(c_t) = \delta_0^c + \underset{(+)}{\delta_1^c} * \ln\left(\frac{YD_{t-1}^h}{pC_{t-1}}\right) + \underset{(+)}{\delta_2^c} * \ln\left(\frac{NW_{t-1}^h}{pC_{t-1}}\right) \quad (\text{EQ.B.6.1})$$

Table 4.9: Real consumption (Long-run)

	<i>Dependent variable:</i>
	ln(c)
δ_1^c	0.657*** (0.116)
δ_2^c	0.176** (0.080)
δ_0^c	1.142*** (0.297)
Observations	23
R ²	0.990
Adjusted R ²	0.988
Residual Std. Error	0.046 (df = 19)
F Statistic	630.318*** (df = 3; 19)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

In the long-run, household consumption depends positively on their disposable income and net wealth of the past period. The marginal propensity to consume is around 0.66, and the elasticity of consumption to financial wealth is 0.17.

$$\Delta \ln(c_t) = \underset{(+)}{\delta_1} * \Delta \ln \left(\frac{NW_{t-1}^h}{pC_{t-1}} \right) + \underset{(+)}{\delta_2} * \Delta \ln \left(\frac{YD_{t-1}^h}{pC_{t-1}} \right) + \underset{(-)}{\delta_3} * vc_{-1} \quad (\text{EQ.B.6.2})$$

$$vc_{-1} = \ln(c_{t-1}) - \delta_0^c - \delta_1^c * \ln \left(\frac{YD_{t-2}^h}{pC_{t-2}} \right) - \delta_2^c * \ln \left(\frac{NW_{t-2}^h}{pC_{t-2}} \right)$$

Table 4.10: Real consumption (Short-run)

<i>Dependent variable:</i>	
$\Delta \ln(c)$	
δ_1	-0.061 (0.035)
δ_2	1.129*** (0.092)
δ_3	-0.594*** (0.092)
Observations	
	22
R ²	
	0.972
Adjusted R ²	
	0.944
Residual Std. Error	
	0.015 (df = 11)
F Statistic	
	34.942*** (df = 11; 11)
Note:	
	*p<0.1; **p<0.05; ***p<0.01

In the short-run, the growth rate of consumption depends mainly on the change in disposable income. Following a 1% increase in the growth rate of disposable income, the percentage change of consumption increases by 1.13%. The effect of the change in a household's wealth on the growth rate of consumption becomes negative but not significant.

Household's investment (EQ.B.7)

$$\frac{\Delta k^h}{k_{t-1}^h} = \underset{(+)}{\zeta_0^h} * \frac{\Delta k_{t-1}^h}{k_{t-2}^h} + \underset{(+)}{\zeta_1^h} * \Delta \ln \left(\frac{YD_{t-1}^h}{pC_{t-1}} \right) + \underset{(-)}{\zeta_2^h} * r_{l_t} + \underset{(+)}{\zeta_3^h} * \frac{F_{t-1}^h}{K_{t-2}^h} \quad (\text{EQ.B.7})$$

Table 4.11: Real household's investment

	<i>Dependent variable:</i>
	$\frac{\Delta k^h}{k_{-1}^h}$
ζ_1^h	0.958*** (0.041)
ζ_2^h	0.098*** (0.026)
ζ_3^h	-0.001*** (0.0004)
ζ_0^h	0.006* (0.003)
Observations	22
R ²	0.999
Adjusted R ²	0.998
Residual Std. Error	0.004 (df = 10)
F Statistic	948.277*** (df = 12; 10)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Table 4.11 shows the estimated coefficients of the impact of households' disposable income and the cost of borrowing on their decision on investment. A 1% rise in disposable income leads to around 0.1% increase in their investment. The real lending rate, which represents the cost of borrowing, has a negative effect on their investment. A 1% rise in the lending rate provokes a fall in the demand for household's investment by 0.01%. In reality, households' investment in housing is important. An increase in house prices motivates households to invest more in constructing new houses (Byrialsen and Raza, 2020). However, we do not have the data for investment in housing as well as the housing price.

Exports (EQ.B.12)

$$\begin{aligned}
\Delta \ln(x_t) = & \theta_0^x + \underset{(+)}{\theta_1^x} * \Delta \ln(x_{t-1}) + \underset{(+)}{\theta_2^x} * \Delta \ln(im_t^{PTN}) \\
& + \underset{(+)}{\theta_3^x} * \Delta \ln(FDI_{t-2}) + \underset{(+)}{\theta_4^x} * \Delta \ln\left(\frac{p_x}{p_x^*}\right) + \underset{(+)}{\theta_5^x} * \Delta \ln(xr_{t-1})
\end{aligned} \tag{EQ.B.12}$$

Table 4.12: Real exports

	<i>Dependent variable:</i>
	$\Delta \ln(x)$
θ_1^x	0.147* (0.070)
θ_2^x	0.044* (0.025)
θ_3^x	0.196** (0.086)
θ_4^x	-0.359*** (0.081)
θ_5^x	0.291* (0.157)
θ_0^x	0.079*** (0.016)
Observations	22
R ²	0.971
Adjusted R ²	0.938
Residual Std. Error	0.015 (df = 10)
F Statistic	29.989*** (df = 11; 10)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Table 4.12 shows that the change in the growth rate of exports depends firstly positively on the foreign demand even though the effect is relatively low. A 1% increase in the growth rate of foreign demand implies a 0.044% rise in the growth rate of exports, respectively. An increase in the exchange rate represents a depreciation of the domestic currency, which leads to an improvement in competitiveness. A 1% rise in the exchange rate provokes an 0.29% increase in the growth rate of exports. The negative sign of the coefficient of the relative price illustrates that a 1% increase in Vietnamese export price above the world export price will diminish the demand for exports by 0.34%. Finally, one of the specific characteristics of

the Vietnamese economy is the contribution of the FDI sector to exports. It translates to a positive impact of the changes in FDI on the growth rate of the volume of real exports.

Imports (EQ.B.13)

$$\ln(im_t) = \underset{(+)}{\iota_0^{im}} + \underset{(+)}{\iota_1^{im}} * \ln(DMD_{t-1}) + \underset{(+)}{\iota_2^{im}} * \ln\left(\frac{pIM_{t-1}}{pY_{t-1}}\right) + \underset{(+)}{\iota_3^{im}} * \ln\left(\frac{FDI_{t-1}}{Y_{t-1}}\right) \quad (\text{EQ.B.13.1})$$

Table 4.13: Real imports (Long-run)

	<i>Dependent variable:</i>
	ln(im)
ι_1^{im}	1.222*** (0.126)
ι_2^{im}	-0.906*** (0.287)
ι_3^{im}	0.350 (0.415)
ι_0^{im}	-2.739** (1.023)
Observations	23
R ²	0.990
Adjusted R ²	0.989
Residual Std. Error	0.091 (df = 19)
F Statistic	641.599*** (df = 3; 19)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The volume of imports is a function of domestic demand and the ratio of the domestic price level with respect to the price of imports. A 1% rise in domestic demand leads to a 1.2% increase in real imports. The role of domestic demand in determining the level of imports is clearly important. The fall of domestic prices relative to import prices will reduce Vietnamese imports. In addition, the majority of Viet Nam's total imports were implemented by the FDI sector, especially for machinery and equipment. It confirms the positive result of the coefficient of the FDI as in percentage of GDP. However, the coefficient is not significant in the long-run. We found only a significant effect in the short-run.

$$\Delta \ln(im_t) = \iota_0 + \underset{(+)}{\iota_1} * \Delta \ln(im_{t-1}) + \underset{(-)}{\iota_2} * vc_{-1} \quad (\text{EQ.B.13.2})$$

$$vc_{-1} = \ln(im_{t-1}) - \iota_0^{im} - \iota_1^{im} * \ln(DMD_{t-2}) - \iota_2^{im} * \ln\left(\frac{p_{IM_{t-2}}}{p_{Y_{t-2}}}\right) - \iota_3^{im} * \ln\left(\frac{FDI_{t-2}}{Y_{t-2}}\right)$$

Table 4.14: Real imports (Short-run)

<i>Dependent variable:</i>	
$\Delta \ln(im)$	
ι_1	0.280** (0.107)
ι_2	-0.124 (0.087)
ι_0	0.097*** (0.015)
Observations	22
R ²	0.922
Adjusted R ²	0.864
Residual Std. Error	0.023 (df = 12)
F Statistic	15.867*** (df = 9; 12)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The short-run equation of imports shows an autoregressive persistence. The estimated speed of adjustment of -0.124 implies that the short-run evolution (the ECM estimation) approaches its long-term evolution at a rate of 12.4% annually.

4.3.3 Financial assets

Firm's debt (EQ.B.3)

$$\Delta \ln(L_t^{fD}) = \tau_0^{lf} + \underset{(-)}{\tau_1^{lf}} * \frac{L_{t-1}^f}{NW_{t-1}^f} + \underset{(+)}{\tau_2^{lf}} * \Delta \ln(L_{t-1}^f) + \underset{(-)}{\tau_3^{lf}} * \Delta \ln(r_t) \quad (\text{EQ.B.3})$$

Table 4.15: Firm's debt

	<i>Dependent variable:</i>
	$\Delta \ln(L^{fD})$
τ_1^{lf}	-0.075*** (0.025)
τ_2^{lf}	0.522*** (0.082)
τ_3^{lf}	-0.015*** (0.003)
τ_0^{lf}	0.288*** (0.050)
Observations	22
R ²	0.945
Adjusted R ²	0.912
Residual Std. Error	0.038 (df = 13)
F Statistic	28.113*** (df = 8; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The specification for the firms' indebtedness is shown in EQ.B.3. The negative effect of the interest rate on the debt demand of firms is confirmed where the coefficient τ_3^{lf} is negative. Since the high indebtedness implies higher interest expenses, it affects the creditworthiness of firms. Thus, it makes firms' credit demand decrease. An increase in the debt ratio of firms represents a reduction in debt demand.

Firm's foreign debt (EQ.B.2)

$$\Delta \ln(FL_t^f) = \tau_1^{flf} \left(r_{l_t} - r_{l_t}^{us} - \frac{\Delta x r_t}{x r_{t-1}} \right) + \tau_2^{flf} \left(r_{l_{t-1}} - r_{l_{t-1}}^{us} - \frac{\Delta x r_{t-1}}{x r_{t-2}} \right) + \tau_3^{flf} * \frac{\Delta y_{t-1}}{y_{t-2}} \quad (\text{EQ.B.2})$$

Table 4.16: Firm's foreign debt

<i>Dependent variable:</i>	
$\Delta \ln(FL^f)$	
τ_1^{flf}	-0.021** (0.009)
τ_2^{flf}	0.025** (0.009)
τ_3^{flf}	0.015* (0.007)
Observations	22
R ²	0.845
Adjusted R ²	0.738
Residual Std. Error	0.106 (df = 13)
F Statistic	7.898*** (df = 9; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Firms have different options to finance their financing need, for example borrowing from commercial banks. Consequently, it is supposed that if it becomes more expensive to borrow from banks (i.e. the lending rate increases), it leads firms to contract more foreign debt. It is considered a substitution of financing instruments. Moreover, a "good news" scenario, represented by an increase in economic growth rate, pushes output up. This positively affects the investment and, thus, the demand for foreign debt to finance it. From the point of view of foreign investors, the high economic growth will attract foreign capital. It translates into the positive coefficient of the variable "economic growth" (τ_3^{flf}) in the EQ.B.2.

Firm's equities (EQ.B.4)

$$\Delta E_t^f = \tau_0^{ef} + \underset{(-)}{\tau_1^{ef}} * \Delta E_{t-1}^f + \underset{(+)}{\tau_2^{ef}} * i_t^f + \underset{(+)}{\tau_3^{ef}} * r_{t-1} \quad (\text{EQ.B.4})$$

Table 4.17: Firm's equities

	<i>Dependent variable:</i>
	ΔE^f
τ_1^{ef}	-0.300** (0.121)
τ_2^{ef}	0.662*** (0.144)
τ_3^{ef}	13.608** (6.178)
τ_0^{ef}	-229.164** (87.788)
Observations	22
R ²	0.871
Adjusted R ²	0.792
Residual Std. Error	60.326 (df = 13)
F Statistic	10.965*** (df = 8; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Table 4.17 indicates that the changes in the volume of equity issued by firms are determined positively by the interest rate, which represents an alternative financing instrument for firms and the volume of investment which reflects the financing need of firms. From the demand side, they seek the cheapest option for financing. It must be noticed that it is in contrast to the effect of the changes in equity in the previous period.

Bank's foreign debt (EQ.B.11)

$$\ln(FL_t^b) = v_0 + \underset{(+)}{v_1} * \ln(FL_{t-1}^b) + \underset{(+)}{v_2} * (r_{t-1} - r_{fl_{t-1}}) + \underset{(+)}{v_3} * \ln(L_t) \quad (\text{EQ.B.11})$$

Table 4.18: Bank's foreign debt

<i>Dependent variable:</i>	
$\ln(FL^b)$	
v_1	-0.300** (0.121)
v_2	0.662*** (0.144)
v_3	13.608** (6.178)
v_0	-229.164** (87.788)
Observations	22
R ²	0.871
Adjusted R ²	0.792
Residual Std. Error	60.326 (df = 13)
F Statistic	10.965*** (df = 8; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

As expected, the estimation results (Table 4.18) show that commercial banks will increase their stock of foreign debt when the demand for credit in the domestic economy rises. However, their decision depends also on the difference between the cost of borrowing from abroad and the profit from lending domestically. The higher the difference, the higher the demand for foreign debt is. The coefficient v_2 , which is positive and significant, validates our hypothesis.

Household's debt (EQ.77)

$$\Delta \ln(L_t^{hD}) = \chi_0 + \chi_1 * \Delta \ln(L_{t-1}^h) + \chi_2 * \Delta \ln(r_{t-1}) + \chi_3 * \frac{\Delta k_{t-1}^h}{k_{t-2}^h} \quad (\text{EQ.77})$$

Table 4.19: Household's debt

	<i>Dependent variable:</i>
	$\Delta \ln(L^{hD})$
χ_1	0.267** (0.106)
χ_2	-0.296*** (0.058)
χ_3	0.615* (0.305)
χ_0	0.059 (0.035)
Observations	22
R ²	0.909
Adjusted R ²	0.853
Residual Std. Error	0.037 (df = 13)
F Statistic	16.220*** (df = 8; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

There is a negative long-term association between the interest rate and household debt demand, representing a negative coefficient. This implies that a 1% increase in the lending rate decreases household credit demand by 0.3%. On the other hand, a 1% increase in the physical capital accumulation of the households sector leads to an increase in debt by 0.6%.

Household's cash (EQ.B.8)

$$\ln(H_t) = \delta_0^h + \underset{(+)}{\delta_1^h} * \ln(C_t) + \underset{(-)}{\delta_2^c} * \ln(r_{mt}) \quad (\text{EQ.B.8.1})$$

Table 4.20: Household's cash (Long-run)

	<i>Dependent variable:</i>
	ln(H)
δ_1^h	1.185*** (0.041)
δ_2^h	-0.209* (0.121)
δ_0^h	-2.251*** (0.379)
Observations	23
R ²	0.977
Adjusted R ²	0.975
Residual Std. Error	0.191 (df = 20)
F Statistic	430.208*** (df = 2; 20)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Cash held by households is estimated as a dependent variable of their nominal consumption. Households hold more cash when they increase their consumption. However, they also seek the financial return from the deposits in commercial banks. Thus, the deposit rate will negatively affect the stock of cash of households. It is reflected in the positive and negative significant coefficient of consumption and deposit rate, respectively, in the long-run equation (Table 4.20).

$$\Delta \ln(H_t) = \underset{(+)}{\varrho_0} * \Delta \ln(H_{t-1}) + \underset{(+)}{\varrho_1} * \Delta \ln(C_{t-1}) + \underset{(-)}{\varrho_2} * \Delta \ln(r_{m_{t-1}}) + \underset{(-)}{\varrho_3} * vc_{-1} \quad (\text{EQ.B.8.2})$$

$$vc_{-1} = \ln(H_{t-1}) - \delta_0^h - \delta_1^h * \ln(C_{t-1}) - \delta_2^h * \ln(r_{m_{t-1}})$$

Table 4.21: Household's cash (Short-run)

<i>Dependent variable:</i>	
$\Delta \ln(H)$	
ϱ_0	0.863*** (0.149)
ϱ_1	0.231** (0.104)
ϱ_2	-0.097* (0.046)
ϱ_3	-0.259** (0.100)
Observations	22
R ²	0.959
Adjusted R ²	0.935
Residual Std. Error	0.049 (df = 14)
F Statistic	40.761*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The short-run equation confirms the findings from the long-run specification. The speed of adjustment is, as expected, negative and significant.

International reserves (EQ.B.10)

$$\Delta \ln(RES_t) = \gamma_0 + \underset{(-)}{\gamma_1} * \Delta \ln(RES_{t-1}) + \underset{(-)}{\gamma_2} * \Delta \ln(xr_t) + \underset{(-)}{\gamma_3} * \frac{RES_{t-2}}{Y_{t-2}} \quad (\text{EQ.B.10})$$

Table 4.22: International reserves

<i>Dependent variable:</i>	
$\Delta \ln(RES)$	
γ_1	-0.485** (0.180)
γ_2	-3.223** (1.190)
γ_3	-2.946*** (0.687)
γ_0	0.809*** (0.149)
Observations	22
R ²	0.774
Adjusted R ²	0.634
Residual Std. Error	0.147 (df = 13)
F Statistic	5.557*** (df = 8; 13)

Note: *p<0.1; **p<0.05; ***p<0.01

As mentioned above, the central bank responds to the exchange rate variation by intervening in the stock of international reserves. The results (Table 4.22) indicate that the growth in international reserves will decline by around 3.2% in response to depreciation by one percentage point. In addition, it falls by 2.9% in response to a one percentage point increase in the reserve to GDP ratio. The latter implies that when the stock of reserves is enough, the central bank does not hesitate to intervene. They will decumulate international reserves following a depreciation.

Remittances (EQ.B.5)

$$\Delta \ln(TR_{pt}^r) = \underset{(+)}{\eta_1^{rem}} * \Delta \ln(xr_{t-1}) + \underset{(+)}{\eta_2^{rem}} * \Delta \ln(r_{mt}) + \underset{(+)}{\eta_3^{rem}} * \frac{MIGRANT}{POP} \quad (\text{EQ.B.5})$$

Table 4.23: Remittances

<i>Dependent variable:</i>	
$\Delta \ln(TR_p^r)$	
η_1^{rem}	1.021* (0.558)
η_2^{rem}	0.311*** (0.084)
η_3^{rem}	0.677 (0.390)
Observations	22
R ²	0.949
Adjusted R ²	0.906
Residual Std. Error	0.080 (df = 12)
F Statistic	22.214*** (df = 10; 12)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The estimation results confirm our hypothesis. Migrants will send remittances to the origin country when the exchange rate and the deposit rate increase. The higher the number of workers, the greater the remittances. We obtain all three coefficients as positive and significant.

4.3.4 Prices

GDP deflator (EQ.B.14)

$$\ln(p_{Y_t}) = \xi_0^{py} + \underset{(+)}{\xi_1^{py}} * \ln(w_{t-1}) + \underset{(+)}{\xi_2^{py}} * \ln(p_{IM_t}) \quad (\text{EQ.B.14.1})$$

Table 4.24: GDP deflator (Long-run)

	<i>Dependent variable:</i>
	$\ln(p_Y)$
ξ_1^{py}	0.512*** (0.128)
ξ_2^{py}	0.510* (0.250)
ξ_0^{py}	-1.895*** (0.496)
Observations	23
R ²	0.970
Adjusted R ²	0.967
Residual Std. Error	0.104 (df = 20)
F Statistic	321.592*** (df = 2; 20)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The GDP deflator is estimated as a logarithmic function and depends on the wage rate and the price of imports in the long-run. The results can be interpreted in percentage terms. It implies that a 1% increase in wage rate and import price leads to 0.51% and 0.52% in the GDP deflator, respectively.

$$\Delta \ln(p_{Y_t}) = \underset{(+)}{\xi_1} * \Delta \ln(p_{Y_{t-1}}) + \underset{(+)}{\xi_2} * \Delta \ln(p_{IM_t}) + \underset{(+)}{\xi_3} * \Delta \ln(w_{t-1}) + \underset{(-)}{\xi_4} * vc_{-1} + \underset{(+)}{\xi_5} * \frac{y_{t-1}}{y_{t-1}^*}$$

(EQ.B.14.2)

$$vc_{-1} = \ln(p_{Y_{t-1}}) - \xi_0^{py} - \xi_1^{py} * \ln(w_{t-2}) - \xi_2^{py} * \ln(p_{IM_{t-1}})$$

Table 4.25: GDP deflator (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_Y)$
ξ_1	0.183** (0.072)
ξ_2	0.438*** (0.060)
ξ_3	0.185*** (0.046)
ξ_4	-0.205*** (0.051)
ξ_5	0.025*** (0.008)
Observations	22
R ²	0.985
Adjusted R ²	0.969
Residual Std. Error	0.016 (df = 11)
F Statistic	63.612*** (df = 11; 11)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The short-run specification is shown in Table 4.25. It indicates that the growth rate of the GDP deflator (inflation rate) is positively affected by its previous period. Following a 1% increase in the growth rate of the general price level in this period will cause a 0.18% rise in a period later. Wage rate and import price positively affect the price. A 1% rise in the growth rate of wage rate provokes a 0.44% increase in inflation in the same year. An increase of 1% in the import price leads to an increase in prices of 0.18%. We also found a positive impact on capacity utilisation, which represents a demand effect. Finally, the annual speed of adjustment is about 20%.

Price of exports (EQ.B.15)

$$\ln(p_{X_t}) = \underset{(+)}{\mu_1^{px}} * \ln(p_{Y_{t-1}}) + \underset{(+)}{\mu_3^{px}} * \ln(p_{X_{t-1}}^*) \quad (\text{EQ.B.15.1})$$

Table 4.26: Export price (Long-run)

	<i>Dependent variable:</i>
	$\ln(p_X)$
μ_1^{px}	0.638*** (0.064)
μ_2^{px}	0.270* (0.139)
Observations	23
R ²	0.962
Adjusted R ²	0.958
Residual Std. Error	0.098 (df = 21)
F Statistic	265.954*** (df = 2; 21)

Note: *p<0.1; **p<0.05; ***p<0.01

The price of exports is estimated as a function of the domestic and world export prices. We found that a 1% increase in domestic price and the world price of exports in the previous period lead to a change of 0.64% and 0.27% in the export price of the present period. We note that the coefficient associated with the domestic price, which represents the cost-push effect, is higher than that of the world price.

$$\Delta p_{X_t} = \underset{\text{(+)}}{\mu_0} * \Delta \ln(p_{X_{t-1}}) + \underset{\text{(-)}}{\mu_1} * vc_{-1} \quad (\text{EQ.B.15.2})$$

$$vc_{-1} = \ln(p_{X_{t-1}}) - \mu_1^{px} * \ln(p_{Y_{t-2}}) - \mu_2^{px} * \ln(p_{X_{t-2}}^*)$$

Table 4.27: Export price (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_X)$
μ_0	0.418*** (0.076)
μ_1	-0.245*** (0.068)
Observations	22
R ²	0.957
Adjusted R ²	0.933
Residual Std. Error	0.024 (df = 14)
F Statistic	39.066*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Table 4.27 shows the short-run specification of the export price. The growth rate of the price of exports is determined by its previous one-period lagged values. An increase of 1% in the growth rate of export price in the previous period implies a 0.42% increase in the growth rate of the export price one period later. The speed of adjustment to the long-run trajectory is 24.5% annually.

Price of imports (EQ.B.16)

$$\ln(p_{IM_t}) = \underset{(+)}{\nu_1^{pim}} * \ln(xr_{t-1}) + \underset{(+)}{\nu_2^{pim}} * \ln(p_{IM_{t-1}}^*) \quad (\text{EQ.B.16.1})$$

Table 4.28: Import price (Long-run)

	<i>Dependent variable:</i>
	$\ln(p_{IM})$
ν_1^{pim}	0.007 (0.004)
ν_2^{pim}	1.813*** (0.175)
Observations	23
R ²	0.874
Adjusted R ²	0.862
Residual Std. Error	0.156 (df = 21)
F Statistic	72.579*** (df = 2; 21)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Following the same convention of interpretation as the price of exports, the log of the price of imports is a function of the exchange rate and the world price of imports in logarithms. The coefficient of the exchange rate has a right sign but is not significant. The import price elasticity with respect to the world import price is 1.81, which is very high. It can be explained by the fact that Viet Nam is a small open economy, and the country is a price taker on the import side.

$$\Delta \ln(p_{IM_t}) = \underbrace{\nu_1}_{(+)} + \underbrace{\nu_2 * \Delta \ln(p_{IM_{t-1}})}_{(+)} + \underbrace{\nu_3 * \Delta \ln(p_{IM_t}^*)}_{(+)} + \underbrace{\nu_4 * \Delta \ln(p_{IM_{t-1}}^*)}_{(+)} + \underbrace{\nu_5 * vc_{-1}}_{(-)} \quad (\text{EQ.B.16.2})$$

$$vc_{-1} = \ln(p_{IM_{t-1}} - \nu_1^{pim} * \ln(xr_{t-2}) - \nu_2^{pim} * \ln(p_{IM_{t-2}}^*))$$

Table 4.29: Import price (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_{IM})$
ν_2	-0.278*** (0.084)
ν_3	0.430*** (0.069)
ν_4	0.537*** (0.104)
ν_5	-0.145*** (0.029)
ν_1	0.026*** (0.005)
Observations	22
R ²	0.971
Adjusted R ²	0.950
Residual Std. Error	0.017 (df = 12)
F Statistic	45.213*** (df = 9; 12)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The estimation results of the short-run equation (Table 4.29) show that the growth rate of import price is determined by itself lagged one period, that of world import price of the same period and lagged one period. The coefficient representing the speed of adjustment is negative and significant, around 14.5% per year.

As mentioned above, for simplicity, the price of public expenditures, price of capital, price of inventories and price of output are defined as a function of the GDP deflator in both the long-run and the short-run. The long-run specification consists of each price level in a logarithmic function of the GDP deflator. The short-run is represented by the growth rate of the long-run specification with an annual speed of adjustment. All prices are demonstrated to move with the GDP deflator. Given that the interpretations are in the same convention, we will not interpret for each corresponding interpretation but only show the estimated results below.

Price of public expenditures (EQ.B.17)

$$\ln(p_{G_t}) = \underset{(+)}{\sigma_0^{pg}} + \underset{(+)}{\sigma_1^{pg}} * \ln(p_{Y_t}) \quad (\text{EQ.B.17.1})$$

Table 4.30: Price of public expenditures (Long-run)

<i>Dependent variable:</i>	
$\ln(p_G)$	
σ_1^{pg}	0.859*** (0.017)
σ_0^{pg}	0.077*** (0.011)
Observations	23
R ²	0.992
Adjusted R ²	0.992
Residual Std. Error	0.045 (df = 21)
F Statistic	2,637.072*** (df = 1; 21)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

$$\Delta \ln(p_{G_t}) = \underset{(+)}{\sigma_1^g} * \Delta \ln(p_{G_{t-1}}) + \underset{(+)}{\sigma_2^g} * \Delta \ln(p_{Y_{t-1}}) + \underset{(-)}{\sigma_3^g} * vc_{-1} \quad (\text{EQ.B.17.2})$$

$$vc_{-1} = \ln(p_{G_{t-1}}) - \sigma_0^{pg} - \sigma_1^{pg} * \ln(p_{Y_{t-2}})$$

Table 4.31: Price of public expenditures (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_G)$
σ_1^g	0.427*** (0.109)
σ_2^g	0.389*** (0.085)
σ_3^g	-0.484*** (0.118)
Observations	22
R ²	0.950
Adjusted R ²	0.931
Residual Std. Error	0.020 (df = 16)
F Statistic	50.810*** (df = 6; 16)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Price of capital (EQ.B.18)

$$\ln(p_{K_t}) = \underset{(+)}{\sigma_0^{pk}} + \sigma_1^{pk} * \ln(p_{Y_{t-1}}) \quad (\text{EQ.B.18.1})$$

Table 4.32: Price of capital (Long-run)

	<i>Dependent variable:</i>
	$\ln(p_K)$
σ_1^{pk}	0.668*** (0.029)
Observations	23
R ²	0.961
Adjusted R ²	0.959
Residual Std. Error	0.087 (df = 22)
F Statistic	545.822*** (df = 1; 22)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

$$\Delta \ln(p_{K_t}) = \underset{(+)}{\sigma_1^k} * \Delta \ln(p_{K_{t-1}}) + \underset{(+)}{\sigma_2^k} * \Delta \ln(p_{Y_{t-1}}) + \underset{(-)}{\sigma_3^k} * vc_{-1} \quad (\text{EQ.B.18.2})$$

$$vc_{-1} = \ln(p_{K_{t-1}}) - \sigma_0^{pk} - \sigma_1^{pk} * \ln(p_{Y_{t-2}})$$

Table 4.33: Price of capital (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_K)$
σ_1	0.315** (0.132)
σ_2	0.278*** (0.088)
σ_3	-0.156** (0.053)
Observations	22
R ²	0.953
Adjusted R ²	0.921
Residual Std. Error	0.018 (df = 13)
F Statistic	29.479*** (df = 9; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Price of inventories (EQ.B.19)

$$\ln(p_{INV_t}) = \tau_0^{pinv} + \tau_1^{pinv} * \ln(p_{Y_{t-1}}) \quad (\text{EQ.B.19.1})$$

(+)

Table 4.34: Price of inventories (Long-run)

<i>Dependent variable:</i>	
$\ln(p_{INV})$	
τ_1^{pinv}	0.753*** (0.026)
τ_0^{pinv}	0.039** (0.016)
Observations	24
R ²	0.975
Adjusted R ²	0.973
Residual Std. Error	0.073 (df = 22)
F Statistic	840.841*** (df = 1; 22)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

$$\Delta \ln(p_{INV_t}) = \tau_0 + \underset{(+)}{\tau_1} * \Delta \ln(p_{INV_{t-1}}) + \underset{(-)}{\tau_2} * vc_{-1} \quad (\text{EQ.B.19.2})$$

$$vc_{-1} = \ln(p_{INV_{t-1}}) - \tau_0^{pinv} - \tau_1^{pinv} * \ln(p_{Y_{t-2}})$$

Table 4.35: Price of inventories (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_{INV})$
τ_1	0.276* (0.146)
τ_2	-0.556*** (0.144)
τ_0	0.055*** (0.014)
Observations	22
R ²	0.732
Adjusted R ²	0.624
Residual Std. Error	0.038 (df = 15)
F Statistic	6.813*** (df = 6; 15)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Price of output (EQ.B.20)

$$\ln(p_{Q_t}) = \alpha_0^{pq} + \alpha_1^{pq} * \ln(p_{Y_{t-1}}) \quad (\text{EQ.B.20.1})$$

(+)

Table 4.36: Price of output (Long-run)

	<i>Dependent variable:</i>
	$\ln(p_Q)$
α_1^{pq}	0.986*** (0.022)
α_0^{pq}	0.067*** (0.014)
Observations	23
R ²	0.990
Adjusted R ²	0.989
Residual Std. Error	0.059 (df = 21)
F Statistic	2,014.603*** (df = 1; 21)

Note: *p<0.1; **p<0.05; ***p<0.01

$$\Delta \ln(p_{Q_t}) = \underset{(+)}{\alpha_0^{pq}} * \Delta \ln(p_{Y_{t-1}}) + \underset{(+)}{\alpha_1^{pq}} * vc_{-1} \quad (\text{EQ.B.20.2})$$

$$vc_{-1} = \ln(p_{Q_{t-1}}) - \tau_0^{pq} - \tau_1^{pq} * \ln(p_{Y_{t-2}})$$

Table 4.37: Price of output (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(p_Q)$
α_1	0.661*** (0.072)
α_2	-0.396*** (0.110)
Observations	22
R ²	0.968
Adjusted R ²	0.949
Residual Std. Error	0.021 (df = 14)
F Statistic	52.178*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

4.3.5 Interest rates, Rates of return and asset prices

Refinancing rate (EQ.B.21)

$$\ln(r_{it}^{cb}) = \beta_0^l + \beta_1^l * \pi_t \quad (\text{EQ.B.21.1})$$

(+)

Table 4.38: Refinancing rate (Long-run)

<i>Dependent variable:</i>	
$\ln(r_{it}^{cb})$	
β_1^l	0.019** (0.009)
β_0^l	1.856*** (0.086)
Observations	24
R ²	0.176
Adjusted R ²	0.139
Residual Std. Error	0.269 (df = 22)
F Statistic	4.709** (df = 1; 22)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01	

The long-run specification of the refinancing rate equation is a function that links the refinancing rate of the central bank to the inflation rate. Clearly, following a rise in inflation, the central bank will raise the refinancing rate.

$$\Delta \ln(r_t^{cb}) = \underset{(+)}{\beta_0} * \Delta \ln(xr_t) + \underset{(+)}{\beta_1} * (r_t^{us} - r_{t-1}^{cb}) + \underset{(-)}{\beta_2} * vc_{-1} + \underset{(+)}{\beta_3} * \Delta \ln(r_{t-1}^{cb}) \quad (\text{EQ.B.21.2})$$

$$vc_{-1} = \ln(r_{t-1}^{cb}) - \beta_0^l - \beta_1^l * \pi_{t-1}$$

Table 4.39: Refinancing rate (Short-run)

<i>Dependent variable:</i>	
$\Delta \ln(r_t^{cb})$	
β_0	1.852* (0.913)
β_1	0.025*** (0.006)
β_2	-0.291** (0.113)
β_3	-0.260** (0.111)
Observations	22
R ²	0.905
Adjusted R ²	0.840
Residual Std. Error	0.102 (df = 13)
F Statistic	13.792*** (df = 9; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Table 4.39 shows the short-run specification of the refinancing rate announced by the central bank. As expected, this growth rate of the serie depends positively on the interest rate differential (i.e. the difference between the US's interest rate and the refinancing rate) of the previous period. When the US raise their interest rate, the Vietnamese central bank will also increase the refinancing rate. The change in the exchange rate will positively affect the refinancing rate. A 1% depreciation of the Viet Nam dong will lead to a 1.8% increase in the refinancing rate. The annual speed of adjustment is 26%.

Lending rate (EQ.B.22)

$$\ln(r_{lt}) = \varpi_0^{rl} + \varpi_1^{rl} * \ln(r_{lt}^{cb}) \quad (\text{EQ.B.22.1})$$

(+)

Table 4.40: Lending rate (Long-run)

	<i>Dependent variable:</i>
	$\ln(r_l)$
ϖ_1^{rl}	0.785*** (0.134)
ϖ_0^{rl}	0.802*** (0.272)
Observations	24
R ²	0.607
Adjusted R ²	0.590
Residual Std. Error	0.187 (df = 22)
F Statistic	34.045*** (df = 1; 22)

Note: *p<0.1; **p<0.05; ***p<0.01

In the long-run, the lending rate depends positively on the refinancing rate of the SBV. A 1% increase in the refinancing rate will lead to an increase of 0.8% in the lending rate of commercial banks. It will affect the investment decision of sectors in the economy.

$$\Delta \ln(r_{l_t}) = \underbrace{\varpi_0}_{(+)} * \Delta \ln(r_{l_{t-1}}) + \underbrace{\varpi_1}_{(+)} * \Delta \ln(r_{l_t}^{cb}) + \underbrace{\varpi_2}_{(-)} * vc_{-1} \quad (\text{EQ.B.22.2})$$

$$vc_{-1} = \ln(r_{l_{t-1}}) - \varpi_0^{rl} - \varpi_1^{rl} * \ln(r_{l_{t-1}}^{cb})$$

Table 4.41: Lending rate (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(r_l)$
ϖ_0	0.240*** (0.055)
ϖ_1	0.398*** (0.033)
ϖ_2	-0.173*** (0.050)
Observations	22
R ²	0.978
Adjusted R ²	0.963
Residual Std. Error	0.035 (df = 13)
F Statistic	64.606*** (df = 9; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

In the short-run, with a 1% rise in the growth rate of the refinancing rate, the growth rate of the deposit rate will increase by 0.4%. The speed of adjustment to the long-run pathway is 17.3% annually.

Deposit rate (EQ.B.23)

$$\ln(r_{mt}) = \omega_0^{rm} * \ln(r_t^{cb}) \quad (\text{EQ.B.23.1})$$

(+)

Table 4.42: Deposit rate (Long-run)

<i>Dependent variable:</i>	
$\ln(r_m)$	
ω_0^{rm}	0.967*** (0.026)
Observations	24
R ²	0.983
Adjusted R ²	0.982
Residual Std. Error	0.262 (df = 23)
F Statistic	1,333.635*** (df = 1; 23)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The same specification is applied to the deposit rate. In the long-run, commercial banks will adjust the level of the deposit rate when the central bank changes the refinancing rate. An increase of 0.97% in the deposit rate is in response to a 1% increase in the refinancing rate.

$$\Delta \ln(r_{m_t}) = \underset{(+)}{\omega_0} * \Delta \ln(r_{l_t}^{cb}) + \underset{(+)}{\omega_1} * \Delta \ln(r_{l_{t-1}}^{cb}) + \underset{(-)}{\omega_2} * vc_{-1} \quad (\text{EQ.B.23.2})$$

$$vc_{-1} = \ln(r_{m_{t-1}}) - \omega_0^{rm} * \ln(r_{l_{t-1}}^{cb})$$

Table 4.43: Deposit rate (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(r_m)$
ω_0	0.801*** (0.111)
ω_1	0.480*** (0.112)
ω_2	-0.308** (0.117)
Observations	22
R ²	0.902
Adjusted R ²	0.847
Residual Std. Error	0.111 (df = 14)
F Statistic	16.167*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The short-run specification results (Table 4.43) confirm the positive relationship between the deposit rate and the refinancing rate.

Exchange rate (EQ.B.24)

$$\Delta \ln(xr_t) = \alpha_0 + \underset{(+)}{\alpha_1} * \Delta \ln(xr_{t-1}) + \underset{(+)}{\alpha_2} * (r_{t-1}^{US} - r_{t-1}^{cb}) + \underset{(+)}{\alpha_3} * \frac{D_{t-1}^{FX} - S_{t-1}^{FX}}{S_{t-1}^{FX}} \quad (\text{EQ.B.24})$$

Table 4.44: Exchange rate

<i>Dependent variable:</i>	
<i>ln(xr)</i>	
α_1	0.316*** (0.080)
α_2	0.003** (0.001)
α_3	0.048* (0.029)
α_0	0.024*** (0.005)
Observations	
	22
R ²	
	0.959
Adjusted R ²	
	0.934
Residual Std. Error	
	0.008 (df = 13)
F Statistic	
	38.018*** (df = 8; 13)
Note:	
	*p<0.1; **p<0.05; ***p<0.01

The estimation results (Table 4.44) show that widening the interest rate differential implies exchange rate depreciation. If the Vietnamese economy is less profitable, the Viet Nam dong depreciates due to capital outflows. As expected, the nominal exchange rate increases with the excess demand for foreign exchange.

Price of equity (EQ.B.25)

$$\ln(p_{E_t}) = \zeta_0^{pe} + \underset{(+)}{\zeta_1^{pe}} * \ln(p_{E_t}^{us}) \quad (\text{EQ.B.25.1})$$

Table 4.45: Price of equity (Long-run)

<i>Dependent variable:</i>	
$\ln(p_E)$	
ζ_1^{pe}	0.884*** (0.136)
ζ_0^{pe}	-0.237*** (0.069)
Observations	24
R ²	0.659
Adjusted R ²	0.643
Residual Std. Error	0.338 (df = 22)
F Statistic	42.468*** (df = 1; 22)

Note: *p<0.1; **p<0.05; ***p<0.01

The price of equity is supposed to depend on the leader equity price, which is represented by the US's equity price. Following a 1% increase in the US's equity price causes a further 0.8% rise in the Vietnamese price of equity.

$$\Delta \ln(p_{E_t}) = \underset{(+)}{\varsigma_0} * \Delta \ln(p_{E_{t-1}}) + \underset{(+)}{\varsigma_1} * \Delta \ln(p_{E_t}^{us}) + \underset{(+)}{\varsigma_2} * \Delta \ln(r_{t_t}^{cb}) + \underset{(-)}{\varsigma_3} * vc_{-1} \quad (\text{EQ.B.25.2})$$

$$vc_{-1} = \ln(p_{E_{t-1}}) - \varsigma_0^{pe} - \varsigma_1^{pe} * \Delta \ln(p_{E_{t-1}}^{us})$$

Table 4.46: Price of equity (Short-run)

<i>Dependent variable:</i>	
	$\Delta \ln(p_E)$
ς_0	-0.268** (0.109)
ς_1	0.364* (0.192)
ς_2	0.198 (0.116)
ς_3	-0.606*** (0.093)
Observations	22
R ²	0.924
Adjusted R ²	0.871
Residual Std. Error	0.115 (df = 13)
F Statistic	17.470*** (df = 9; 13)

Note: *p<0.1; **p<0.05; ***p<0.01

The short-run specification results shown in Table 4.46 indicate that the growth rate of equity price is positively affected by itself one period later. In addition, following a 1% increase in the growth rate of the refinancing rate provokes a 0.2% rise in the price of equity in the same period. Finally, the annual speed of adjustment is about 60%.

Interest rate of foreign loans (EQ.B.26)

$$\ln(r_{fl_t}) = \alpha_0^{rfl} + \alpha_1^{rfl} * \ln(r_{t-1}^{US}) \quad (\text{EQ.B.26.1})$$

(+)

Table 4.47: Interest rate of foreign loans (Long-run)

	<i>Dependent variable:</i>
	$\ln(r_{fl})$
α_1^{rfl}	0.086** (0.041)
α_0^{rfl}	0.653*** (0.062)
Observations	23
R ²	0.299
Adjusted R ²	0.229
Residual Std. Error	0.292 (df = 20)
F Statistic	4.275** (df = 2; 20)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The estimation output of the long-run equation of the interest rate of foreign loans is reported in Table 4.47. The interest rate is estimated as a function of the US interest rate lagged one period.

$$\Delta \ln(r_{fl_t}) = \underset{(+)}{\alpha_0} * \Delta \ln(r_{fl_{t-1}}) + \underset{(+)}{\alpha_1} * \Delta \ln(r_{t-1}^{US}) + \underset{(-)}{\alpha_2} * vc_{-1} \quad (\text{EQ.B.26.2})$$

$$vc_{-1} = \ln(r_{fl_{t-1}}) - \alpha_0^{rfl} - \alpha_1^{rfl} * \ln(r_{t-2}^{US})$$

Table 4.48: Interest rate of foreign loans (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(r_{fl})$
α_0	0.230 (0.150)
α_1	0.142*** (0.046)
α_2	-0.339* (0.162)
Observations	22
R ²	0.809
Adjusted R ²	0.700
Residual Std. Error	0.173 (df = 14)
F Statistic	7.428*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The specification for the short-run evolution of the interest rate of foreign loans is shown in Table 4.48. It indicates the positive effect of the change in the US interest rate on the change in the interest rate of foreign loans. The speed of adjustment is relatively high (34% per year).

Rate of return of bonds (EQ.B.27)

$$\Delta \ln(r_{b_t}) = \underset{(+)}{\varphi_0} * \Delta \ln(r_{b_{t-1}}) + \underset{(+)}{\varphi_1} * \Delta \ln(r_{i_t}^{cb}) + \underset{(+)}{\varphi_2} * \Delta \ln(r_{i_{t-1}}^{cb}) + \underset{(+)}{\varphi_3} * \frac{NFC_{t-1}^g}{Y_{t-1}} \quad (\text{EQ.B.27})$$

Table 4.49: Rate of return of bonds

<i>Dependent variable:</i>	
$\ln(r_b)$	
φ_0	-0.308*** (0.077)
φ_1	0.614*** (0.082)
φ_2	0.372*** (0.100)
φ_3	0.015*** (0.004)
Observations	
	22
R ²	
	0.946
Adjusted R ²	
	0.916
Residual Std. Error	
	0.089 (df = 14)
F Statistic	
	30.855*** (df = 8; 14)
Note:	
	*p<0.1; **p<0.05; ***p<0.01

As expected, the results show that the change in the rate of return of bonds depends positively on itself lagging one period, the change in the refinancing rate of the central bank and the public debt to GDP ratio.

Price of FDI (EQ.B.28)

$$\ln(p_{FDI_t}) = \underset{(+)}{\vartheta_0^{pfdi}} * \ln(p_{E_{t-1}}) + \underset{(+)}{\vartheta_1^{pfdi}} * \ln(xr_{t-1}) \quad (\text{EQ.B.28})$$

Table 4.50: Price of FDI

	<i>Dependent variable:</i>
	$\ln(p_{FDI})$
ϑ_0^{pfdi}	0.461*** (0.052)
ϑ_1^{pfdi}	0.016*** (0.003)
Observations	23
R ²	0.906
Adjusted R ²	0.865
Residual Std. Error	0.108 (df = 16)
F Statistic	22.095*** (df = 7; 16)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

In the case of the price of FDI, it is estimated as a function of the equity price and the exchange rate. The results confirm that the price of FDI positively relates to the price of equity and the exchange rate in the previous period. However, the effect of the exchange rate is much lower than the price of domestic equity.

4.3.6 Labour market

Wage rate (EQ.B.29)

$$\ln(w_t) = \vartheta_0 + \underset{(+)}{\vartheta_1} * \ln(p_{C_{t-1}}) + \underset{(-)}{\vartheta_2} * \ln(U_{t-1}) + \underset{(+)}{\vartheta_3} * \ln\left(\frac{y_t}{NBW_t}\right) \quad (\text{EQ.B.29.1})$$

Table 4.51: Wage rate (Long-run)

<i>Dependent variable:</i>	
<i>ln(wr)</i>	
ϑ_1	0.699*** (0.244)
ϑ_2	-0.188* (0.095)
ϑ_3	0.520** (0.238)
ϑ_0	8.655*** (2.099)
Observations	23
R ²	0.992
Adjusted R ²	0.991
Residual Std. Error	0.070 (df = 19)
F Statistic	822.289*** (df = 3; 19)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01	

As expected, the price of consumption and labour productivity has a positive effect on the wage rate. Given the specification in EQ.B.29.1, we can interpret it as the elasticity of wage rate to consumer price and labour productivity. Unemployment has had a negative effect on the wage rate. If the unemployment rate rises by 1%, the wage rate will fall by 0.2%.

$$\Delta \ln(w_t) = \underset{(+)}{\vartheta_1^w} * \Delta \ln(p_{C_{t-1}}) + \underset{(+)}{\vartheta_2^w} \Delta \ln\left(\frac{y_t}{NBW_t}\right) + \underset{(-)}{\vartheta_3^w} * vc_{-1} \quad (\text{EQ.B.29.2})$$

$$vc_{-1} = \ln(w_{t-1}) - \vartheta_0 - \vartheta_1 * \ln(p_{C_{t-2}}) - \vartheta_2 * \ln(U_{t-2}) - \vartheta_3 * \ln\left(\frac{y_{t-1}}{NBW_{t-1}}\right)$$

Table 4.52: Wage rate (Short-run)

<i>Dependent variable:</i>	
$\Delta \ln(wr)$	
ϑ_1^w	0.366*** (0.060)
ϑ_2^w	0.773*** (0.062)
ϑ_3^w	-0.633*** (0.079)
Observations	22
R ²	0.985
Adjusted R ²	0.976
Residual Std. Error	0.020 (df = 14)
F Statistic	114.242*** (df = 8; 14)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

In the short-run, represented as the growth rate of the wage rate, it confirms the positive effect of the consumer price and labour productivity on the wage rate. Especially, the speed of adjustment to come back to the long-run pathway is 63% annually.

Number of workers (EQ.B.30)

$$\ln(NBW_t^f) = \lambda_0 + \underset{(+)}{\lambda_1} * \ln(va_t^f) + \underset{(+)}{\lambda_2} * \ln(pop_{ACTIV_t}) \quad (\text{EQ.B.30.1})$$

Table 4.53: Workers employed by firms (Long-run)

<i>Dependent variable:</i>	
$\ln(NBW^f)$	
λ_1	0.387*** (0.015)
λ_2	0.672*** (0.006)
Observations	
	24
R ²	
	1.000
Adjusted R ²	
	1.000
Residual Std. Error	
	0.036 (df = 22)
F Statistic	
	2,001,308.000*** (df = 2; 22)
Note:	
	*p<0.1; **p<0.05; ***p<0.01

The estimation output (Table 4.55) demonstrates that the number of workers employed depends positively on the value-added (labour demand) and the active population (labour supply).

$$\begin{aligned} \Delta \ln(NBW_t^f) = & \lambda_0^{nbw^f} + \lambda_1^{nbw^f} * \Delta \ln(NBW_{t-1}^f) + \lambda_2^{nbw^f} * \Delta \ln(va_t^f) \\ & + \lambda_3^{nbw^f} * \Delta \ln(pop_{ACTIV_t}) + \lambda_4^{nbw^f} * vc_{-1} \end{aligned} \quad (\text{EQ.B.30.2})$$

$$vc_{-1} = \ln(NBW_{t-1}^f) - \lambda_0 - \lambda_1 * \ln(va_{t-1}^f) - \lambda_2 * \ln(pop_{ACTIV_{t-1}})$$

Table 4.54: Workers employed by firms (Short-run)

	<i>Dependent variable:</i>
	$\Delta \ln(NBW^f)$
$\lambda_1^{nbw^f}$	-0.354* (0.180)
$\lambda_2^{nbw^f}$	0.811*** (0.170)
$\lambda_3^{nbw^f}$	1.193** (0.544)
$\lambda_4^{nbw^f}$	-0.432*** (0.125)
$\lambda_0^{nbw^f}$	-0.037** (0.016)
Observations	22
R ²	0.895
Adjusted R ²	0.831
Residual Std. Error	0.014 (df = 13)
F Statistic	13.883*** (df = 8; 13)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The short-run specification is the growth rate of the long-run specification. It indicates that the short-run influence of value-added and the total active population positively affect the number of workers.

Active population (EQ.B.31)

$$\Delta \ln(\text{pop}_{ACTIV_t}) = \underset{(+)}{\kappa_1} * \Delta \ln(\text{pop}_{ACTIV_{t-1}}) + \underset{(+)}{\kappa_2} * \Delta \ln(\text{pop}_{t-1}) \quad (\text{EQ.B.31})$$

Table 4.55: Active population

	<i>Dependent variable:</i>
	$\ln(\text{pop}_{ACTIV})$
κ_1	0.416** (0.179)
κ_2	1.097*** (0.356)
Observations	22
R ²	0.959
Adjusted R ²	0.947
Residual Std. Error	0.004 (df = 17)
F Statistic	79.182*** (df = 5; 17)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The active population is assumed to follow a simple autoregressive process and positively depends on the total population.

4.4 Validation

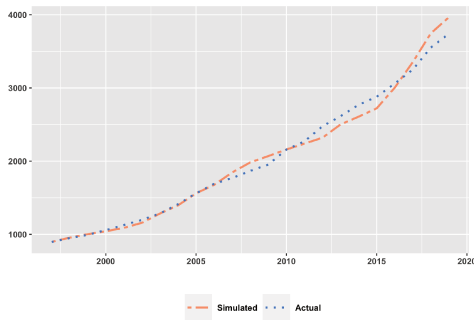
4.4.1 Fitting with past data

This section will show how the model can fit with the past data. Indeed, after integrating all estimated equations in the model, we simulate the model and compare it with the actual data. We show the figures for comparing simulated and actual data of some main variables. In each graph, the red line represents the value simulated from the model, and the blue line shows the actual series we are using.

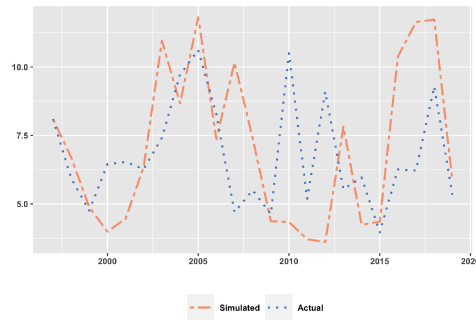
Figure 4.2 shows the simulated results and the actual data of the real GDP and components of GDP. The model replicates quite well the historical data of these series.

Regarding the sectoral financial balances (Figure 4.3), overall, the model could track satisfactorily aggregate sectoral financial balances. The discrepancies between the simulated value from the model and the actual value can be explained by the accumulation of errors at some points. Moreover, it may be due to data limitations related to the huge statistical discrepancies between the net financing capacity from the real side and that from the financial side. As shown in Figure 4.3, we overestimate the net financial balance for the households sector since 2015, corresponding to the underestimation of the rest of the world.

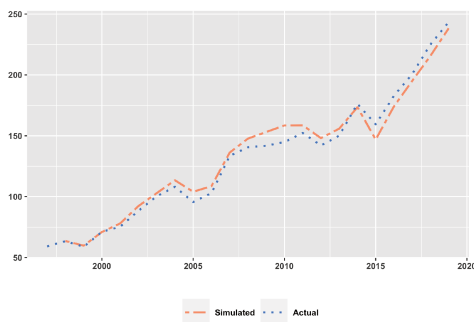
Looking at the financial assets and liabilities, the model can track the dynamic trend of variables. Concerning the labour market, the nominal wages are tracked satisfactorily. Price variables, as well as interest rates in the model, are all replicated well. All results are displayed in Appendix. Overall, our model can track the dynamics of the Vietnamese economy to some extent. Thus, we move to simulate the model in the future and analyse the effects of different scenarios on the economy.



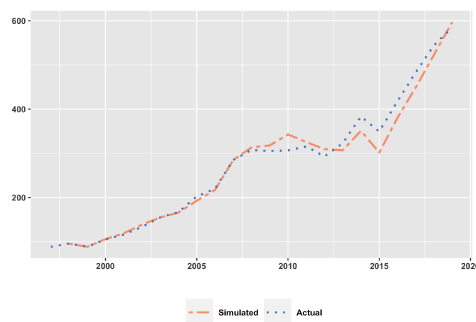
(a) Real GDP



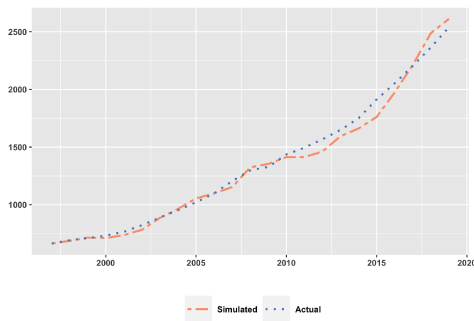
(b) Real GDP growth



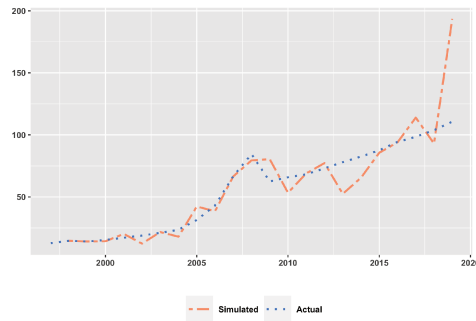
(c) Real household's investment



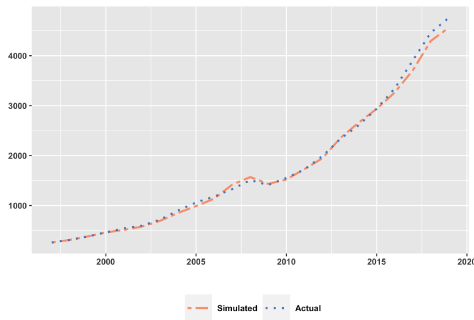
(d) Real firm's investment



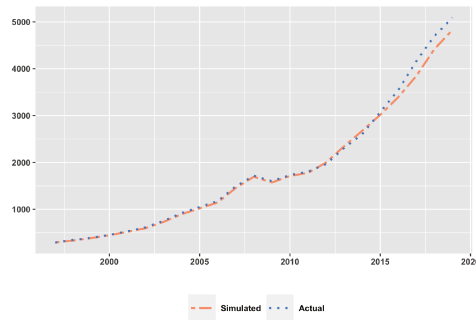
(e) Real consumption



(f) Real inventories



(g) Real exports



(h) Real imports

Figure 4.2: Fitting with past data - GDP Components



Figure 4.3: Fitting with past data - Net sectoral financial balances

4.4.2 Baseline scenario

When we perform the scenario analysis in order to examine the effects of any shock on the economy, we should define the baseline scenario by projecting/extrapolating our exogenous variables and parameters during the period of projection. Broadly speaking, we classify into two sets of exogenous variables. A group of variables represents the socioeconomic development trends of Viet Nam. Some relevant variables are such as population growth, the unemployment rate, the capital depreciation. The second set of variables represents the dynamics of the world. It includes variables such as the world GDP, the demand for imports of main partners, and the US interest rate. The estimated parameters are assumed to be constant in the model simulation. Depending on the analysis, we will describe in detail the baseline scenario.

In practice, there are several ways to project exogenous variables/parameters (Reyes, 2015; Zezza, 2018; Byrialsen and Raza, 2020). In our study, given the size of the model, some simplifying assumptions are made as follows. As mentioned above, all estimated parameters are supposed to be constant. Some variables very small or close to 0 will be projected as 0. Regarding the financial side of the model, we choose how to project them depending on their recent behaviour. We can take the value at the mean of the last years or use the latest value. Choosing some exogenous variables/parameters is also challenging when the combination affects the simulated results.

4.5 Conclusion

This chapter presented an empirical stock-flow consistent model which provides a theory-consistent representation of the general structure of the Viet Nam economy and offers policy/scenario simulation capabilities to the needs of policymakers. The first section gave the detailed model structure with equations that make up the model. We presented a number of justifications for the model's chosen structure.

To summarise briefly, the model comprises six institutional sectors with their behaviours that integrate both the real and financial side of the economy. The financial assets included in the model are chosen based on the data availability and relevance to the Vietnamese economy. Notable features of the model, which will be important in the policy/scenario simulations that look at different transmission mechanisms to the economy (Chapter 5, 6), include:

- The production is determined by demand but faces production capacity constraints.
- Firms have to decide how much to invest and how to finance it from domestic and external financing sources.
- Households essentially deal with consumption, investment and portfolio choices, i.e. accumulation of financial assets.
- The public deficit is assumed to be financed by issuing bonds or borrowing from abroad.
- The central bank conducts monetary policies using different tools such as the refinancing rate, the international reserves or the bank's reserves requirements.
- Commercial banks provide credits but impose credit rationing on firms and households.
- Viet Nam has a high degree of openness. Exports and imports depend on several external factors, such as world demand, world prices as well as FDI.
- Price is supposed to be a cost-push function and is affected by the aggregate demand.
- Employment is determined by supply (active population) and demand side (economic activities).

Our model has several structural parameters estimated using annual data from 1996 to 2019 with Vector Error Correction Models (VECMs), which lead to the corresponding Error Correction Mechanisms (ECMs) for each specification, or OLS regression. These estimations also considered the sudden behavioural shifts of the economy by adding the event-specific dummy variables. We had to go back and forth in estimating relations and checking the implications with simulation exercises in order to choose the reasonable specifications.

The simulation results show the model's overall performance in replicating the system's dynamics by comparing it with the historical data. In addition, it is crucial to be transparent that the main objective of our simulations is to analyse the effects of different shocks on the economy rather than provide a forecast of the economic growth rate. Thus, the simulation results will be used as the baseline scenario against different scenarios in order to analyse the effects of such shocks on the economy. The following two chapters will make use of the model to simulate the effects of different economic policies or shocks on the Vietnamese economy. Our model makes a contribution to Viet Nam's macroeconomic modelling literature and offers a useful macroeconomic analysis tool for policymakers.

CHAPTER 5

Policy responses and model simulation

5.1 Introduction

Within the space of three decades, Viet Nam has gone through deep changes to become a middle-income country by 2010. Because financial and monetary aspects matter in middle-income countries or emerging countries, modelling Viet Nam's macrodynamics requires a framework which captures the features, relationships and dynamic interactions. In the previous chapter, our SFC model tried to capture these aspects.

This chapter is a first attempt to assess the country's ability to conduct macroeconomic policies and to face global external shocks such as the COVID-19 pandemic, given its deep integration into the global economy. To do this, we present some simulation exercises aimed at examining the potential impacts of policy shocks on Vietnamese macroeconomic variables. As mentioned in Chapter 1, the macroeconomic policies include monetary policy, fiscal policy, wage policy and policy related to the open economy. We will run three distinct policy shocks. A standard fiscal shock via an increase in public spending and a monetary shock via an increase in the refinancing rate will proceed. The third shock related to the monetary policy of the US is especially relevant in the actual context of the world economy.

Facing the current situation of high inflation in the US, since March 2022, the Federal Reserve (FED) has raised the interest rate. This action brings a lot of risks of a global recession and negatively affects several developing countries (IMF, 2022). This also implies an increase in the Vietnamese interest rate in September since the US interest rate has exceeded the limit of 2.5% (Figure 5.1). We will analyse the effects of this shock on the economy. It will show that external shocks can significantly impact the domestic economy in the context of the evolution of financial and economic globalisation.

Then, in the second part of this chapter, it develops an application of the model to perform a detailed analysis of the government policy responses, which simultaneously combine monetary and fiscal policies, to the COVID-19 pandemic.

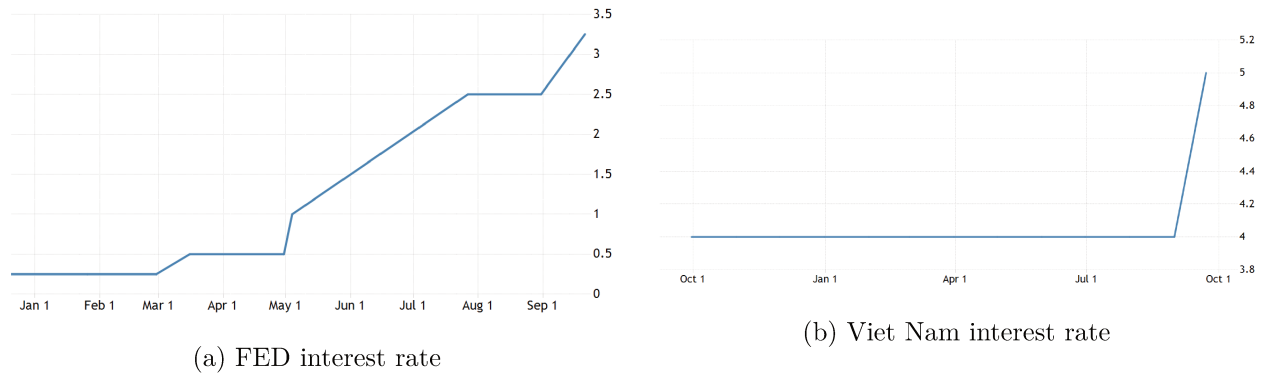


Figure 5.1: Interest rates 2022, %

This chapter is organised as follows. After this introductory section, Section 5.2 conducts some simulation exercises with our empirical SFC model: a fiscal shock, a monetary shock and an external shock. Then Section 5.3 develops an analysis of Viet Nam’s COVID-19 stimulus package and recovery plan. It first overviews the situation of the COVID-19 pandemic in Viet Nam and its impact on the economy. We describe the Vietnamese government policy responses to this crisis. After that, we discuss the simulation results related to these policy responses. Finally, Section 5.4 concludes this chapter.

5.2 Simulations

As mentioned above, in this Section, we will simulate three scenarios and analyse the different transmission mechanisms. It consists of (i) fiscal shock: an increase in public expenditures; (ii) monetary shock: an increase in the refinancing rate - central bank’s interest rate; and (iii) foreign shock: an increase in the US’s interest rate.

Our model provides a consistent framework for macroeconomic analysis. It allows us to examine the effects on macroeconomic performance through macroeconomic indicators that we have considered in Chapter 1. It includes the economic growth (different components of GDP), prices and financial stability (financial balances, sectoral balance sheet) and other relevant variables in the model. The changes in the real side of the economy will be linked with the changes in the financial side of the economy.

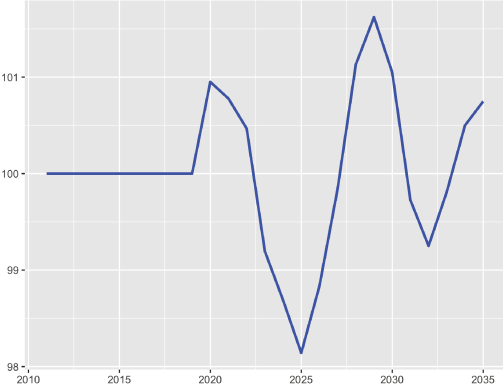
5.2.1 Fiscal shock

We introduce a standard fiscal stimulus. Expansionary fiscal policy, i.e. an increase in government spending, is expected to boost economic activity. We implement a one-shot increase in real government expenditures of 38 Trillion dong in 2020, which corresponds approximatively to 1% real GDP.

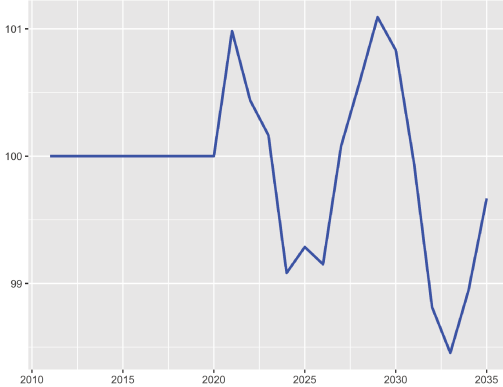
The increase in public spending is expected to have the usual stimulus effects, an increase in the volume of GDP, a limited inflationist shift, and an imbalance in the trade balance. On the financial side, it will affect each sector's financial balance and balance sheet. Especially the fiscal shock impacts public finance and increases public debt.

Figure 5.2 shows the effects of fiscal expansion on GDP and their demand components. Increasing public consumption contributes directly to GDP. The increase in GDP can lead to the improvement in productivity and wages. Thus, consumption and investments rise one period later, while net exports turn negative following the increase in households' disposable income. Indeed, the rise in demand implies an increase in imports and worsens the trade balance. Economic growth attracts foreign capital, which translates to an exchange rate appreciation. Thus, it could raise the trade deficit (Figure 5.3) and reduce GDP.

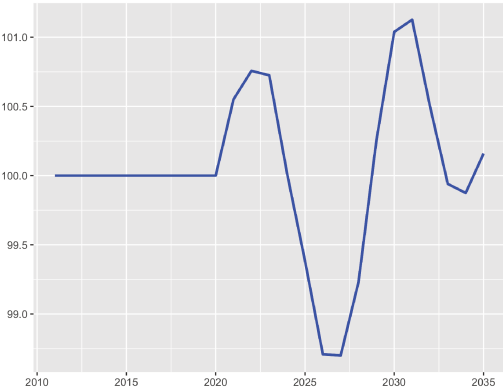
In addition, GDP can decrease after fiscal expansion because the profits slow down the first year after the shock when the wage bill gets most of the increase in GDP. The decrease in the profit rate negatively affects a firm's investment, a component of GDP. Then, the economy enters a new cycle resulting from the system's dynamics.



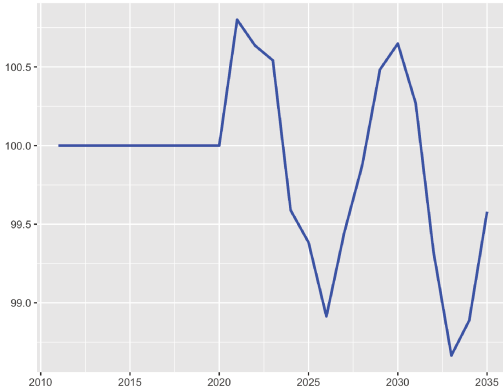
(a) Real GDP



(b) Real consumption

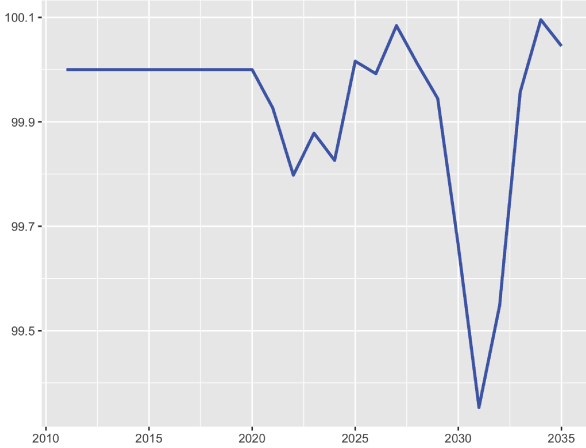


(c) Real firm's investment

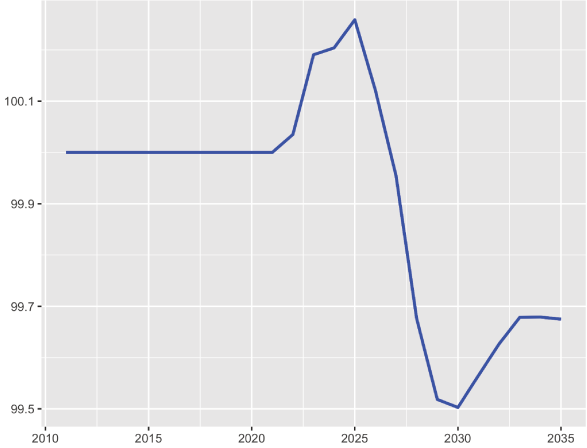


(d) Real HH's investment

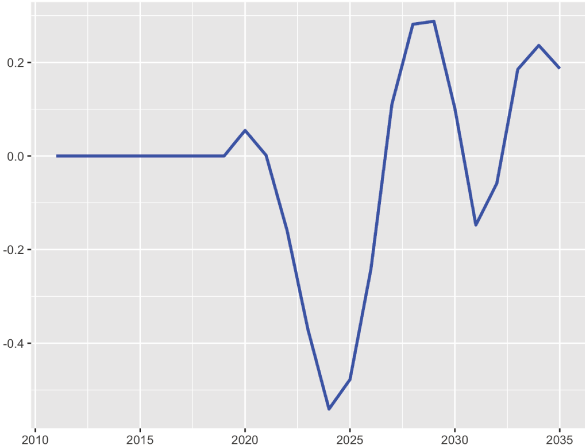
Figure 5.2: Fiscal shock - Impacts on GDP components (Scenario/Baseline * 100)



(a) Real exports (Scenario/Baseline * 100)



(b) Real imports (Scenario/Baseline * 100)



(c) Trade balance, %GDP (Scenario - Baseline)

Figure 5.3: Fiscal shock - Impacts on trade

The stronger demand pushes prices upwards (Figure 5.4). The rise in the prices of exports leads to a decrease in exports in the first years of the fiscal expansion. Once GDP decreases, the GDP deflator will fall. Thus, it contributes to ameliorating export competitiveness. The trade balance, in turn, becomes positive and can boost economic growth.

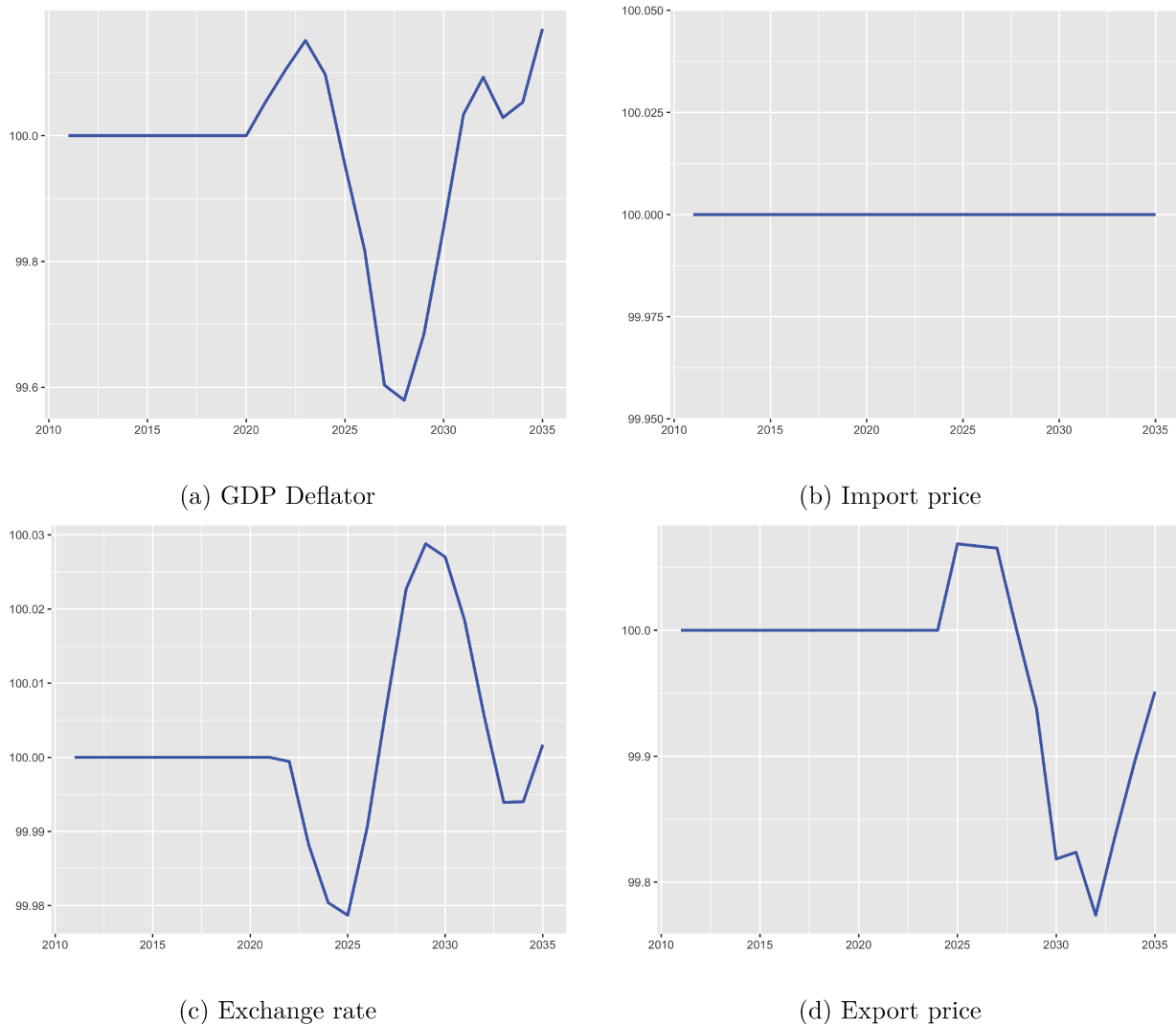


Figure 5.4: Fiscal shock - Impacts on prices (Scenario/Baseline * 100)

Regarding the sectoral financial imbalances (Figure 5.5), the financial balance of firms reflects firms' financing needs. The increase in the firm's investment will negatively affect its financial balance and vice versa. They accumulate mainly debt from commercial banks to finance their investment (Figure 5.7). The banking sector, playing the role of providing credits for the economy, remains in general with a financing capacity.

The fiscal expansion also implies an increase in the flows of deposits of households due to the rise in wages paid by productive sectors. In addition, household consumption rises, leading to the demand for cash and the positive changes in cash among the balance sheet adjustment of the central bank (Figure 5.7). The ROW continues to finance the economy mainly through FDI. FDI experience a strong increase during the period of high financing needs from firms.

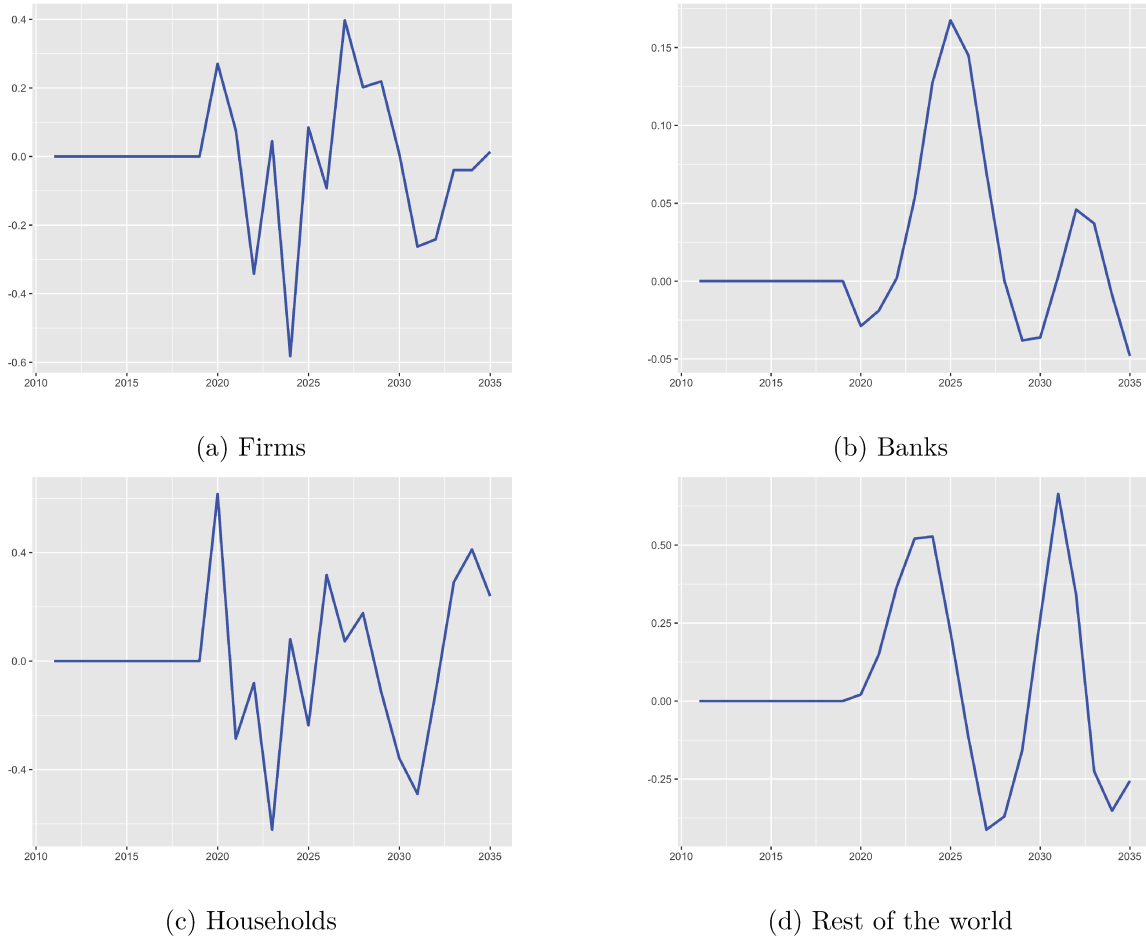


Figure 5.5: Fiscal shock - Impacts on financial balances, %GDP (Scenario - Baseline)

Looking at the government's account, the increase in public spending negatively affects the public deficit compared to the baseline scenario (Figure 5.6). This deterioration of the fiscal balance increases the public debt. In contrast, the positive effect on economic growth can slightly improve the public deficit. As the government finances its public deficit by debt, it increases public debt stock compared to the baseline scenario (Figure 5.7).

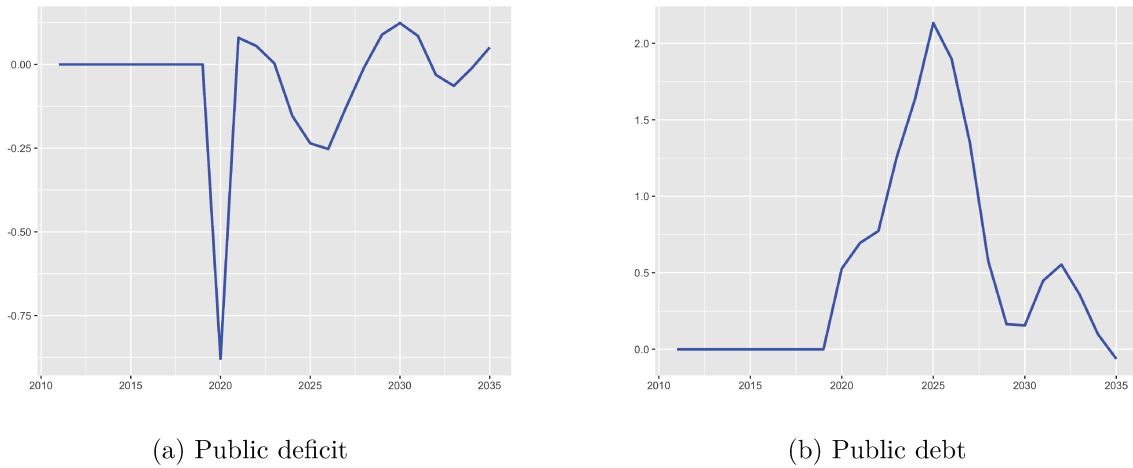


Figure 5.6: Fiscal shock - Impacts on public finance, %GDP (Scenario - Baseline)

The public debt increases due to a higher public deficit, implying higher interest payments to its holders. Concretely, the households and banks holding bonds will receive more interest. Thus, it contributes to improving the financing balance of households and banks, as shown above.

However, after the first year of fiscal expansion, the higher domestic demand will increase government revenues and, therefore, contribute to decreasing the negative effect of the fiscal shock during the following years. Improving the public deficit will translate to a reduction of public debt accordingly.

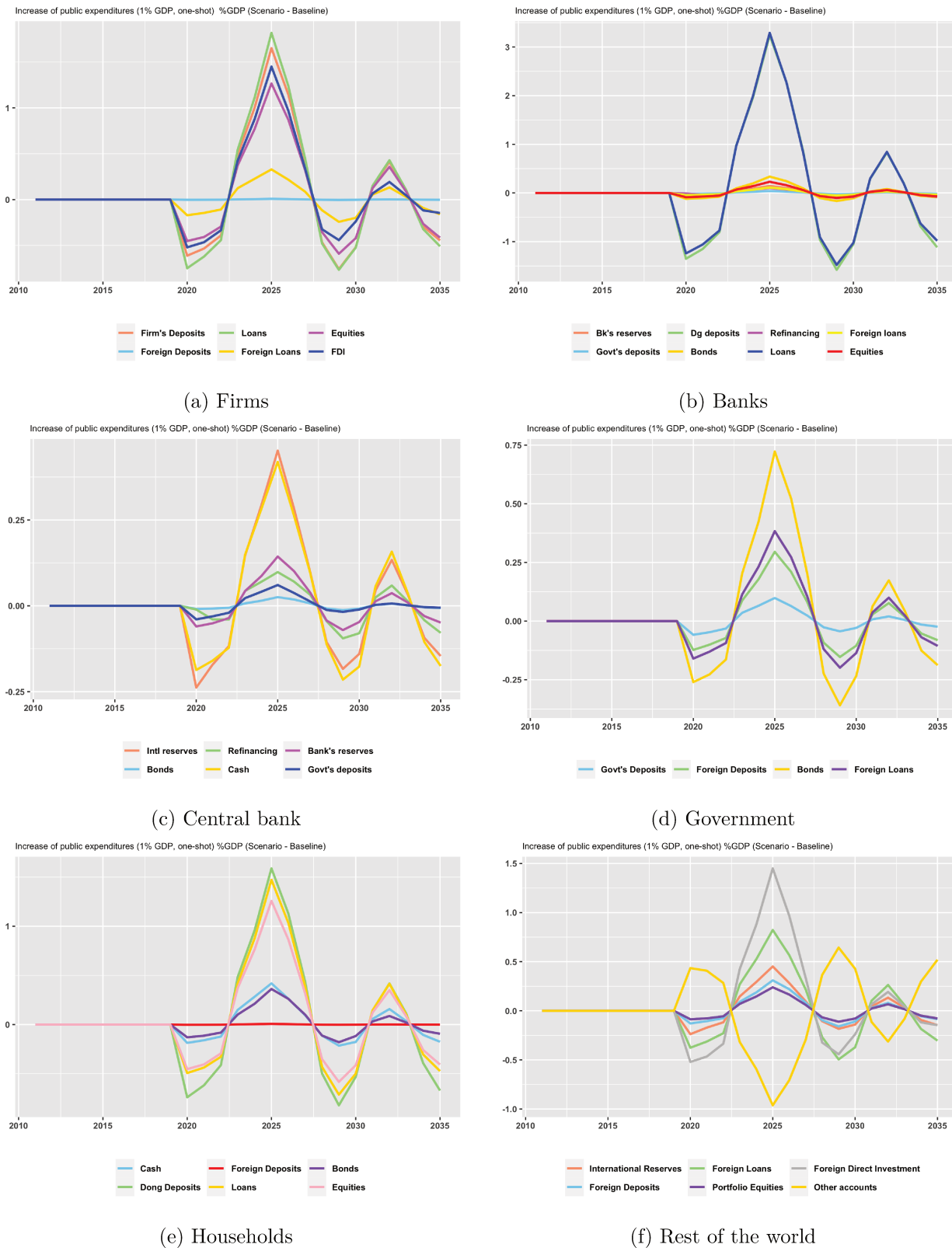
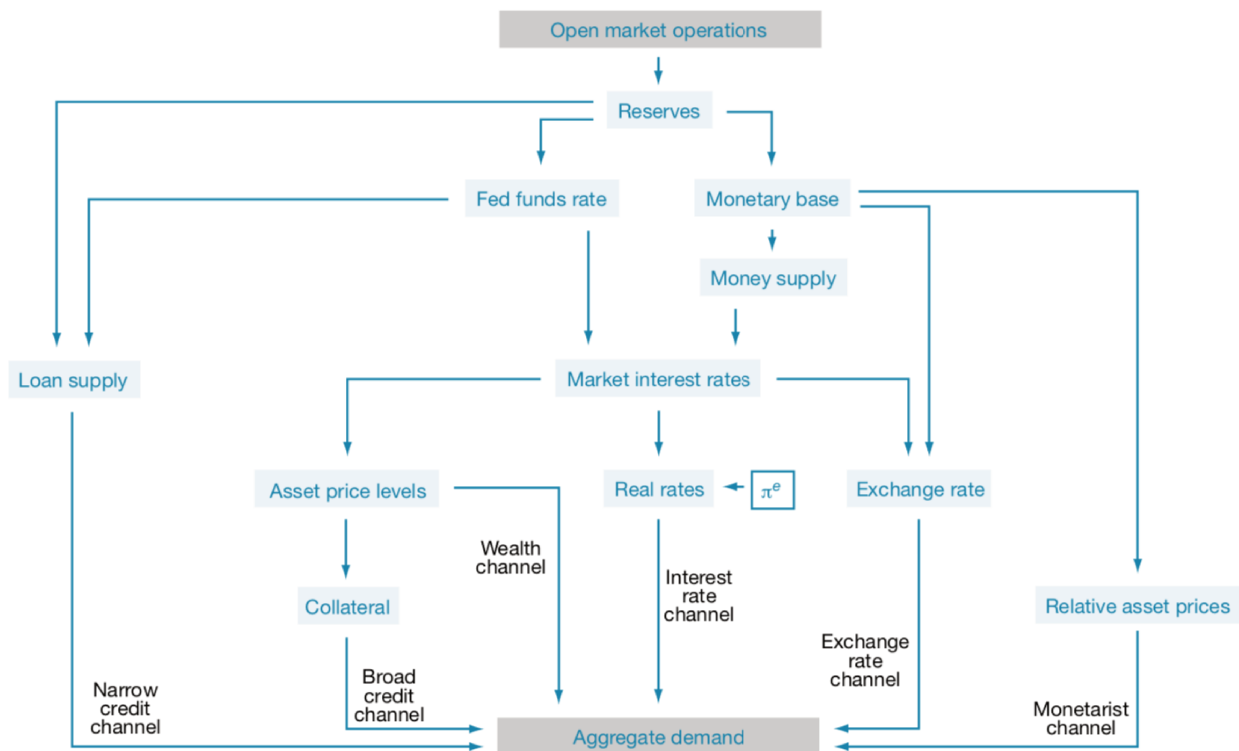


Figure 5.7: Fiscal shock - Impacts on balance sheet, %GDP (Scenario - Baseline)

5.2.2 Monetary shock

We consider an increase of 1% in the refinancing rate – the central bank’s interest rate. Before analysing the simulation results, we will overview the monetary policy transmission mechanisms in the literature. It will help us to, using our model, explain the effects of the monetary shock we perform. Like a previous shock simulation, we look at the main macroeconomic variables such as GDP, prices, current account and financial variables.

The literature shows that monetary transmission is a complex topic. It can pass through several channels. [Kuttner and Mosser \(2002\)](#) summarized different channels in Figure 5.8.

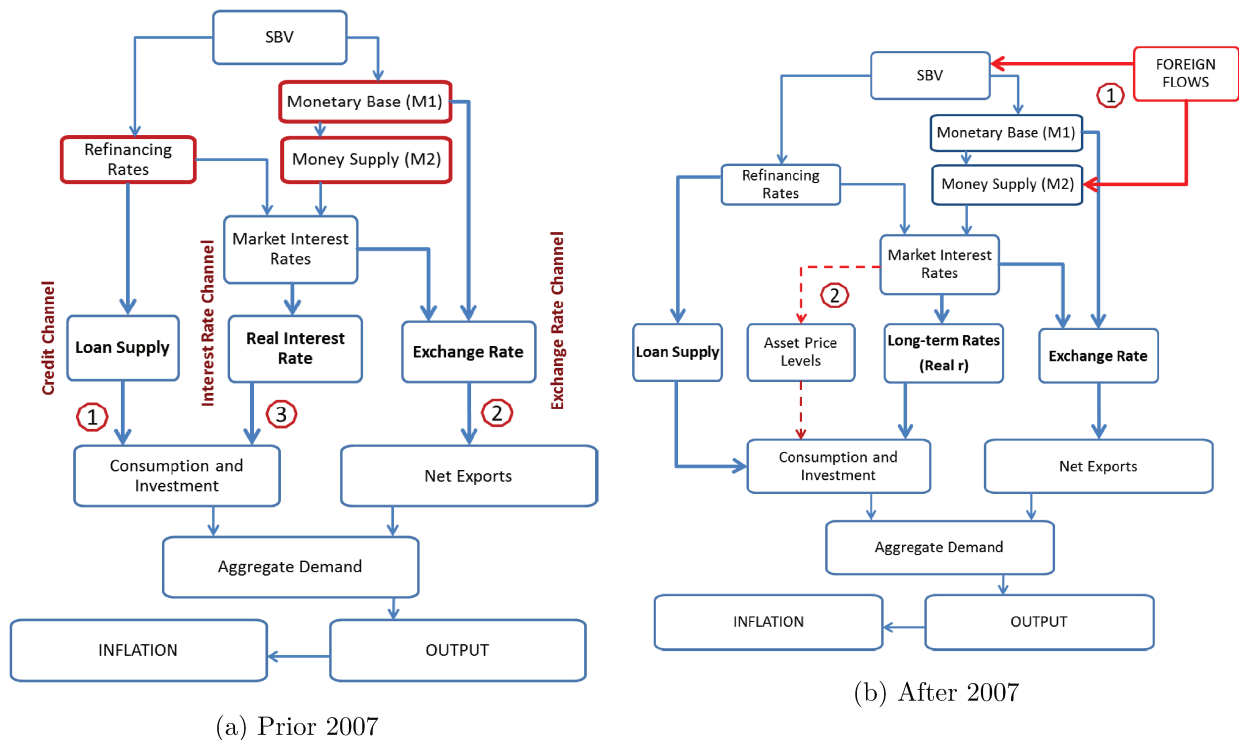


Source: [Kuttner and Mosser \(2002\)](#)

Figure 5.8: Monetary policy transmission

They illustrated six main channels: (i) narrow credit channel; (ii) broad credit channel; (iii) wealth channel; (iv) interest rate channel; (v) exchange rate channel; and (vi) monetarist channel. Among these channels, the interest rate channel is the primary mechanism in conventional macroeconomic models. An increase in nominal interest rates leads to a rise in

the real interest rate and the cost of borrowing. Thus, it will negatively affect the investment. Given that the consumption of households depends on their wealth, the monetary policy can impact aggregate demand through the wealth channel. Asset values also play an important role in the broad credit channel via the value of the collateral to obtain a loan. The narrow credit or bank lending channel relies on credit market frictions. By raising the aggregate volume of bank reserves, contractionary monetary policy will reduce the availability of bank loans. The exchange rate channel is an important conventional channel, especially with an open-economy. An increase in the domestic interest rate relative to foreign rates would lead to an appreciation of the domestic currency and a reduction both in net exports and, thus, aggregate demand. Finally, a monetarist channel is related to the relative quantities of assets rather than interest rates. Because various assets are imperfect substitutes in investors' portfolios, changes in the composition of outstanding assets brought about by monetary policy will lead to relative price changes, which can have real effects.



Source: *Pham (2016)*

Figure 5.9: Viet Nam's monetary policy transmission

In summary, the monetary transmission mechanisms include the interest rate, exchange rate,

asset and credit channels. Studying the monetary policies and the macroeconomic performance of Viet Nam, [Pham \(2016\)](#) shows key features of Viet Nam's monetary transmission between 1995-2013 (Figure 5.9). Before 2007, quantified monetary instruments were the main policy tools of the SBV. The exchange rate was a significant factor influencing economic growth. Market interest rate plays a minor role in the financial system. The interest rate channel was ineffective during this time because state-owned enterprises get loans without considering market factors (such as credit risks). Since 2007, the surge of external flows after the WTO accession has impacted the SBV's control of monetary policy. The accession of foreign firms and banks, accompanied by foreign currency inflows, required the conversion to domestic currency VND, which created pressure on the pegged exchange rate and total money supply (M2).

Taking into account the characteristics of the Vietnamese financial system, [Anwar and Nguyen \(2018\)](#) showed that the SBV relies heavily on the credit channel. The decrease in the interest rate increases investment, which creates more employment and boosts aggregate demand.

In our model, the central bank's interest rate will directly affect the lending rate, which has a crucial role in the investment decision of agents and the deposit rate, which affects the interest on deposits received by sectors in the economy. Both lending rate and deposit rate increase following the interest rate shock, as shown in Figure 5.10. It represents the interest rate channel and loan supply transmission of monetary policy.

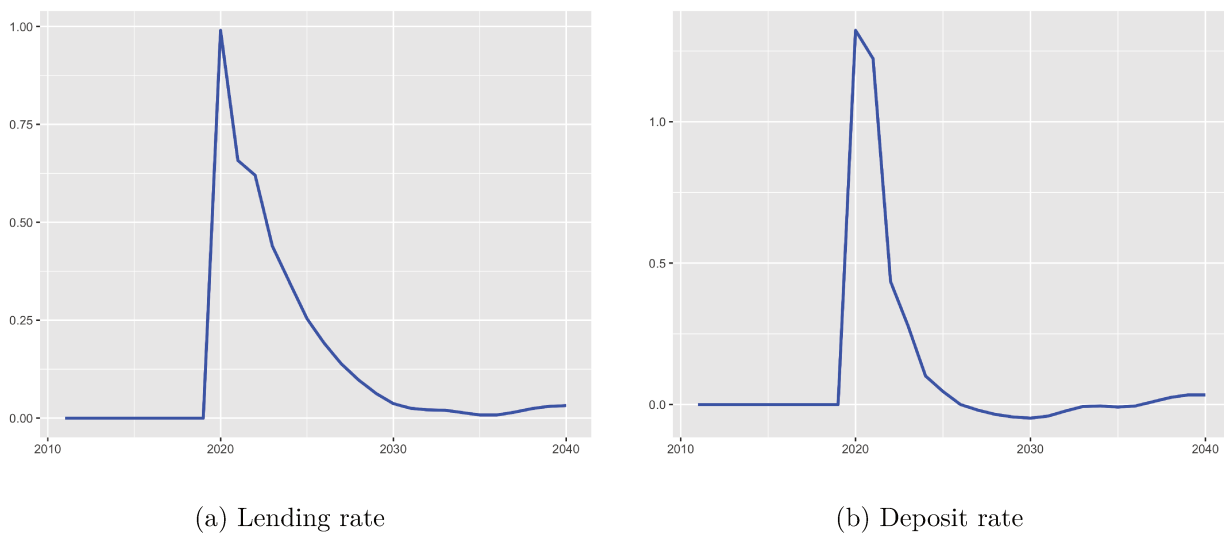


Figure 5.10: Monetary shock - Impacts on interest rates, % (Scenario - Baseline)

Figure 5.11 shows the overall effect of this interest rate shock on real GDP and its components. The negative impact on the real economy is not so strong but can be explained. In the short-run, the positive effect on households' consumption and exports can offset the negative impact on private investment due to credit channel transmission. Indeed, the increase in consumption in the short run is due to a rise in disposable income. The deposit rate increased with the central bank's interest rate, contributing to the interest on household deposits. An increase in the lending rate means that the borrowing cost is higher. Therefore, firms and households will reduce their investment.

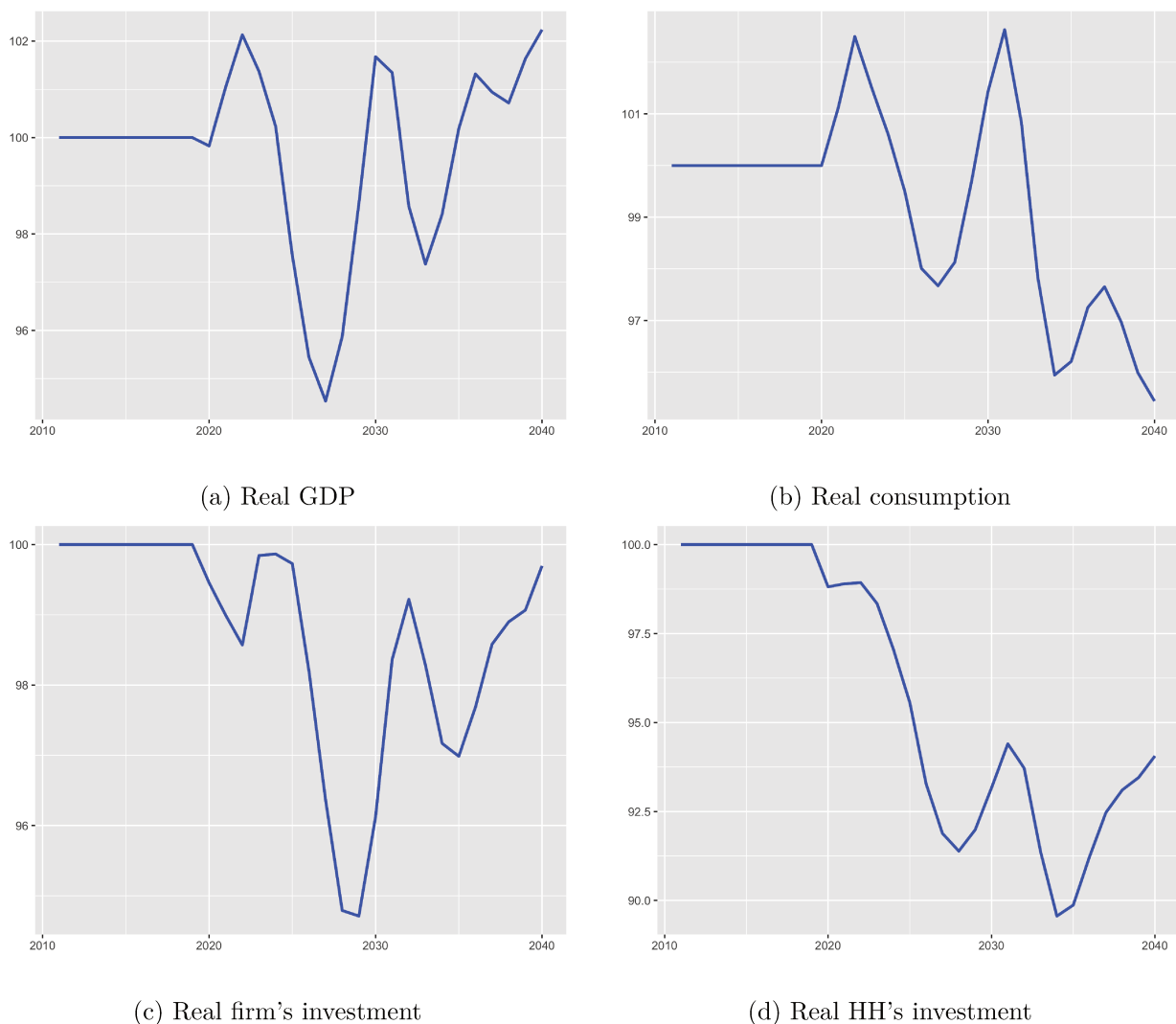


Figure 5.11: Monetary shock - Impacts on GDP components (Scenario/Baseline * 100)

Focusing on the trade balance (Figure 5.12), interest rate shock affects real exports. It reflects the exchange rate channel transmission. In our model, exports depend on FDI. The increase in the central bank's interest rate leads to substituting foreign financing channels for domestic ones. Real imports do not react in the first years of the shock. Then, imports slightly increase when the domestic activities resume, the appreciation which contributes to reducing the import price and a fall in domestic price (Figure 5.13). It translates into a worsening of the trade balance.

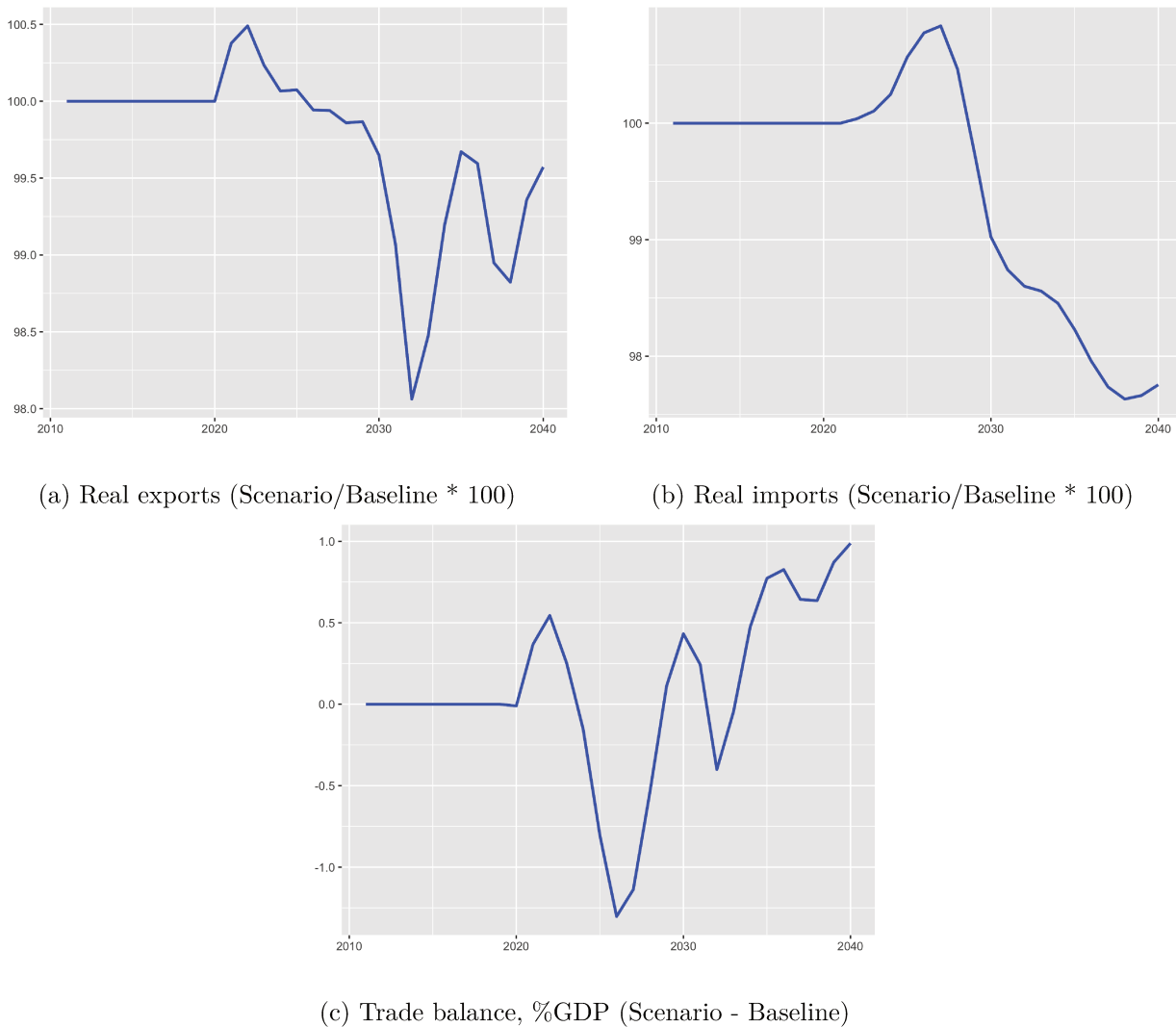
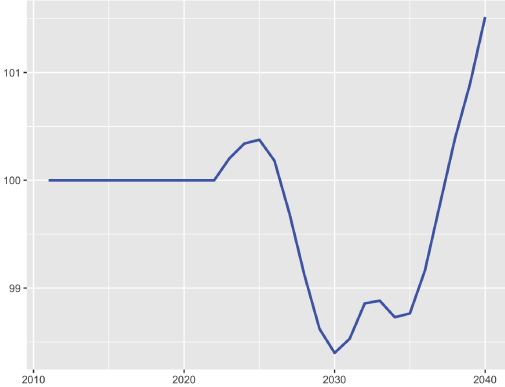
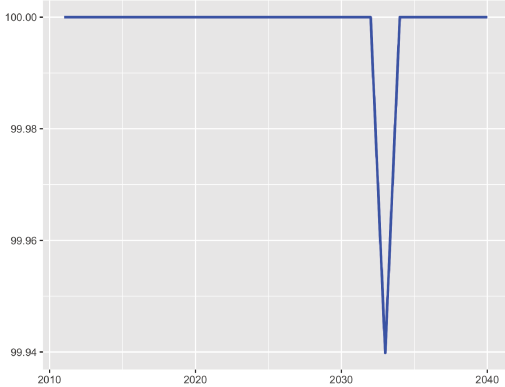


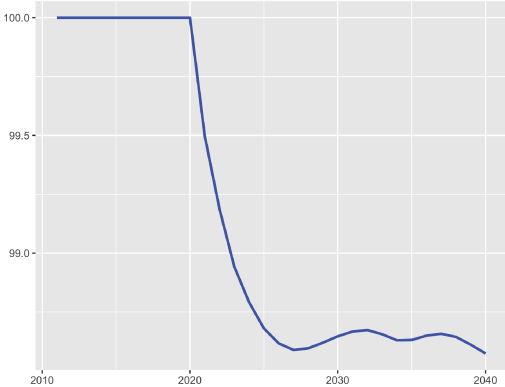
Figure 5.12: Monetary shock - Impacts on trade



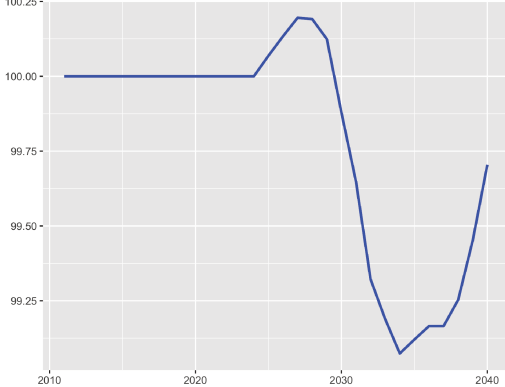
(a) GDP Deflator



(b) Import price



(c) Exchange rate

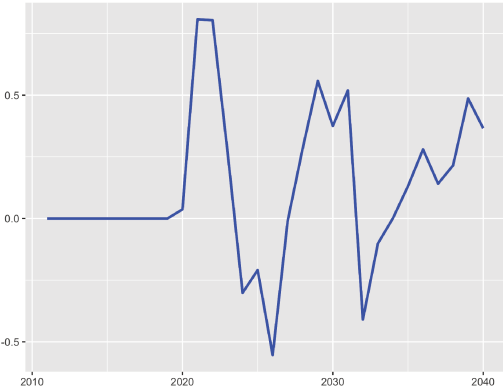


(d) Export price

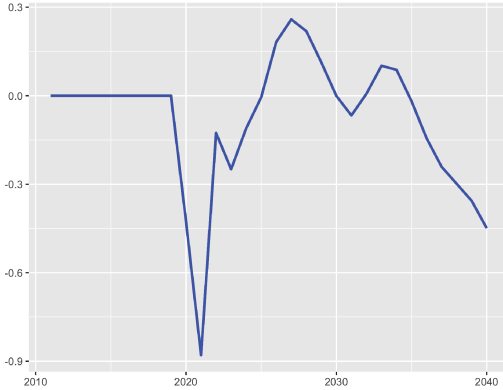
Figure 5.13: Monetary shock - Impacts on prices (Scenario/Baseline * 100)

Focusing on the financial balances, Figure 5.14 shows the results of this interest rate shock. The commercial bank sector has experienced a decrease in financing capacity in the short run due to the increased interest on deposit payments. Then, the debts become more expensive and increase the interest payments. The financial balance of banks will improve. The financial balance of firms increases in the short run because of the reduction in their investment. The substitution of foreign financing ways for domestic ones leads to an increase in the financial balance of the rest of the world in the short run. The household sector has improved its financial balance following the increase in received interest and decreased investment. The decrease in economic activity implies a slight fall in government tax revenues and vice versa. The rise in interest rate also provokes an increase in the rate of return of government bonds. Then, it leads to an increase in government deficit and the stock of public debt.

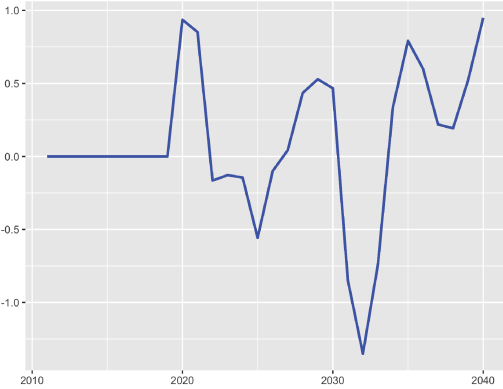
Turning to the financial side of the model, Figure 5.15 shows the impacts on the balance sheet of each sector. For the firm sector, following the rise in investment, firms will demand more loans from banks and FDI and issue more equities. Only a small amount of foreign loans is getting from firms. For the households sector, they have more debt, but they also hold more cash. They also allocate their financing capacity among different assets. The banking sector mostly satisfies the demand for loans from other sectors in the economy. The government issued more bonds instead of increasing foreign loans to finance the public deficit. Finally, the ROW matches the demand for liabilities coming from the domestic economy.



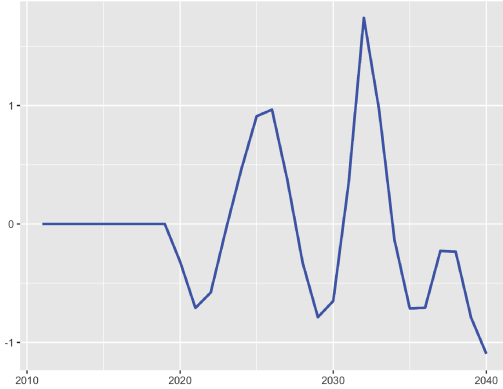
(a) Firms



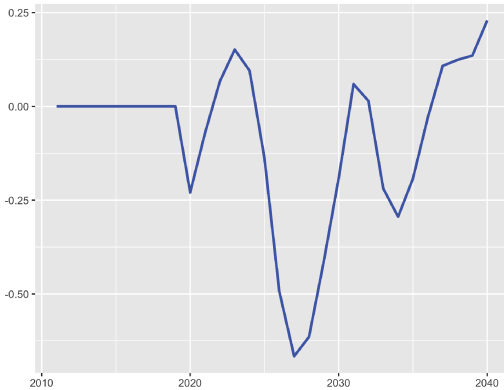
(b) Banks



(c) Households



(d) Government



(e) Rest of the world

Figure 5.14: Monetary shock - Impacts on financial balances, %GDP (Scenario - Baseline)

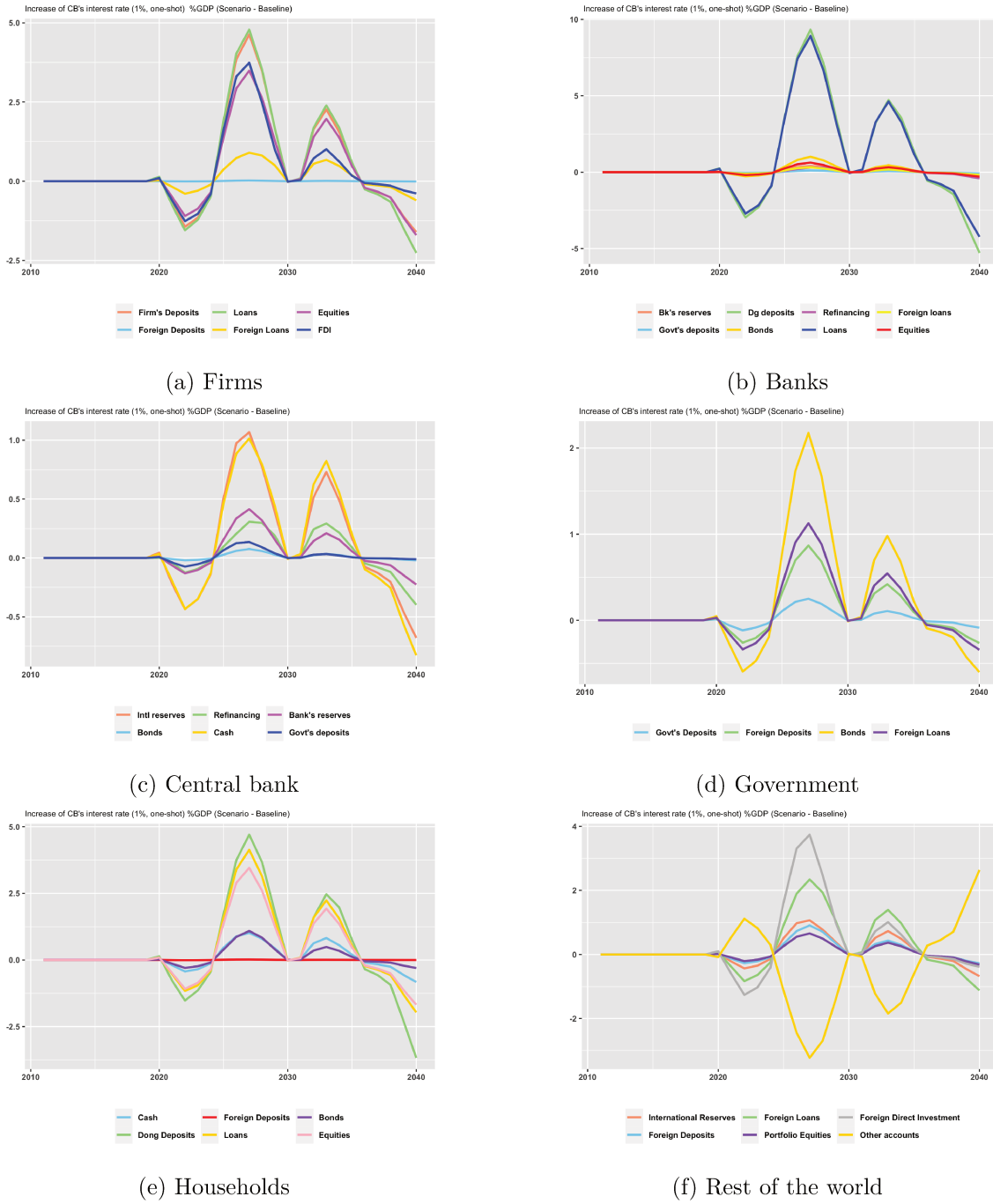


Figure 5.15: Monetary shock - Impacts on balance sheet, %GDP (Scenario - Baseline)

5.2.3 Foreign shock

Nowadays, in the context of financial globalisation and important cross-border capital flows, the US monetary policy can have important financial spillovers to emerging markets. As the FED's interest rate rises, those who invest in emerging markets to seek high rates of return may turn to investing in the US market. It can lead to massive capital inflows to the US and outflows from the emerging world. It can also result in an appreciation of the US dollar and negatively impact the balance sheet with liabilities denominated in the US dollar. Thus, Nier et al. (2014) demonstrated that when the foreign interest rate increases, the interest rate differentials have a statistically significant effect on the amount of capital account, forcing developing economies to raise interest rates in order to curb capital outflows. This foreign shock aptly illustrates the recent US restrictive monetary policy in order to curb domestic inflation. It will hit hard the developing and emerging economies.

In general, the literature identifies three main transmission channels through which capital inflows impact the economy, but it still has conflicting effects on domestic demand ([Godin and Yilmaz, 2020](#)). The overall impacts depend on the relative strengths of these channels and policy responses.

- Trade channel: Capital inflows provoke excess supply in foreign exchange, leading to an appreciation of the domestic currency. It will reduce exports and increase imports because exported goods become expensive and imported goods become cheaper. Thus, the trade balance is in deficit. However, the central bank can intervene to prevent appreciation by increasing domestic bank reserves, reducing financing costs for the domestic banking system, and pulling down the lending rate. It will induce firms to borrow to invest, thus positively affecting aggregate demand.
- Balance sheet Channel: capital inflows are strongly associated with asset price booms. The rise in asset price will increase the sector's wealth, and then the latter positively affects the consumption of households and investment in the economy. Capital inflows can impact the exchange rate, and appreciation leads to a revaluation of liabilities in the balance sheet of each sector. In addition, the appreciation of the currency also leads to an increase in real income for households, fuelling consumption and increasing aggregate demand.
- Liquidity Channel and Credit Booms: Foreign capital inflows can lead to an increase in

bank credit supply, reducing lending rates and fueling credit booms. It contributes to promoting investment and then boosting aggregate demand.

In this scenario, we simulate an increase of 1% in the US's interest rate in order to analyse the potential effects on the Vietnamese economy - one of the emerging markets. An increase in the central bank's interest rate is expected to respond to this foreign shock. It will affect the sectors' decisions regarding investment, consumption, prices, and financial decisions, resulting in the balance sheet of sectors in the economy.

As shown in Figure 5.16, an increase in the US's interest rate forces the central bank to raise the refinancing rate to prevent capital outflows. As the lending rate and deposit rate depend on the central bank's refinancing rate, commercial banks increase it accordingly.

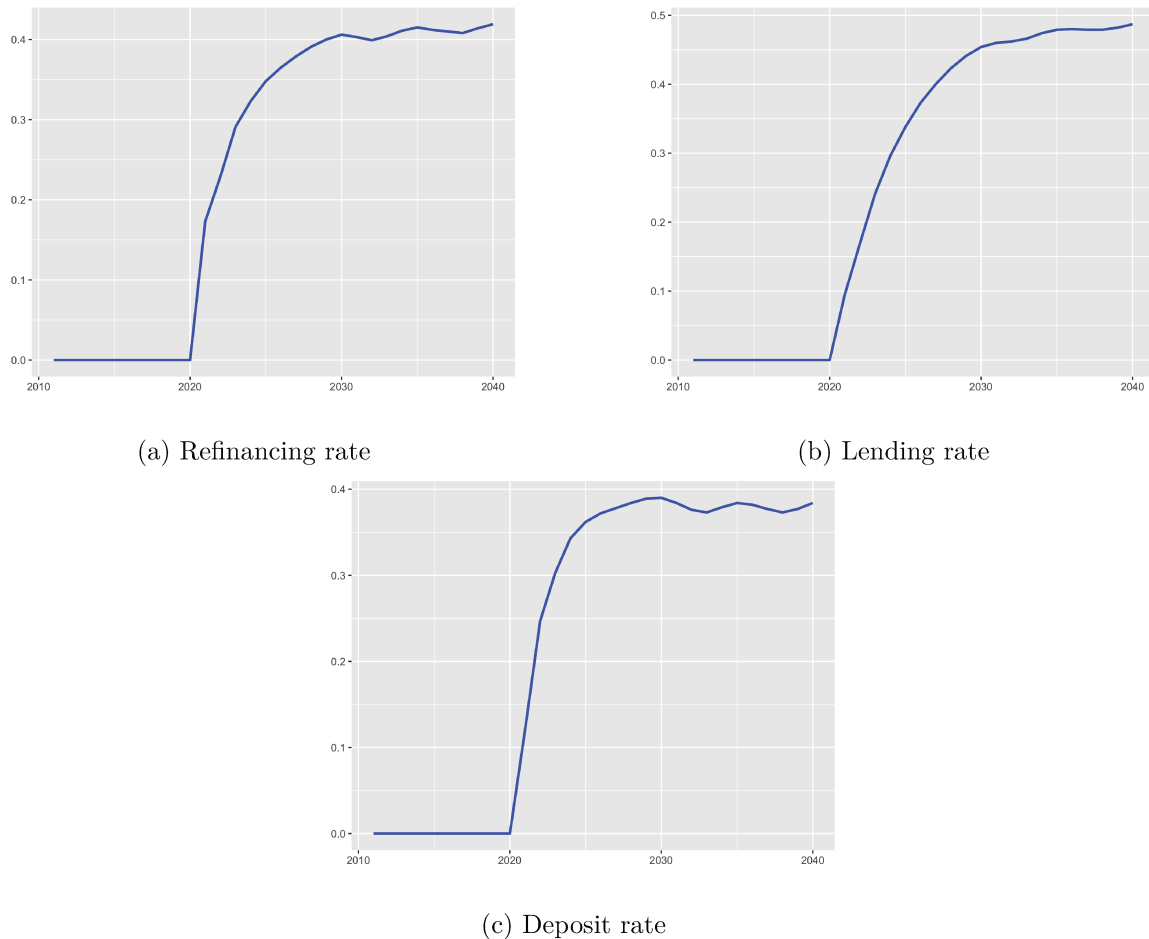


Figure 5.16: Foreign shock - Impacts on interest rates, % (Scenario - Baseline)

Overall, this shock positively impacts GDP (Figure 5.17). Firstly, even if the increase in lending rate reduces the investment of firms and households, but this negative effect occurs in the first years of the shock for the firm's sector. Once economic growth resumes, firms increase their investment. Holding deposits in banks, households receive more interest payments on deposits when the deposit rate increases. It raises their disposable income and then their consumption.

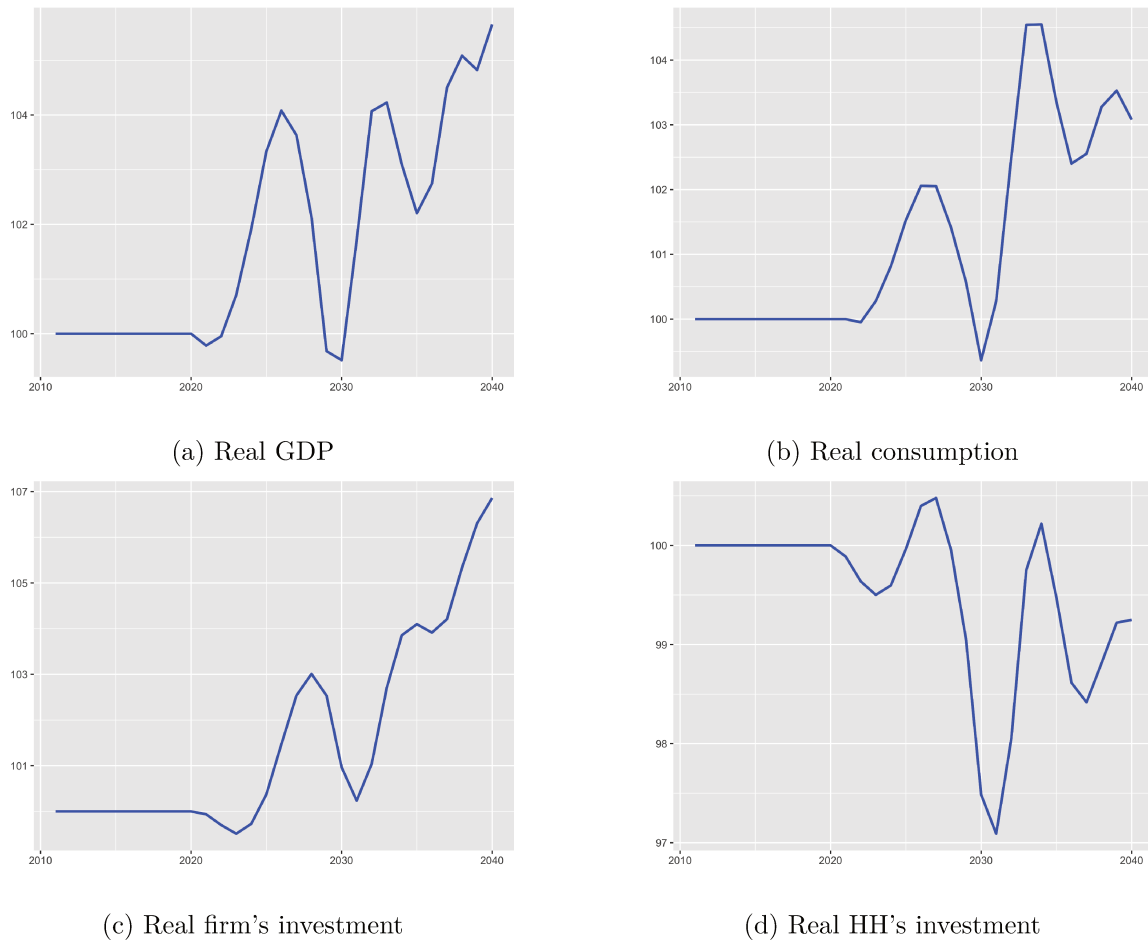


Figure 5.17: Foreign shock - Impacts on GDP components (Scenario/Baseline * 100)

The increase in foreign interest rate also affects the trade balance (Figure 5.18). It leads to domestic currency depreciation (Figure 5.19). The latter contributes to improving the country’s competitiveness and the exports increase. The imports react later, but the effect on the trade balance remains positive.

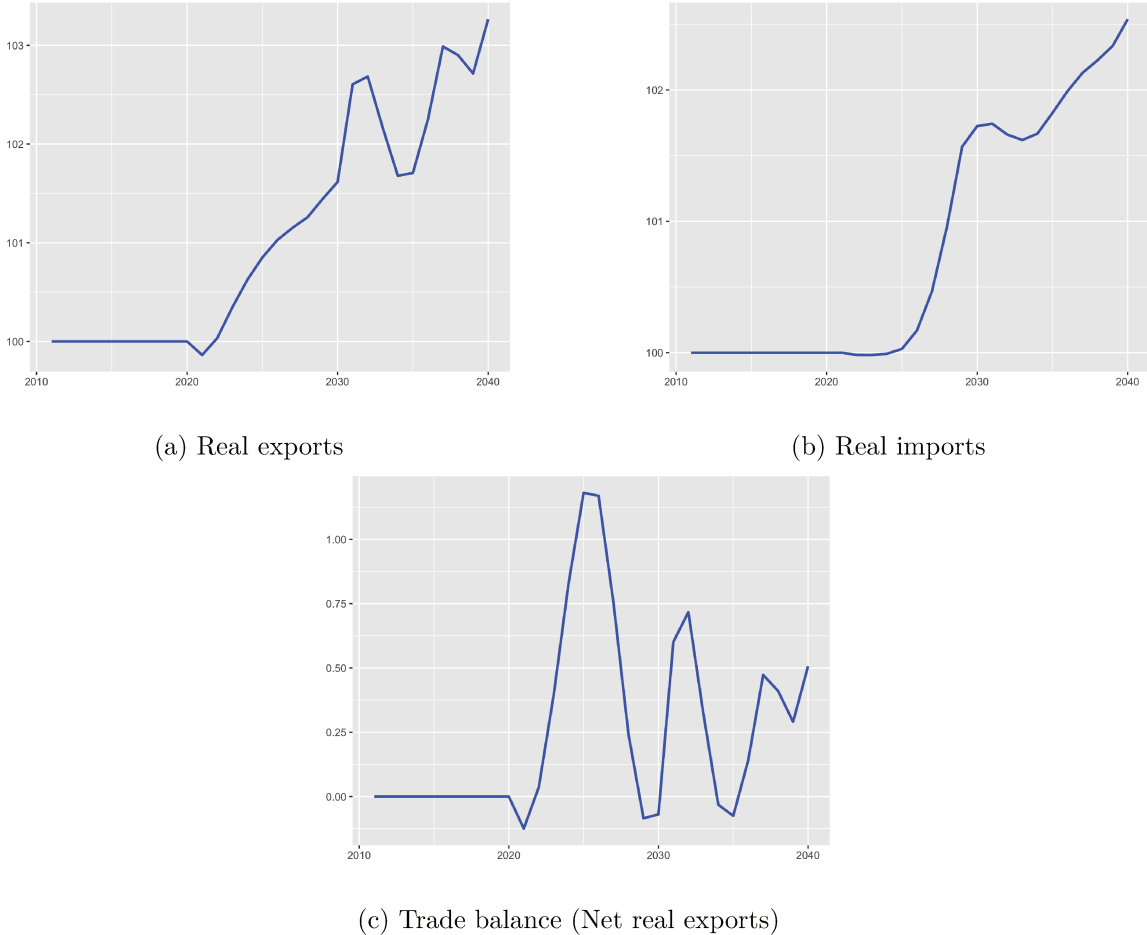


Figure 5.18: Foreign shock - Impacts on trade balance

Figure 5.19 shows the effects of the shock on prices. The rise in real GDP implies an increase in the wage rate and, therefore, in the GDP deflator. It seems that this effect has persisted over the years. The import price is less affected by the exchange rate. However, the export price moves with the domestic price.

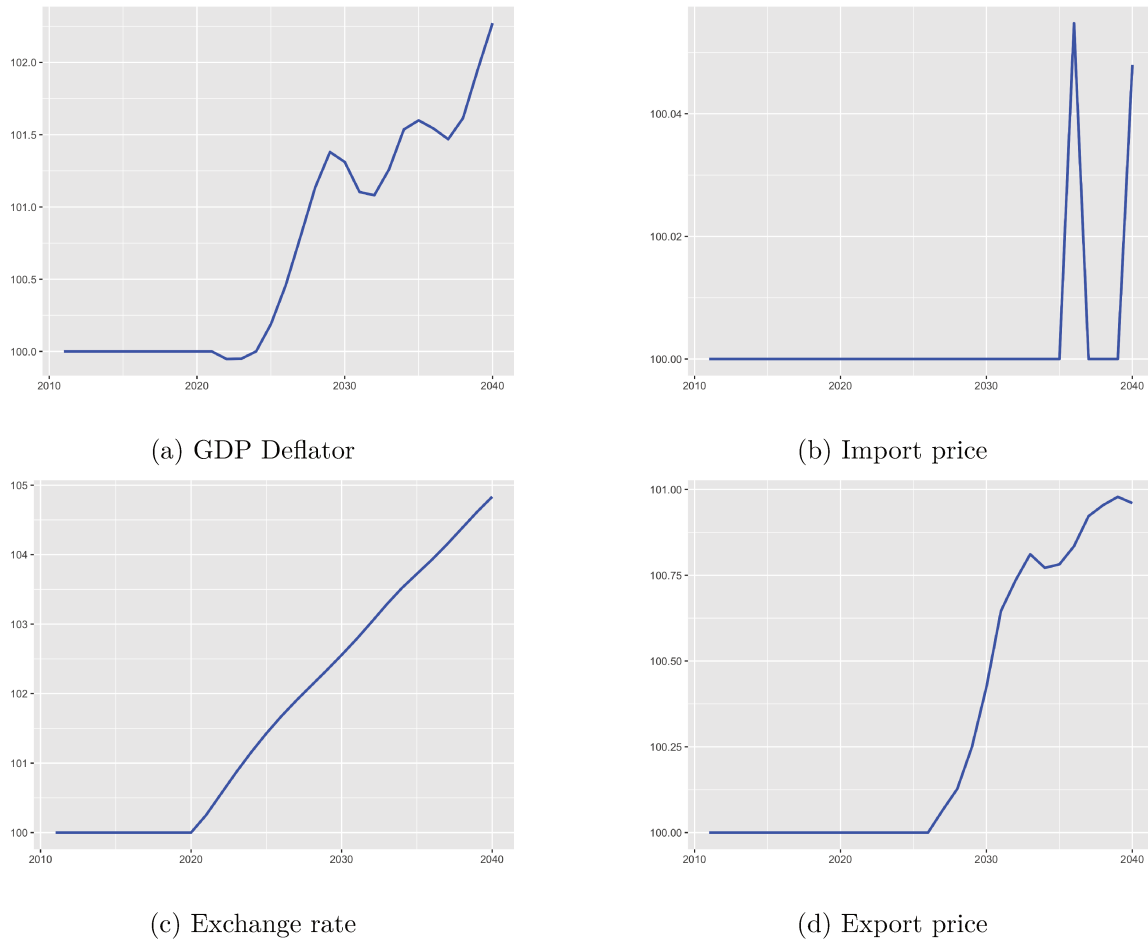


Figure 5.19: Foreign shock - Impacts on prices (Scenario/Baseline * 100)

Regarding the financial balance of each sector (Figure 5.20), the increase in GDP translates into higher financing capacity of firms, households and government compared to the baseline scenario. Banks and the ROW, in turn, see a decrease in the net acquisition of financial assets.

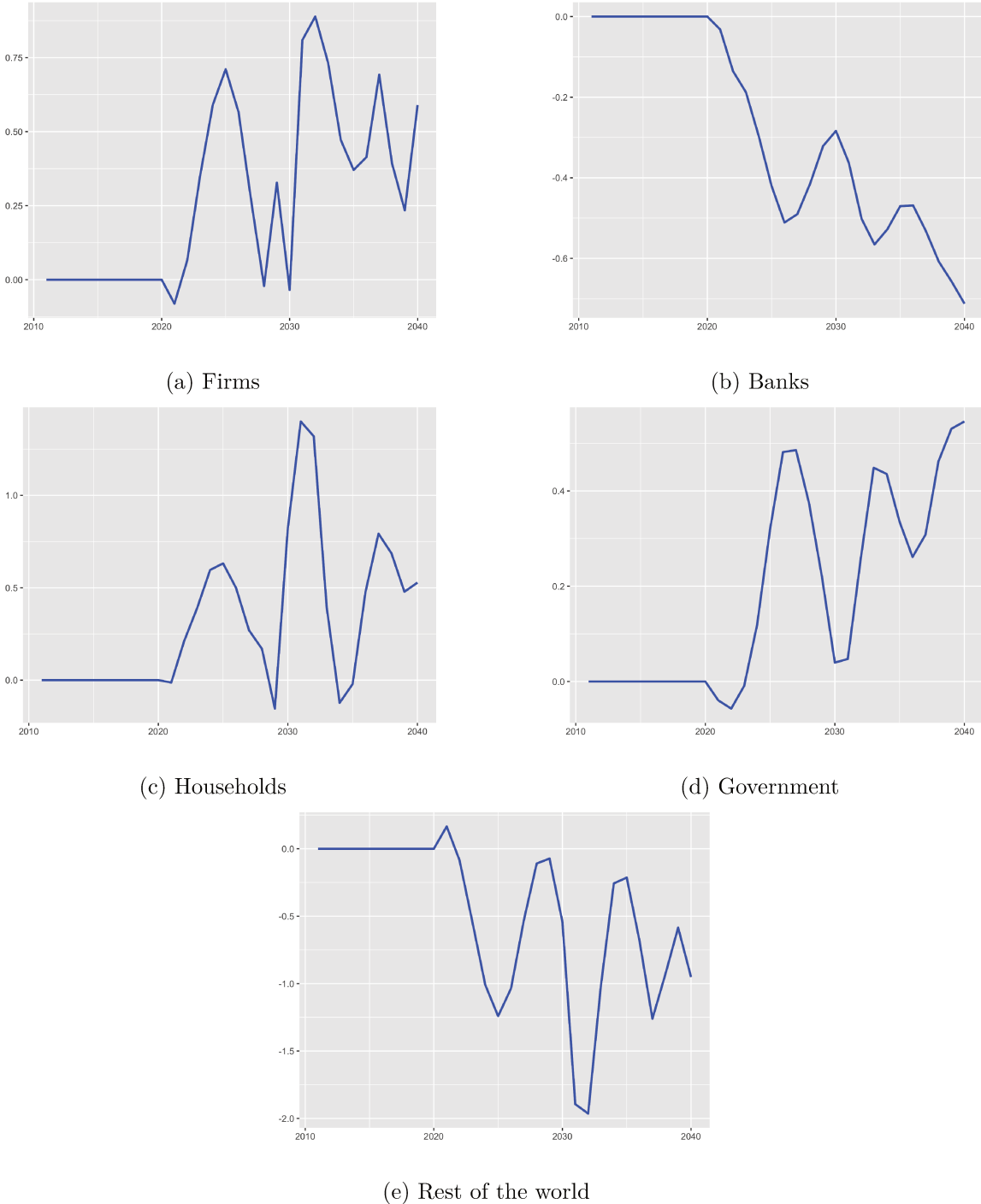


Figure 5.20: Foreign shock - Impacts on financial balances, %GDP (Scenario - Baseline)

Looking at the balance sheet adjustments for each sector (Figure 5.21), the firms and households sector decrease their liabilities compared to the baseline scenario. Given the closure of their balance sheet composition, the banking sector sees a decrease in loans, then in equities. Seeing less deficit, the government will acquire less debt from other sectors of the economy. Finally, the foreign sector experiences less demand for its asset, so the stock of liabilities held by domestic agents decreases.

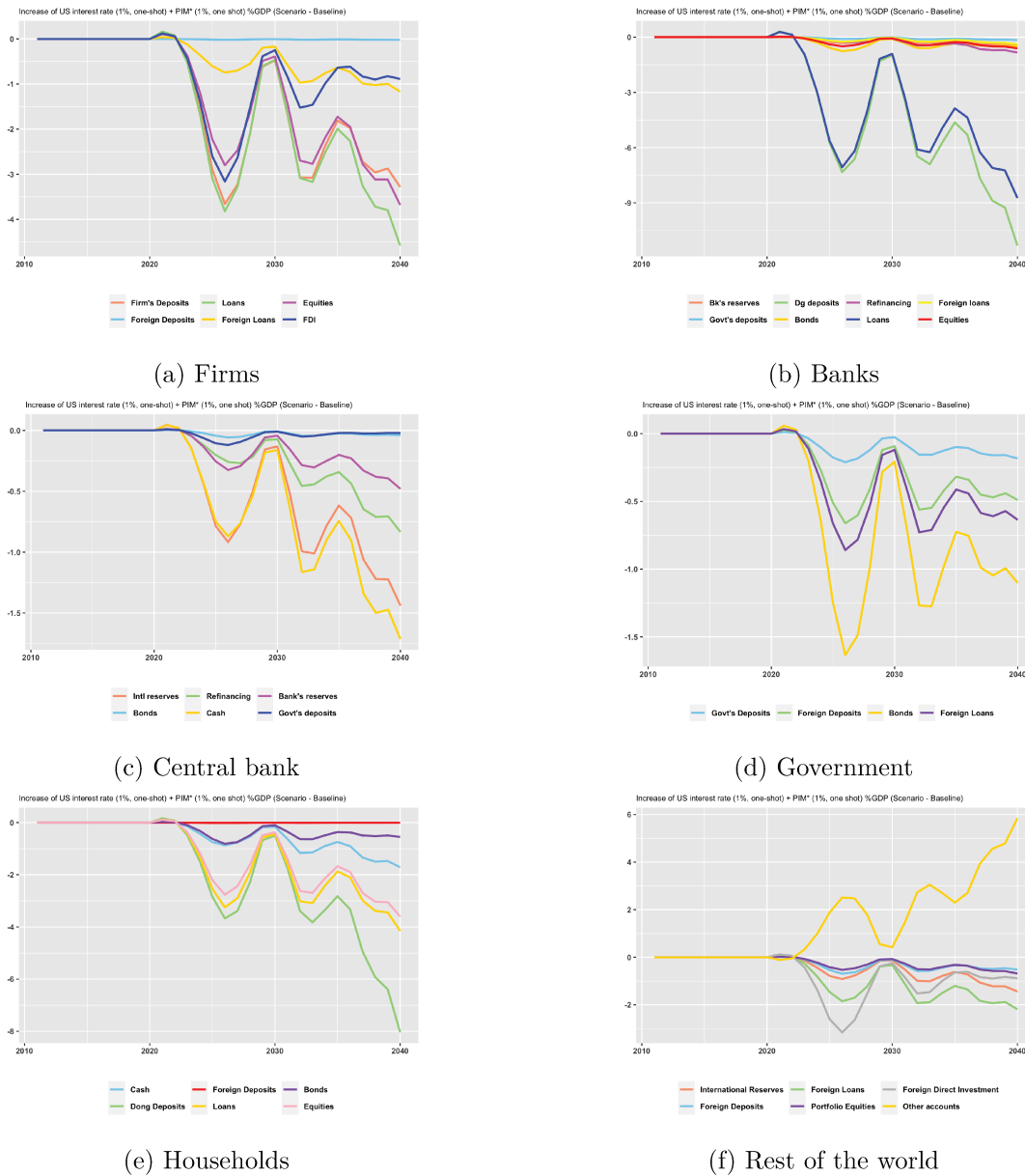


Figure 5.21: Foreign shock - Impacts on balance sheet, %GDP (Scenario - Baseline)

As mentioned above, the effect of a foreign shock on the economy through the balance sheet channel depends on the relative parts of foreign liabilities. Taking one example of foreign loans, the increase in foreign interest rate leads to an appreciation, then an increase in the value of foreign loans due to the revaluation effect (Figure 5.22). It can imply an increase in interest payments. However, in our model, domestic debts and other financial instruments can substitute for foreign loans to finance the financing needs of the sectors. Therefore, the stock of foreign loans held by domestic sectors will decrease compared to the baseline scenario (Figure 5.23). It contributes to preventing the negative effect of this shock.

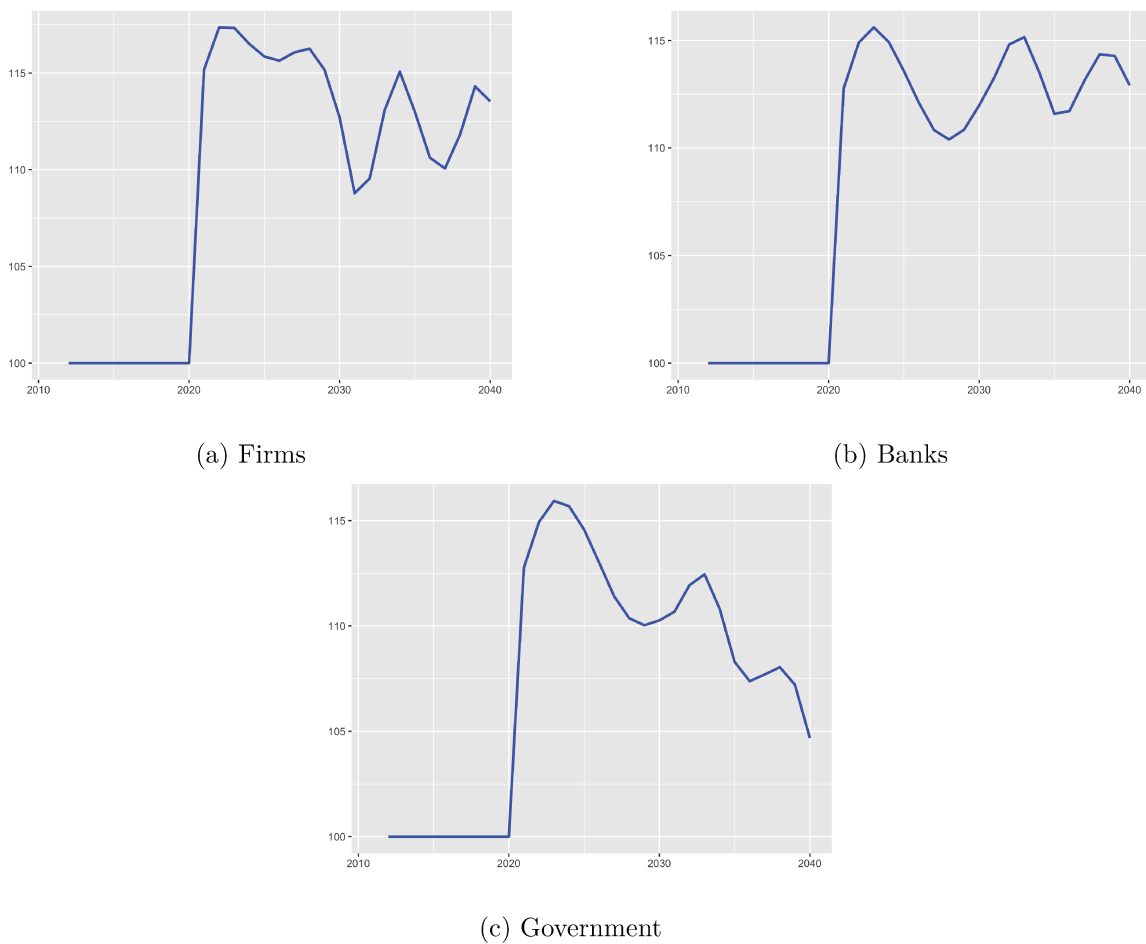


Figure 5.22: Revaluation effect on foreign loans (Scenario/Baseline * 100)

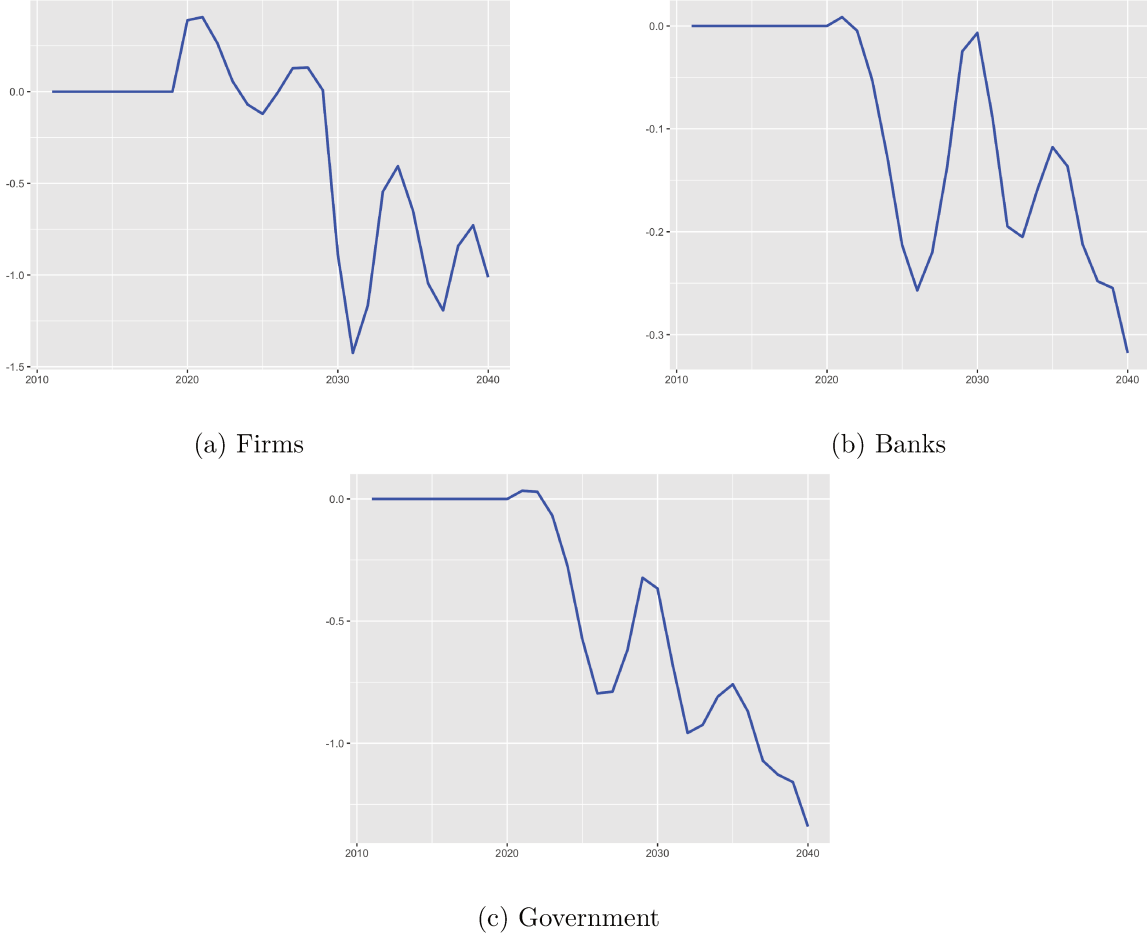
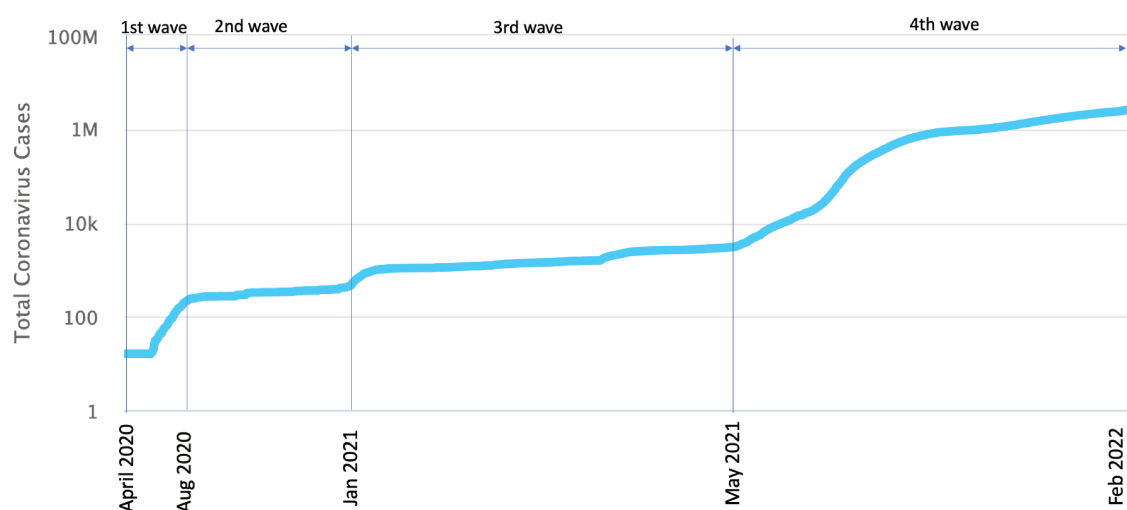


Figure 5.23: Impacts on foreign loans, %GDP (Scenario - Baseline)

5.3 Policy responses to cope with the COVID-19 pandemic¹

5.3.1 Overview of the COVID-19 pandemic in Viet Nam

Sharing a border of more than 1200 km with China, where the epidemic originated, Viet Nam was one of the first countries where COVID-19 cases were first confirmed after China. By the end of 2021, this country was hit by four waves of COVID-19 (Figure 5.24).



Source: Worldometer COVID-19

Figure 5.24: Total number of cases of COVID-19 in Viet Nam

The first two cases in Viet Nam were identified on 23rd January 2020. During this first wave, Viet Nam recorded 16 cases with no casualties directly related to Wuhan, China. Since the first record of local transmission on 1st February, the Prime Minister announced the outbreak with tight measures against the pandemic, including travel restrictions and bans, visa suspensions, compulsory quarantine, and health declarations for heavily affected countries (China, South Korea, Iran, and Italy). Since the 17th case was registered on 6 March 2020, the pandemic has spread worldwide. The number of infected people increased sharply, which

¹This section is an updated version of a working paper, co-authored with Etienne ESPAGNE, Luis REYES and TRAN Thi Anh-Dao, presented at the Conference on Effective Public Debt Management and Fiscal Sustainability in the Post-COVID-19 Era" (March 3-4, 2022) organised by the Asian Development Bank Institute (ADBI). The paper is under review for publication as an ADBI Working Paper and as a chapter in an ADBI book on the conference topic.

led to the suspension of entry for all foreigners from 22 March 2020. Coming back to Viet Nam, the Vietnamese from abroad had to spend 14 days in full quarantine. From 1st April 2020, all Viet Nam conducted social distancing (people stay at home except for essential and emergency outings and closing non-essential businesses) for 15 days. No new cases of community transmission were detected in Viet Nam for a period of 99 days until 25 July. It partly allowed economic activities to continue.

Viet Nam entered the second wave of infection when the COVID-19 community transmission was detected in Da Nang, including the country's first deaths from the virus, which mainly included patients with underlying severe diseases in the Da Nang Hospital cluster. As of 31 August 2020, Viet Nam reported 1,040 cases, with 32 deaths. Globally, Viet Nam had a relatively low number of cases compared with most other countries. With the reintroduction of physical distancing measures throughout areas deemed high-risk, Viet Nam was undergoing a period of three months without any infection cases in the community. After six months of suspension, commercial flights were resumed between Viet Nam, Japan, and South Korea. Economic activities were resumed.

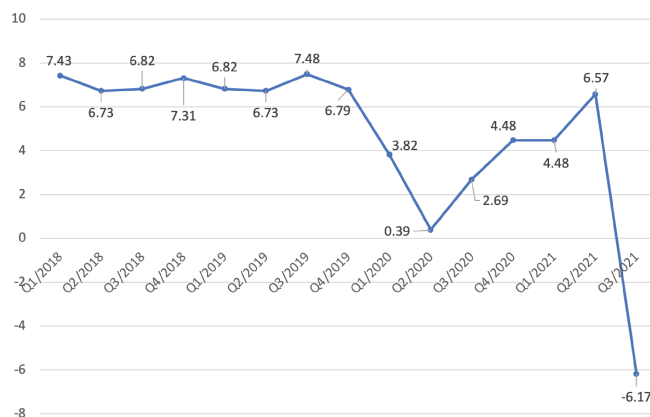
The third wave of infection began on 28 January 2021, when Viet Nam recorded community transmission cases in Hai Duong and Quang Ninh provinces. In this new phase, the government only quarantined the areas directly related to the infected people to limit the economic impact. But the number of cases still increased; on 15 February 2021, Hai Duong province was locked down for 15 days, and other big cities such as Hanoi and Ho Chi Minh city stopped all entertainment activities. Since March 2021, the situation in northern provinces had been under control when the number of new cases fell to single digits. At the same time, Viet Nam started its mass COVID-19 vaccination campaign.

From the end of April 2021, Viet Nam experienced "a fast-spreading outbreak." Many cases were found in industrial parks in Bac Giang province and other prominent hospitals. This time, it was nearly impossible to use tracing management and cut the chain of infection due to the spread of the virus in many provinces of Viet Nam. The situation worsened after the four-day holiday for Reunification Day and International Workers' Day, and on 26 July 2021, Ho Chi Minh City imposed a daily night curfew. This implied that people could not leave the city except in an emergency. The government also mobilised 10,000 troops to the city to enforce the lockdown and deliver food supplies. After several months, in November 2021, COVID-19 came under control nationwide.

One of the contributions to the control of the COVID-19 pandemic was vaccination. As mentioned above, vaccinations commenced on 8 March 2021, with around 203 million administered vaccination doses reported by April 2022. Vaccines were approved, including the Oxford–AstraZeneca vaccine, Sputnik V, the Sinopharm BIBP vaccine, the Pfizer–BioNTech vaccine, the Moderna vaccine, the Janssen vaccine, and Abdala.

5.3.2 COVID-19 economic impacts on the economy

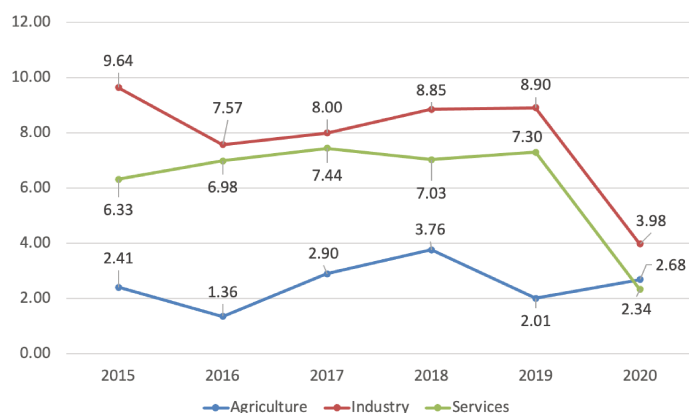
The COVID-19 pandemic significantly impacted Viet Nam’s economic growth. According to the GSO, the real GDP increased by 2.91% in 2020, which was the lowest growth rate since Doi moi in 1986 (in which the second-quarter growth was 0.39% which corresponded to the period of lockdown). However, in 2020, Viet Nam’s economic growth rate was still higher than the average of ASEAN countries and the world. The fourth wave of the COVID-19 pandemic since May 2021 had aggravated the negative impact on economic growth. The third-quarter growth in 2021 was -6.17% (Figure 5.25). The Vietnamese economy was expected to have an annual growth of 5.5% in 2021. However, it was still uncertain due to the extent and duration of the current wave of new COVID-19 cases hitting the country. The spread of COVID-19 posed a significant risk for domestic demand and the risk of disruption to manufacturing output since COVID-19 cases were detected in substantial manufacturing facilities or logistics supply chains. In addition, as of September 2021, the country’s overall vaccination rate remained low at about 28 %, and only 4 % of the population had been fully vaccinated with two shots. Thus, the country remained vulnerable to new COVID-19 waves.



Source: GSO

Figure 5.25: Quarterly GDP growth rate (y-o-y, %)

The COVID-19 pandemic had negatively affected all economic activities. The economic impact was seen due to the implementation of Directive No 15 and Directive No 16 about the nationwide social distancing. Several business sectors, including restaurants, shops, cinemas, and entertainment venues, were affected by the collapse in demand. Even as social distancing measures were relaxed, non-essential businesses remained closed. The restriction of foreign entry negatively affected the airline and tourism sectors. The education and training sector had been impacted due to school closures.

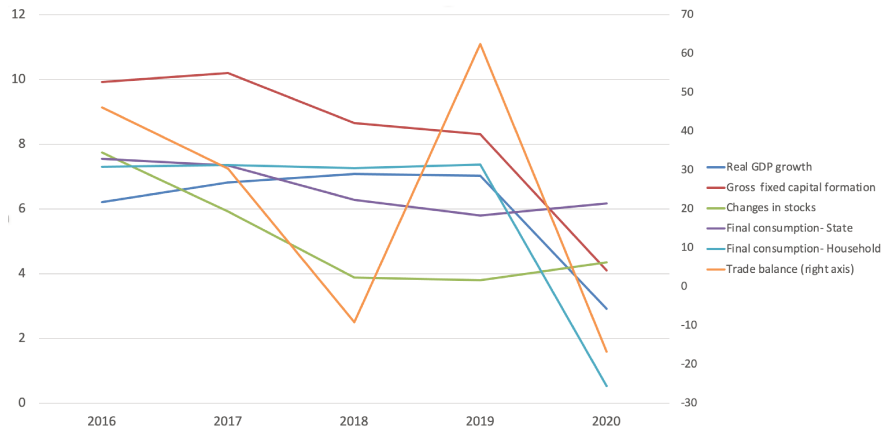


Source: GSO

Figure 5.26: Growth rate of economic activities (%)

Figure 5.26 shows that agriculture had an increased growth rate (2.68%), but industry and service sectors had a decline in the growth rate in 2020 mainly due to the social distancing (3.98% compared to 8.9% in 2019 and 2.34% compared to 7.3% in 2019 respectively).

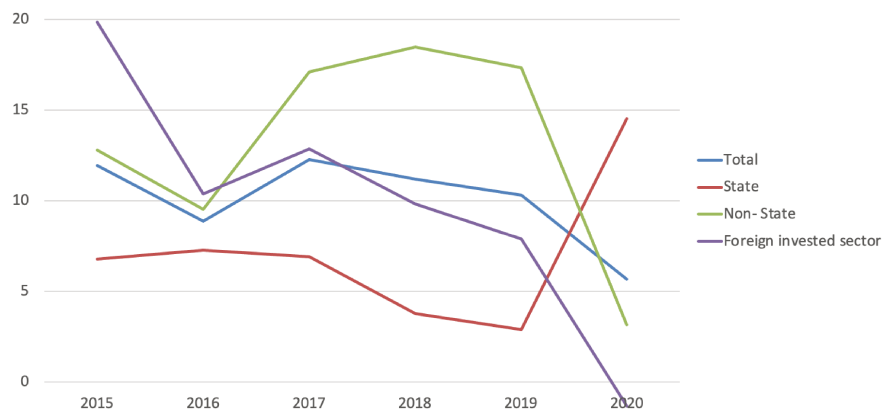
Looking at the demand side of the GDP, all components except the public expenditures declined in the growth rate (Figure 5.27). The household's final consumption increased only by 0.6% in 2020 (compared with 7.23% in 2019) due to the decline in personal income and the social distancing measures. Export has been one of the significant drivers of Vietnamese economic growth. More than 50% of Viet Nam's exports were sent to the United States, China, the European Union, and the United Kingdom. The fact that these countries' imports were also strongly affected by the COVID-19 pandemic in 2020 (UNCTAD, 2021a) contributed to the substantial reduction of Vietnamese exports compared to 2019. The fiscal stimulus explained the slight increase in public consumption (6.16% in 2020 compared with 5.8% in 2019). The capital accumulation increased by 4.12% (compared with 8.28% in 2019).



Source: GSO

Figure 5.27: Growth rate of GDP components (%)

Lockdown policies harm FDI inflows (OECD, 2020). In 2020, the growth rate of the non-state and the FDI sectors was significantly reduced compared to the previous year, 2019 (Figure 5.28). However, to compensate for this reduction, the government had to increase the scale and the intensity of public investment with a growth rate that reached 14.5% (compared to the low growth rate of only 2.6% in 2019).

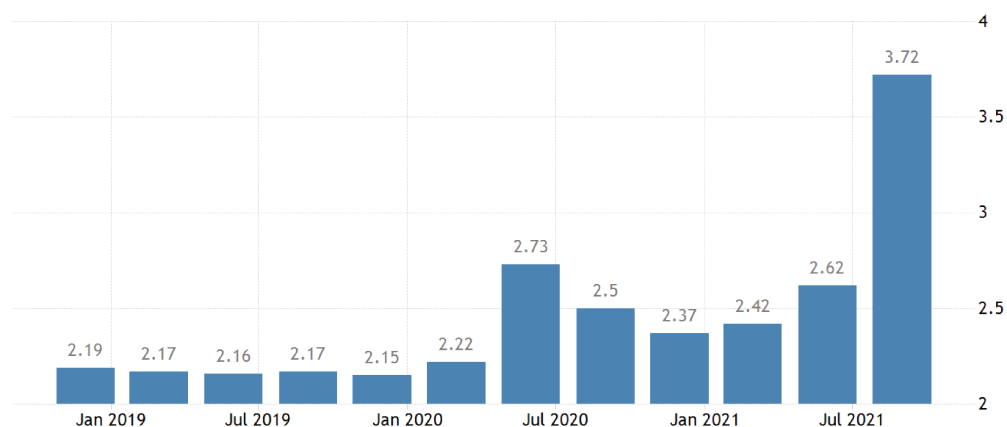


Source: GSO

Figure 5.28: Growth rate of investment by economic sectors (%)

The COVID-19 pandemic had an essential impact on the labour market (ILO, 2020). Social distancing, self-isolation, and travel restrictions caused a reduction in the workforce in the economy, and many jobs were lost. According to the GSO, more than 1.8 million working-age people were underemployed in the third quarter of 2021. It is the highest level in the past

ten years. The underemployment rate of working-age people in urban areas was higher than in rural areas, reaching 5.33 % and 3.94 %, respectively. In addition, the prolonged social distancing period in many localities had pushed the unemployment rate in the third quarter far beyond the usual 2% level. The unemployment rate reached 3.72% in the third quarter of 2021, which was the highest level in three decades (Figure 5.29). The increase in underemployment and unemployment rate reduced the incomes of workers.



Source: *tradingeconomics.com, GSO*

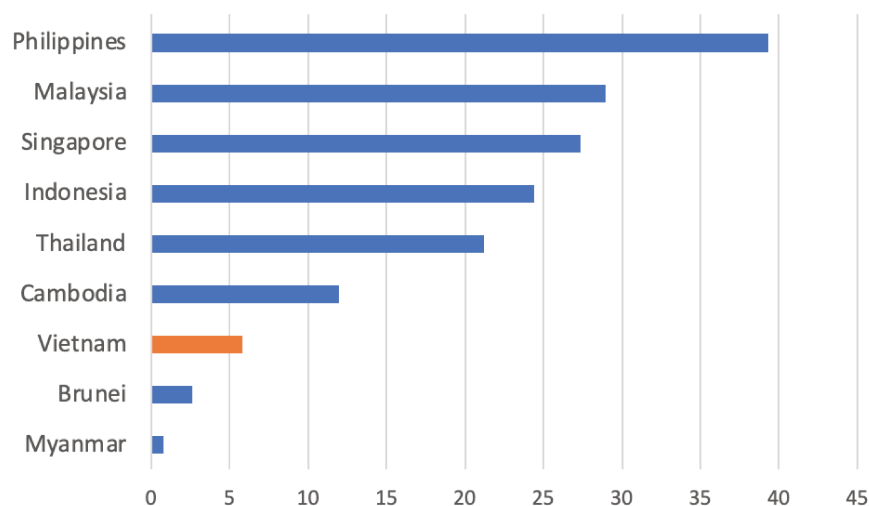
Figure 5.29: Unemployment rate (%)

5.3.3 Government responses during the COVID-19 pandemic

The Vietnamese government proved a strong leadership in response to COVID-19 by establishing the National Steering Committee (NSC) led by Deputy Prime Minister – Vu Duc Dam right after detecting the first new cases. The NSC was a multi-ministerial and multisectoral committee to facilitate decision-making and coordinate the implementation of measures. Sixty-three provincial and 707 district steering committees at the local level were established. It illustrates the multi-sectoral approach and systemic response of the government facing the COVID-19 pandemic.

To mitigate the negative impact of the COVID-19 on the economy, the government decided to introduce stimulus packages to support the most affected firms and people. According to the ISEAS – YUSOF ISHAK Institute (2021), by collecting from various data sets including IMF, International Labour Organisation (ILO), Asian Development Bank (ADB), media outlets, and finance ministries/departments as of May 2021, compared to other COVID-19 stimulus packages of ASEAN countries, that of Viet Nam remained at the modest level (Figure

5.30). However, it was vital in the very short run to reduce the impact of the COVID-19 pandemic. Besides these counter-cyclical fiscal policies, the government had also implemented expansionary monetary policies.



Source: ISEAS – YUSOF ISHAK Institute (2021)

Figure 5.30: Estimated COVID-19 stimulus packages among ASEAN member states (as of 31 May 2021)

Fiscal policies included tax measures to support enterprises consisting of the extension of tax payment (Decree No. 41/2020/ND-CP on 8th April 2020), rental fee with a reduction of 15% (Decision 22/2020/QD-TTg on August 10, 2020) and a decrease of corporate income tax in 2020 by 30% for enterprises, co-operative society, other institutions with total revenue under 200 billion VND (Resolution 116/2020/QH14 on June 19, 2020, and Decree 114/2020/ND-CP on September 25, 2020). It was applied for roughly 740,000 active enterprises (accounting for 98% of entire enterprises) and most of the suspended business households. The expected support package was 180 billion VND.

One of the public policies to promote economic growth in the context of COVID-19 was the acceleration of public investment. A total approved public investment from the government budget in 2020 was nearly 700 thousand billion VND, 2.2 times more than the one in 2019 (312 thousand billion VND), which included 470.6 thousand billion VND in government budget estimation in 2020 and 225,2 thousand billion transferring from 2019. The policy was reflected in different government legal documents to remove difficulties in production and business activities, accelerate the disbursement of public investment capital, and guide

ministries, central and local authorities, and agencies to implement solutions to accelerating public investment disbursement drastically. Thus, the realised capital growth rate from the government budget in 2020 reached the highest from 2016 to 2020.

Targeting the people who were affected by the COVID-19 pandemic, according to Resolution No.42/NQ-CP on 9th April 2020 and Decision No.15/2020/QĐ-TTg, social security policy provided the guides for assistance and implementation of policies to support people facing difficulties caused by the COVID-19 pandemic, respectively. Accordingly, about 62,000 billion VND (around 0.96%GDP) would be disbursed for roughly 20 million workers who lost their jobs due to the impact of the pandemic. However, the people who received support were mainly from the group of workers belonging to the insured sector and poor households. Meanwhile, workers that were significantly affected are freelance ones, and workers in the informal sector have no access to this support. The implementation of direct support policies had faced a significant barrier because there was no database to manage information about beneficiaries, leading to the complicated application-for-support procedure, bringing inconvenience to people. In 2021, facing the fourth wave of the pandemic, Viet Nam issued Resolution 68, unveiling financial incentives for employers and employees affected by COVID-19. The support package was worth around 1.13 billion USD.

According to the information released by the Government about the report on the results of the implementation of the state budget in 2020 and the estimated state budget in 2021, which had been sent to the National Assembly, to offset overspending mainly due to the COVID-19 pandemic, in 2020, the Government had actively operated the issuance of government bonds. Around VND 333,000 billion in government bonds were issued to cover overspending and repay principal. In 2020, the Government extended the maturity of government bonds by more than 3.5 times that in 2011. From 3.9 years (in 2011) to an average of 13.94 years (in 2020), they increased the average debt maturity of the government bond portfolio at the end of 2020 to 8.42 years. Moreover, the government also mobilised medium and long-term capital. It did not borrow more from international financial institutions such as the World Bank and Asian Development Bank, contributing to strengthening the country's credit rating.

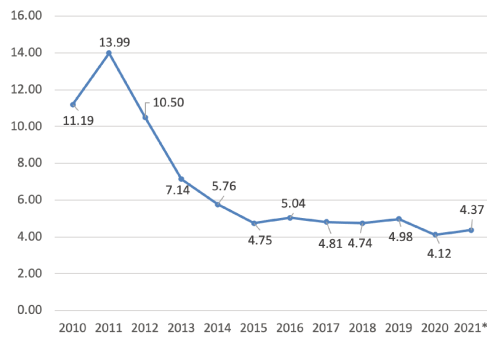
Regarding monetary policies, the SBV had decided to reduce the operating interest rate, which allowed liquidity support for credit institutions and reduced the cost of borrowing capital for businesses and households.



Source: tradingeconomics.com, The State Bank of Viet Nam

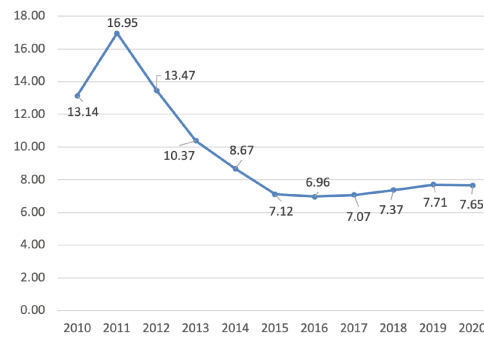
Figure 5.31: Operating interest rate, %

Since December 2019, the SBV had adjusted the operating rate four times in March, May and October 2020 (Figure 5.31). Consequently, the deposit interest rate in VND and the lending rate decreased in 2020 (Figure 5.32 & 5.33).



*: expected; Source: World Bank

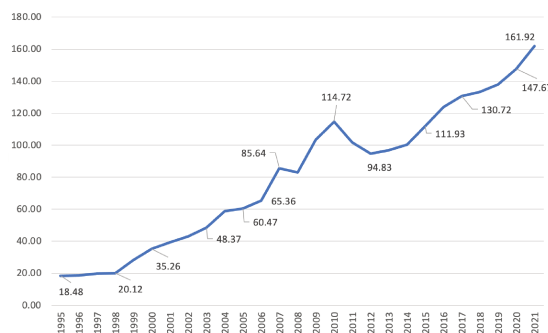
Figure 5.32: Deposit rate, %



Source: World Bank

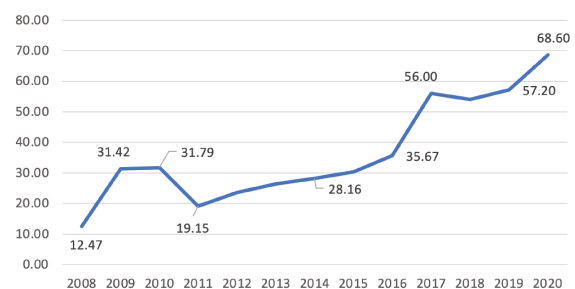
Figure 5.33: Lending rate, %

The decline in lending and deposit rates resulted in the credit and stock markets. Figure 5.34 and 5.35 show that the domestic credit and the market capitalisation increased strongly at the end of 2020.



Source: World Bank

Figure 5.34: Domestic credit, %GDP



Source: World Bank

Figure 5.35: Market capitalisation, %GDP

Another monetary policy to support enterprises affected by the COVID-19 is related to the debt term restructuring and loan interest exemption (Circular No. 01/2020/TT-NHNN on 13th March 2020). This policy contributed to controlling bad debts during this period. In addition, the SBV had the credit support policy for the banking sector to balance their capital sources, save operating costs to restructure debt, exempt or reduce loan interests and payment fees and consider new lending for production and business of enterprises and households; regularly monitor and evaluate the situation of borrowers to promptly and effectively implement support measures; stabilising deposit and lending interest rates; promptly responding to people's payment needs. Credit support package of commercial banks, worth 250,000 trillion VND, according to which banks were committed to implementing credit support packages with per-year interest rates lower than 2% than before COVID-19. The support package from the Social Policy Bank was worth 16,000 trillion VND to extend the debt for customers, adjusted repayment terms and issued new loans.

5.3.4 Post-Covid recovery plan

Recently, in January 2022, Viet Nam's National Assembly approved the Resolution 43, which was the post-Covid recovery plan for the Vietnamese economy and focused on six pillars to revive the economy post-pandemic: (1) circulation of goods and smooth production of enterprises; (2) promoting manufacturing to restore economic growth; (3) large-scale investment (inter-regional transport infrastructure, green energy, and national digital infrastructure); (4) address difficulties confronting businesses; (5) institutional reforms; (6) human resources. This recovery plan set several policies to support the country in achieving a GDP growth of 6.5 to 7 per cent between 2021 and 2025. Under this resolution 43, around US\$15 billion was approved. It consists of both fiscal and monetary policies (Figure 5.36). In terms of fiscal policies (Figure 5.37), a 2 per cent reduction in VAT (from 10% to 8% in 2022 and 2023), as well as CIT deduction for businesses, was announced. There were different incentive measures. The government was committed VND 14 trillion (US\$620 million) to the health sector, including improving facilities, disease control, hospitals, and human resources related to COVID-19. A fund of around VND 5 trillion (US\$220 million) was allocated to Viet Nam Bank for Social Policies for preferential loans. This included investment in job training, vocational education, and social security. A package of VND 40 trillion (US\$1.76 billion) took the form of loans at 2 per cent a year through commercial banks for various industries to support business households and cooperatives. Especially more than 30% of the recovery

package was allocated for public investment (infrastructure projects in transportation, IT, digitalisation, water security, climate change, and natural disasters). Another package of VND 6.6 trillion (US\$2.9 million) for employee housing for those working in industrial zones, export processing zones and key economic areas were committed. The government planned to increase the spending on the healthcare sector, importing COVID-19 vaccines, and spending on social security. Regarding the monetary policy, the interest rate would be reduced by 0.5-1% in 2022 and 2023 to stimulate investment.

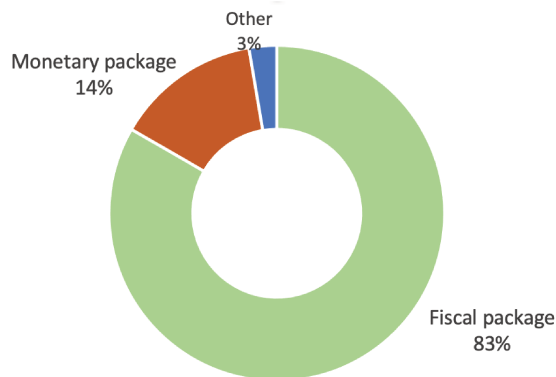


Figure 5.36: Total recovery package

Source: MOF

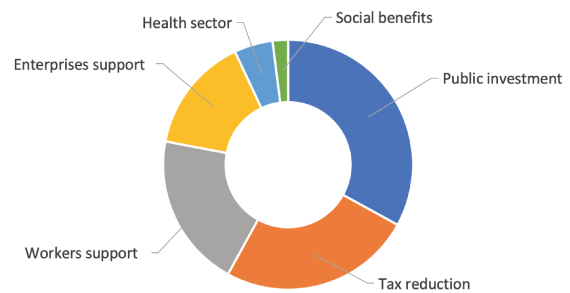


Figure 5.37: Fiscal package

Source: MOF

However, during the COVID-19 pandemic, the government was not only collecting less revenues due to the economic slowdown but also spending a lot more to cope with the negative consequences of the pandemic. This public intervention would raise a crucial question about how to finance it. The Resolution 43 specified different financing methods, including government bonds, ODA, and other official loans. It means that this public financing need was mainly financed by debt. The National Assembly had another resolution 23, in 2021, which fixed the public deficit, public debt, and external debt limit. The country's annual public debt ceiling would not exceed 60 % of GDP. The national foreign debt would not be over 50 % of GDP, with a warning level of 45 % of GDP. Public debt has remained a concern among the government, which justifies our study to examine the effects of the government's responses to coping with COVID-19 on the economy and public debt vulnerability and fiscal sustainability.

5.3.5 Public debt and fiscal sustainability

As mentioned above, the COVID-19 crisis had exacerbated the pressure on the country's financing challenges for significant unexpected public spending. The various measures taken

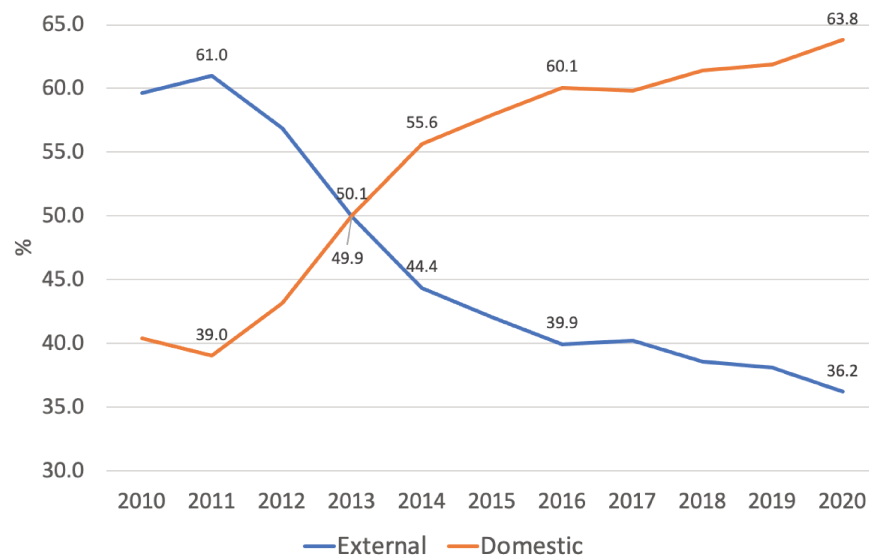
by the government to bring the Vietnamese economy back to its pre-COVID level had raised the concern of public debt management, one of the macroeconomic fundamentals. Hence, it justifies our study examining the effects of the government's responses to coping with COVID-19 on the economy, public debt, and fiscal sustainability. In other words, the pandemic was going to have a substantial impact on public finances.

The notion of public debt sustainability refers to the fact that public debt cannot continue to increase relative to national income. When public debt increases over several periods, the government must increase future primary surpluses in order to repay the debt or face default (Oviedo and Mendoza, 2004). This means that the government has to increase their revenues (mainly taxes) and/or reduce its spending. This is linked to the government's fiscal policies. However, the government can also rely on monetary policies implemented by the central bank. The central bank increases the money supply, which leads to higher inflation and then the real value of public debt declines. However, suppose that the stock of public debt is too large. In that case, it will have a negative impact on the financial markets due to the loss of confidence/expectations in the government's financial capacity.

Moreover, public debt tends to increase very rapidly after each crisis. Several international organisations have decided to increase the loans and provide more financial resources for developing countries to avoid sovereign debt defaults. However, [Arquié, Héricourt, and Tripier \(2020\)](#) insisted that the Domestic Resources Mobilization (DRM) is an underused instrument to build recovery from the pandemic and the road to sustainable development, especially in low- and middle-income countries. For developing countries, due to the difficulties of mobilising domestic resources for social and investment, it is inevitable to rely on foreign aid or other external financing resources. However, to avoid inconsistency with the country's development goals/priorities, DRM is a critical 'anchor' for country-led development strategies and contributes to reducing the country's fiscal vulnerability ([Napo, 2022](#)).

Chapter 1 gave us an overview of the government account. The government collects taxes, receives other transfers or payments, and then consumes and invests. The government's current expenditures and public investment are exogenous as policy instruments. The public deficit can be financed by issuing bonds or borrowing from abroad. The Vietnamese public domestic debt has sharply increased since the 2010s with the development of the domestic bond market, while the proportion of external debt gradually decreased (Figure 5.38). Before 2013, the government financed its deficit mainly by borrowing from abroad. There was

considerable currency risk. It led to more prudent policies that reduce external debt compared to domestic debt. Nowadays, domestic debt accounts for more than 60% of the public debt.



Source: MOF

Figure 5.38: Structure of public debt, %total

5.3.6 Simulating policy impacts

In order to examine the impacts of public policies, we define the baseline scenario by projecting our exogenous variables in the future, representing the socio-economic development trends of Viet Nam and the world. The population growth rate is taken from the United Nations population projections for Vietnam. The capital depreciation rates are taken from IMF Investment and Capital Stock Dataset 2019. As mentioned above, due to the large share of informal and self-employment in the Vietnamese economy and the low unemployment rate in the past, we assume that the unemployment rate remains constant at 2%. However, to capture the impact of the COVID-19 pandemic without public intervention, we take the value of unemployment in 2020 and 2021 of GSO.

To address our main research question of the effects of the policy responses to cope with the COVID-19 pandemic, we implement a simultaneous shock representing the stimulus package and recovery plan. In other words, the effects of the public intervention will be simulated by changing the parameters related to the policy variables. The baseline scenario is the scenario without public intervention, and the alternative scenario is in which the stimulus package and

recovery plan are considered. It consists of both fiscal and monetary policies, as simulated in our previous Section.

In terms of modelling implications, we integrate an increase in the government's final consumption, an increase in public investment, an increase in transfers from the government to households, and the reduction of the central bank's interest rate during the period 2020-2023. The values of these shocks are based on the actual value of fiscal stimulus and the government's recovery plan to replicate the reality as possible.

We will examine the effects of these public interventions against the COVID-19 pandemic. Following the same analysis framework of the previous section, we will discuss the impact on main macroeconomic indicators, including GDP, prices, current account and fiscal account. We expect that the government's responses will impact not only the real side but also the financial side, which is the public debt.

Firstly, an increase in public consumption and public investment can contribute directly to the GDP but with a slight delay due to the adaptive expectations in the production decision (Figure 5.39). Secondly, the fiscal expansion will increase the transfers to households which stimulate their disposable incomes, resulting in a relative increase in their consumption and investment. Thirdly, reducing the central bank's interest rate will reduce the lending rate (Figure 5.41) and the cost of borrowing for firms and households. After the public intervention during 2020-2023, the real GDP turns to the baseline scenario and declines during the next period, which can mainly be explained by the negative impact on the country's trade balance (Figure 5.40). By 2025, the economy can enter into a new cycle.

The overall increase in aggregate demand, however, has a negative impact on the current account. Imports increase due to the higher domestic demand (Figure 5.40). On the contrary, exports decrease because the inflation resulting from the stimulus package implies a reduction in the country's competitiveness (Figure 5.42).

Looking at the government's account, the red line represents the results of the fiscal expansion scenario compared to the baseline scenario (the blue line). The increase in public spending, public investment, and household transfers will increase the government's total expenditures. In the meantime, reducing tax revenues will cut back the government's revenue. Overall, it negatively affects the public deficit compared to the baseline scenario. This deterioration of the fiscal balance (Figure 5.43) increases the public debt in the medium-term as the

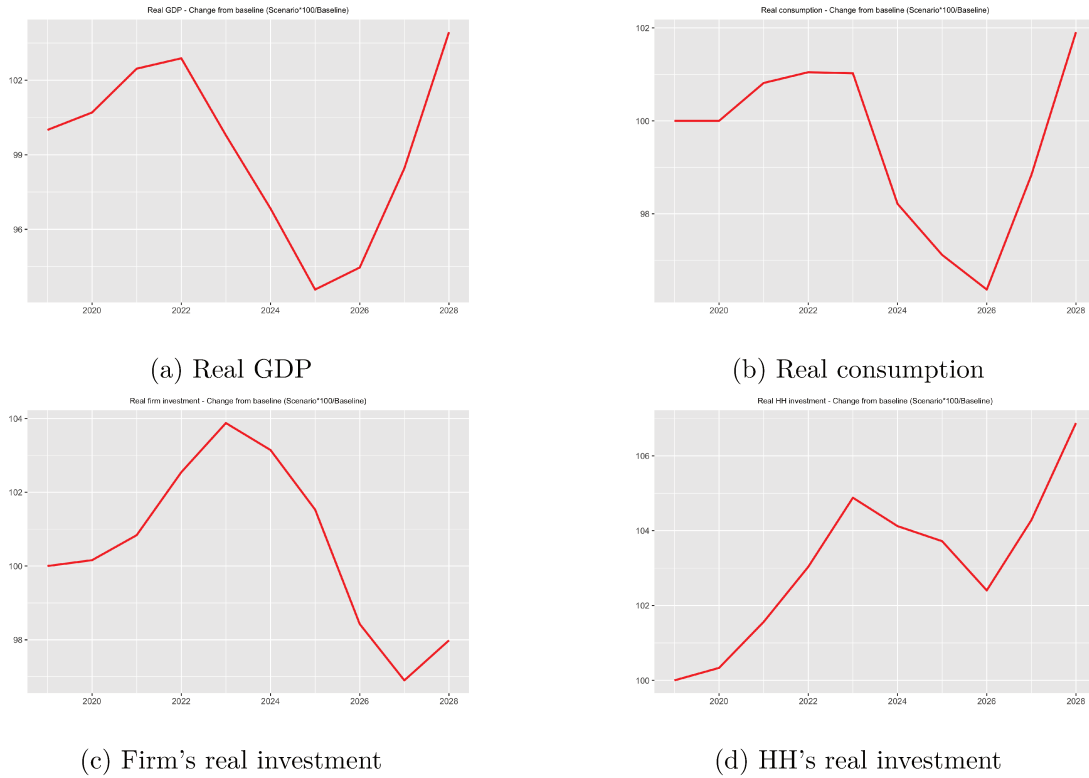


Figure 5.39: COVID-19 responses shock - Impacts on GDP and components (Scenario/Baseline * 100)

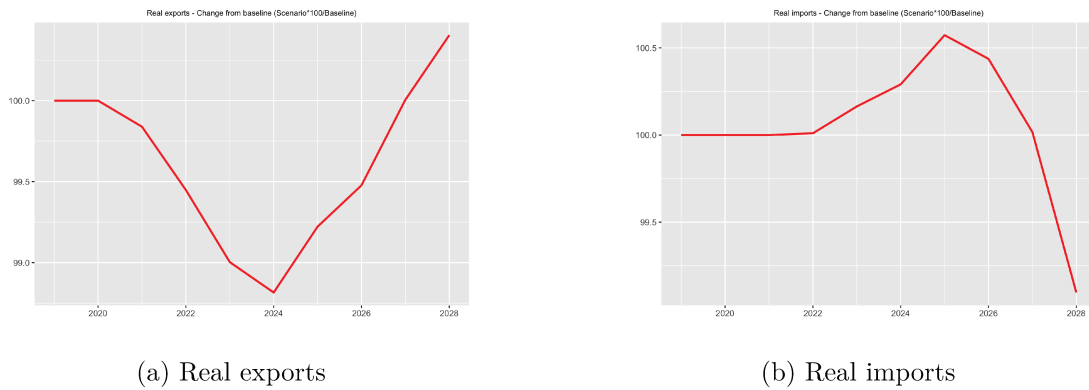


Figure 5.40: COVID-19 recovery shock - Impacts on trade (Scenario/Baseline * 100)

government finances its public deficit by debt. By 2026, the positive effect on economic growth can slightly improve the public deficit and bring the public debt closer to the baseline value. In addition, until 2025, the public debt is still lower than the public debt limit of 60% fixed in the Resolution 23 of the National assembly. Thus, it still has a potential risk to the

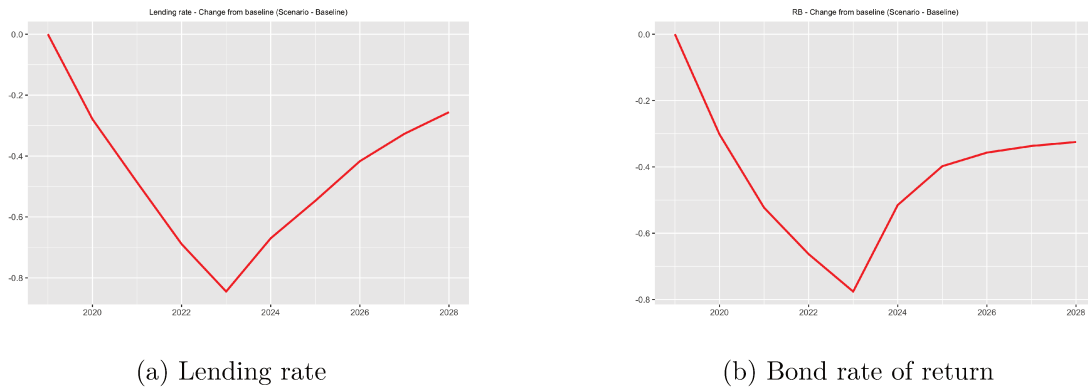


Figure 5.41: COVID-19 recovery shock - Impacts on interest rates, % (Scenario - Baseline)

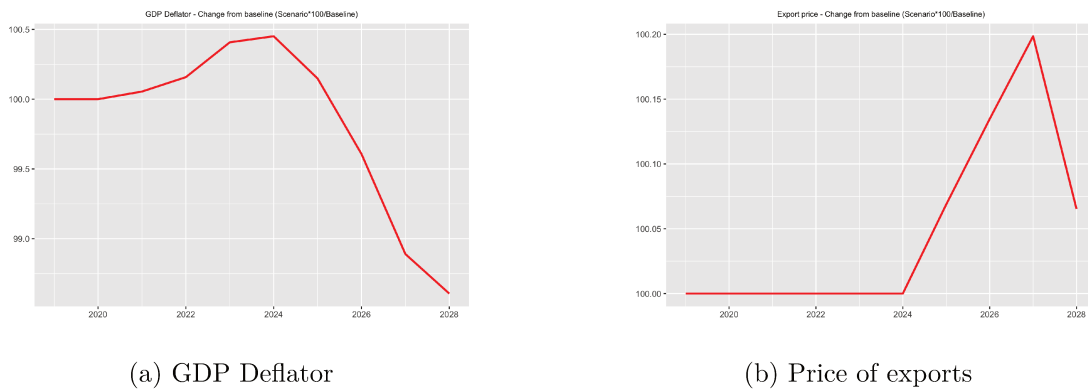


Figure 5.42: COVID-19 recovery shock - Impacts on prices (Scenario/Baseline * 100)

government's financial stability during 2025-2027 (Figure 5.43). It corresponds to the period where real GDP decreases compared to the baseline scenario. The reduction of GDP will lead to a decline in government revenue, affecting the public deficit and increasing the public debt.

During the pandemic, the government can finance its financing needs through domestic debt (issuing bonds) with a lower interest rate. Indeed, the bond's rate of return declines (Figure 5.41) with the central bank's interest rate. Thus, it reduces the risk of debt burden. In addition, according to the Ministry of Finance (MOF), the public external debt has been controlled at the safe limits approved by the National Assembly to ensure national financial security.

In summary, the COVID-19 pandemic has led to an unprecedented decline in economic activity. A global economic crisis is expected, with a contraction in global GDP far greater than the global financial crisis of 2008. It requires policy actions to support the economic

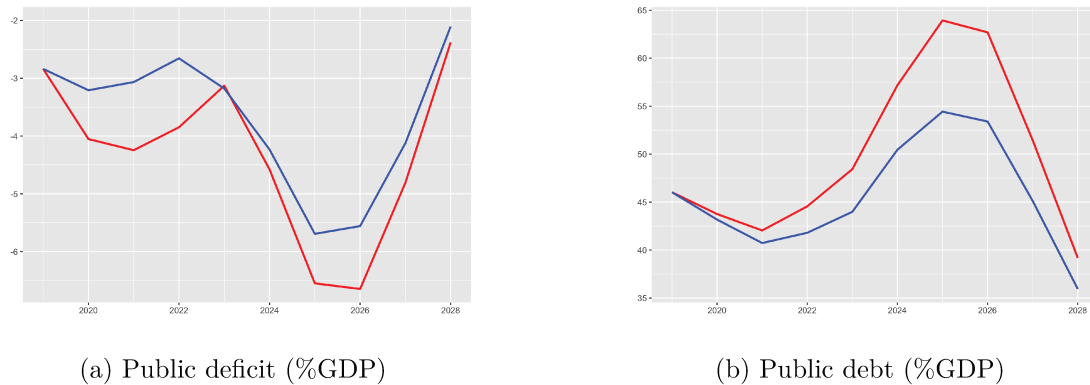


Figure 5.43: COVID-19 recovery shock - Impacts on public finance, %GDP (Scenario - Baseline)

sectors and the economic recovery post-COVID-19. Thus, our simulation results from the model show that stimulus packages and recovery plan are effective policy interventions to cope with the COVID-19 pandemic. In the short-term, it had a positive effect on aggregate demand. However, it raised the financing need of the government and then could cause the deterioration in public deficit and an increase in public debt. In the short term, the primary source of financing comes from borrowing. Still, in the medium and long term, policymakers need to consider taxes to increase the government's revenues and spending policies after the recovery.

5.4 Conclusion

This chapter attempted to assess the country's ability to conduct macroeconomic policies and face global external shocks to the economy. The first section conducted three simulation exercises related to fiscal policy, monetary policy and foreign shock. The model served as a macroeconomic analysis framework, which is helpful for discussions of policy relevance. We explained our results while focusing on various transmission channels.

Using the policy responses to cope with the COVID-19 pandemic as a case study, we examined the effects of the stimulus package and recovery plan. The Vietnamese government had demonstrated their strong commitment to coping with COVID-19 since the beginning. The effectiveness of the stimulus package and the recovery plan depends on its implementation, monitoring and evaluation. In other words, to ensure the rapid and efficient absorption of stimulus funds for productive public expenditure, it is essential to strengthen the administrative capacity and reduce implementation delays. Additional public investment could help offset

the possible short-term adverse effects of the pandemic on the private sector. Viet Nam aims to accelerate the disbursement of public investment, which can contribute to stimulating private investment, thereby amplifying the impact of the stimulus and recovery package. For the household sector, local authorities ensure the fastest disbursement of support packages for pandemic-hit workers. The delayed disbursement will affect the effect of the stimulus and recovery package on economic growth.

The banking system plays a critical role in financing businesses and household investments to contribute to economic recovery. Indeed, the monetary policy of the recovery plan will ease the lending conditions for financial institutions, debt repayment delays for households and firms, and credit guarantee schemes. These policies aimed to reduce the pandemic's adverse economic outcomes in the short run. However, they also revealed several potential economic fragilities and financial risks for the economic recovery. Thus, it could have an adverse impact on economic growth and worsen the government revenue, the public deficit and the public debt.

The fact that the government mobilises the domestic debt rather than external debt helps to avoid the country's debt burden. The COVID-19 crisis amplified and exposed several pre-existing structural weaknesses of the economy and society. The Vietnamese recovery after COVID-19 also faces several long-term structural challenges, such as climate change, population ageing, the acceleration of digitalisation, and rising inequalities. A sustainable post-COVID recovery could be achieved when the government has to ensure that the investments undertaken today will be consistent with the development priorities of Vietnam. This requires the government to take a policy mix to promote resilient and inclusive economic growth, compensate the costs of public debts due to COVID-19-induced budget deficits, and support the sustainability of public finances.

Not only being able to adopt with an interest in policy, the SFCVN model can also be used at the core of research in a number of subjects, as presented in Chapter 2, such as ecological macroeconomics. The next chapter of the thesis will investigate the macroeconomic impacts of climate change and adaptation measures on Viet Nam using the SFCVN model.

CHAPTER 6

Macroeconomic impacts of climate change ¹

6.1 Introduction

With a long coastal line and abundant geological and natural diversity, Viet Nam has emerged as one of the most vulnerable countries to climate change in the Asia-Pacific region. In 2019, Viet Nam was ranked 99th out of 182 countries according to the Notre Dame University Global Adaptation Index (ND-GAIN) in terms of vulnerability score. Vulnerability measures a country's exposure, sensitivity and ability to adapt to the negative impact of climate change. ND-GAIN measures the overall vulnerability by considering vulnerability in six life-supporting sectors – food, water, health, ecosystem service, human habitat and infrastructure. According to the Global Climate Risk Index (CRI) published by Germanwatch (2021), which analyses to what extent countries and regions have been affected by impacts of weather-related loss events, Viet Nam is ranked 13th among countries the most directly affected in the period 2000-2019. While located at the end of several transboundary river basins, a low-lying coastline of 3,444 kilometres exposes the country to rising sea levels. With the high population density and 70% of the population living in coastal areas and low-lying deltas, fast population growth and urbanisation increase the risks of socioeconomic losses attributable to climate hazards. Climate change has deeply impacted different economic sectors, including cereal production, fishing, and electricity from hydropower. The Vietnamese economy also is exposed to the transversal impact of climate change on labour and capital, which are production factors. Climate change, therefore, sets out major challenges for the country, and the Vietnamese government is putting climate change and sustainable development at the heart of its development policy.

Climate policies aimed at mitigating global warming or adapting to its most detrimental effects are the dynamic result of complex processes involving scientific evidence and instruments' social and economic feasibility that gather parties with varying interests in taking action. Climate change and its impacts are projected to intensify in Viet Nam, and thus, it urges

¹This chapter is an updated version of a working paper, co-authored with Etienne ESPAGNE presented at a number of conferences/workshops. It is under review for the conference volume of the Fifth Post-Keynesian Conference (Aalborg, April 27-30, 2022). The study is also integrated into two reports of the GEMMES Viet Nam project ([Espagne et al., 2021](#); [Espagne et al., 2022](#)).

Viet Nam to pay more attention to climate change adaptation strategy. Climate change responses are mainstreamed in the national strategy to ensure that they align with the country's socio-economic and sustainable development plans. The ND-GAIN ranked Viet Nam 92th out of 192 countries in terms of readiness to respond effectively to climate change. Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness by considering three components – economic readiness, governance readiness and social readiness. The priority sectors for adaptation include agriculture, transport, infrastructure and urbanisation, natural resources, industry and trade, public health, and tourism. Financial help for implementation shall be mobilised through different channels, including the state budget (central and local budgets), international funding, the private sector, and community contributions.

At the 26th United Nations Climate Change Conference of the Parties (COP26), Viet Nam declared its commitment to achieving net zero by 2050 and phasing out coal power between 2030 and 2040. This announcement by the Vietnamese Prime Minister Pham Minh Chinh has surprised the international community. A National Steering Committee was established to direct programs, projects and prioritised tasks in response to climate change and to promote the energy transformation required to fulfil Viet Nam's commitments. The current draft of the Power Development Plan VIII (PDP8) is expected to be significantly overhauled in order to create much more room for renewable energy and sustainable energy solutions. Net zero emissions require profound structural change and will demand substantial new investments in green technologies, sustainable infrastructure and increased resource productivity. Given the high degree of openness of the Vietnamese economy, a net zero emissions target could lead the country to face a “Green transition trilemma” (Valdecantos, 2020). External financial sustainability, internal economic development and environmental sustainability can be antagonistic objectives unless specific macro-financial conditions can be met. Thus, assessing climate change impacts and adaptation is crucial for policy planning at the macroeconomic level.

This chapter aims to develop an integrated prospective economy-wide assessment to analyse the economic impacts of climate change and adaptation measures in the context of a greener industrialisation process for Viet Nam. Beyond this introduction, this chapter has three other sections. Section 6.2 gives an overview of climate change and climate policy in Viet Nam. Section 6.3 explains in detail our integrated framework built to assess the economic impacts

of climate change. Section 6.4 and 6.5 discuss the integration and the potential effects of adaptation measures on the economy. Section 6.6 concludes with some more policy-oriented recommendations and avenues for further research.

6.2 Climate change and climate policy in Viet Nam²

6.2.1 Climate change in Viet Nam

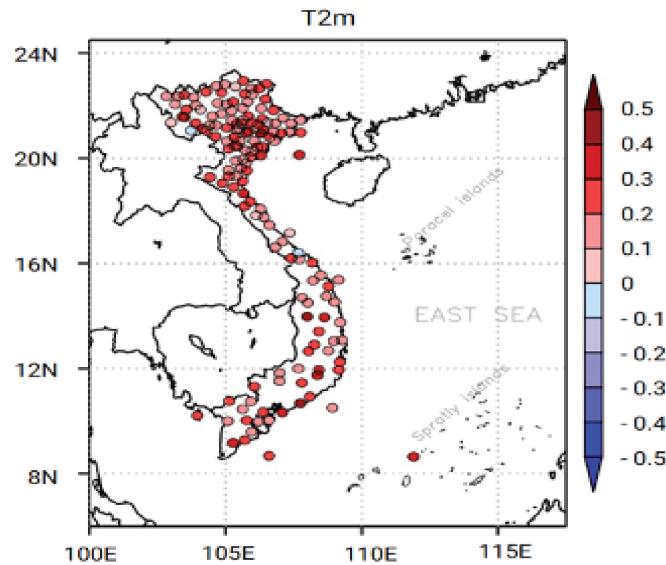
In this subsection, we provide the observed data and projected trends for climate (temperature and rainfall) and sea level rise in Viet Nam. The information related to climate change scenarios, especially temperature, is an essential input for climate change impact assessment in the following sections.

Temperature

The observed trend in Vietnamese temperatures shows an overall increase during the period 1981–2018, with the most significant increases recorded in recent years (2011–2018). The increases vary between regions (Figure 6.1), but the average annual temperature across the country increased by 0.78°C over the period 1981–2018. That is equivalent to an increase of around 0.205°C per decade. The highest increases were recorded in the Central Highlands in autumn and the North Delta in spring. The lowest increase was in summer in the Northeast and North Central regions.

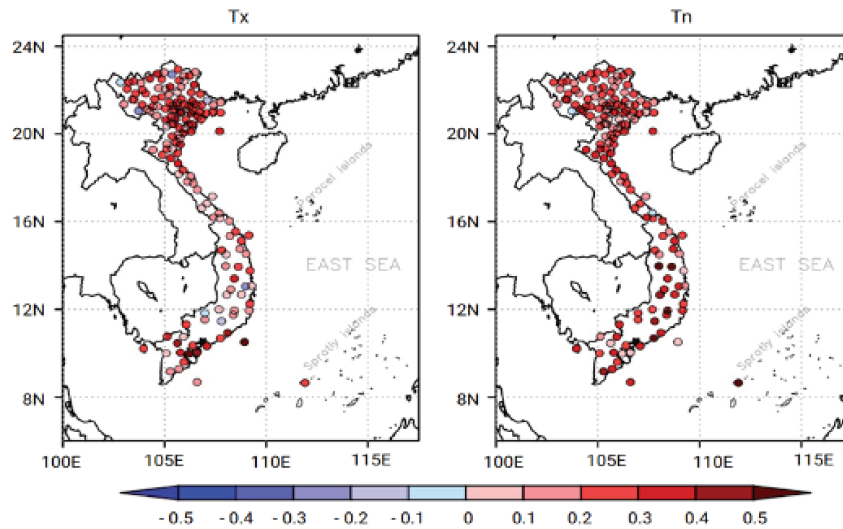
Regarding the extreme temperatures (Figure 6.2), the average daily maximum (T_x) and minimum (T_n) temperatures increased across the whole country over the period 1981–2018. High records were set mainly in El Nino years (1987, 1997, 2010, 2017). The general incremental levels were from 0.11 to 0.32°C/decade in almost all regions. However, the T_x increased relatively faster in the North Delta, southern Northeast, northern North Central, and eastern Southern Viet Nam. T_x increased relatively more slowly in the South Central and western Central Highlands. T_n recorded its greatest increase in the Central Highlands (0.5°C/decade), followed by 0.45°C/decade in the Northwest, 0.29°C/decade in the South, and 0.24–0.26°C/decade in the remaining regions.

²This section is an updated version of a chapter, co-authored with Etienne ESPAGNE, in the book "Rethinking Asian Capitalism. The Achievements and Challenges of Vietnam under Doi Moi" (Tran, T.A-D. (Ed.), 2022).



Source: *Espagne et al. (2021)*

Figure 6.1: Average annual T2m increase in Viet Nam for the period 1981–2018



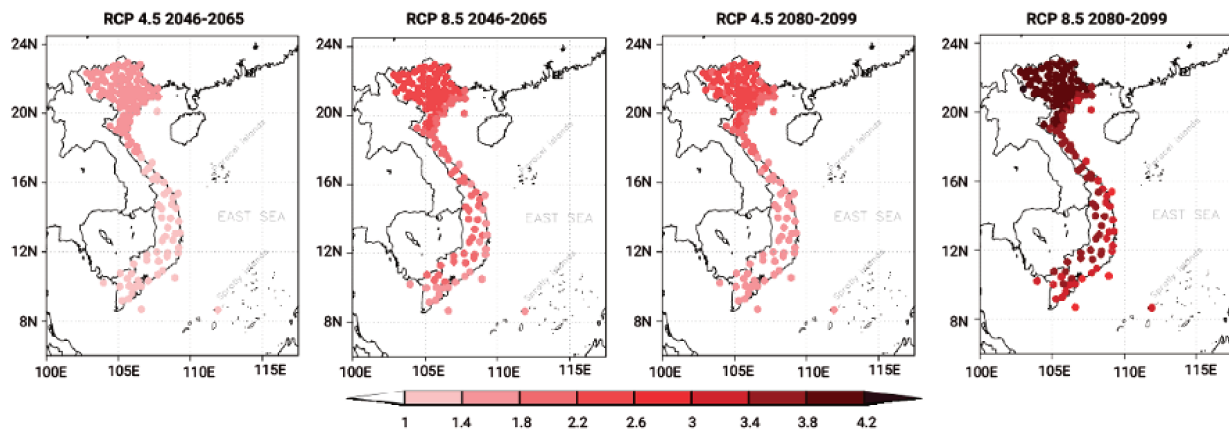
Source: *Espagne et al. (2021)*

Figure 6.2: Average daily maximum (Tx) and minimum temperature (Tn) changes for 1981–2018

According to climate change projections, increasing loss and damage are inevitable. IMHEN projection results show that the rate of temperature increase in Viet Nam is slightly lower than the global average, particularly for Representative Concentration Pathways - RCP8.5. The average temperature in Viet Nam increases by $1.13 \pm 0.87^\circ\text{C}$ under RCP2.6 and by $1.9 \pm 0.81^\circ\text{C}$ under RCP8.5 by the middle of the 21st century. At the end of the 21st century,

the temperature in Viet Nam increases by $1.34 \pm 1.14^\circ\text{C}$ under RCP2.6 and by $4.18 \pm 1.57^\circ\text{C}$ under RCP8.5. However, projected temperature changes in the North, from Northeast to North Central, are higher than those in the South, from Central Highland to Southern Viet Nam.

Annual daily maximum temperature T_x and annual daily minimum temperature T_n are also projected to increase under RCP4.5 and RCP8.5, but the increase is higher in RCP8.5 than in RCP4.5 (Figure 6.3). In the end-century period 2080–2099 under RCP4.5, T_x is projected to increase by 1.7–2.6°C; the North increases by 2.0–2.6°C and the South by 1.7–2.9°C. Under RCP8.5, much higher increases of 3.2–4.7°C are projected for T_x , with the highest projected increases of 4.0–4.7°C observed in the North. Annual daily minimum temperature T_n is projected, in the end-century period and under RCP4.5, to increase by 1.7–2.1°C, with widespread increases of over 2.0°C in the North. At the end of the 21st century, projected T_n generally increases by 3.3–4.1°C.



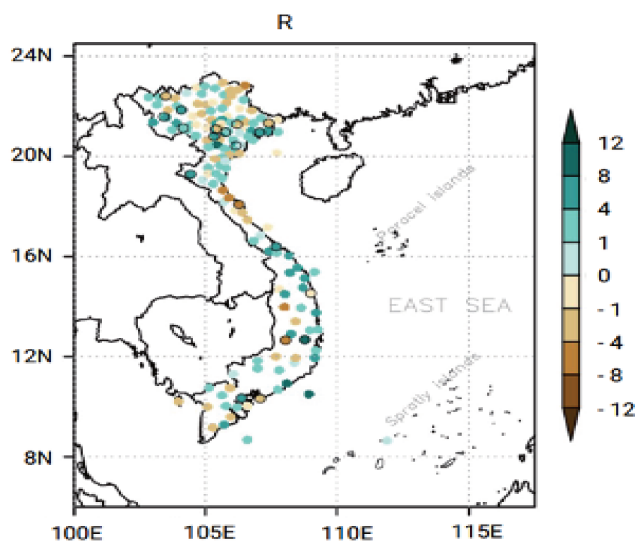
Source: *IMHEN (2021)*

Figure 6.3: Annual temperature changes under RCP4.5 and RCP8.5

Rainfall

Average annual precipitation for the whole country increased slightly by 5.5% over the period 1981–2018, albeit with regional variations (Figure 6.4). Annual precipitation declined at several stations in the North and North Central regions and increased at many stations in the Northeast, North Delta, South Central and Central Highlands. However, unlike temperatures, the rainfall trend is statistically significant at only a few stations. In recent years, heavy

rainfall has occurred abnormally in terms of time, place, frequency and intensity (IMHEN, 2021). Such rainfall has occurred not only during the normal rainy seasons but also during the usual dry ones.

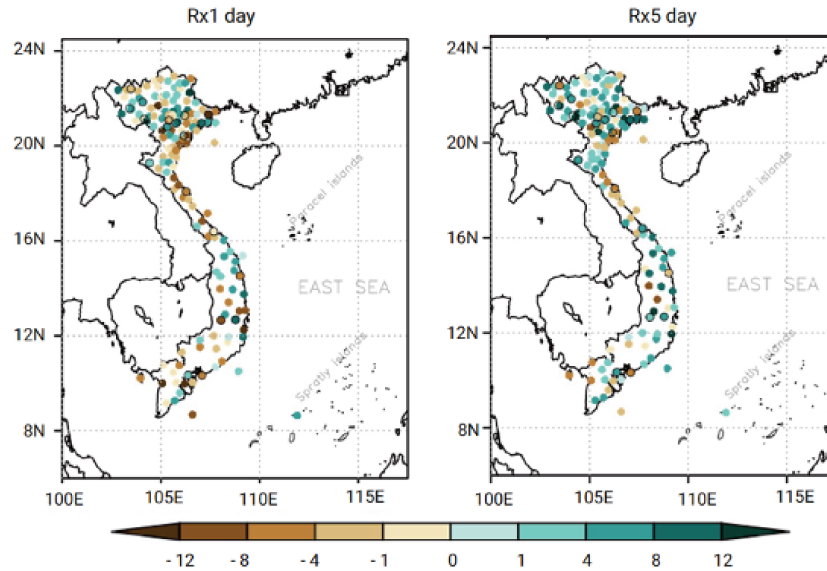


Source: Espagne et al. (2021)

Figure 6.4: Annual rainfall changes in Viet Nam for the period 1981–2018

Figure 6.5 shows the rainfall trend extremes during the observation period 1981–2018. The trend in maximum 1-day rainfall (Rx1day) was upward in the centre of the North East region, some areas of the North and the northern part of the Southern Central region, with increases of between 5 and 30% (i.e. 1.3%–7.9% per decade). In contrast, Rx1day declined in a few provinces in the coastal areas of the North Central region and most of the Southwest region. The maximum 5-day rainfall (Rx5day) increased more than Rx1day, with typical increases from 1.3 to 15.8% per decade. The highest increases were in some areas of the North and Southern Central regions, while 0.5 to 5.3% decreases in Rx5day were recorded in parts of the North East, North Central, and Southwest regions.

Future projections for rainfall usually contain more uncertainties than those for temperature (Knutti and Sedlacek, 2013; Ngo-Duc et al., 2017). One model predicts increased rainfall at a particular location, while another shows decreased rainfall. In the case of Viet Nam, the rainfall projections certainly vary according to the model, region or scenario chosen. The projected rainfall results obtained with the five dynamic downscaling experiments provided by IMHEN show an increase in annual average rainfall throughout Viet Nam under both



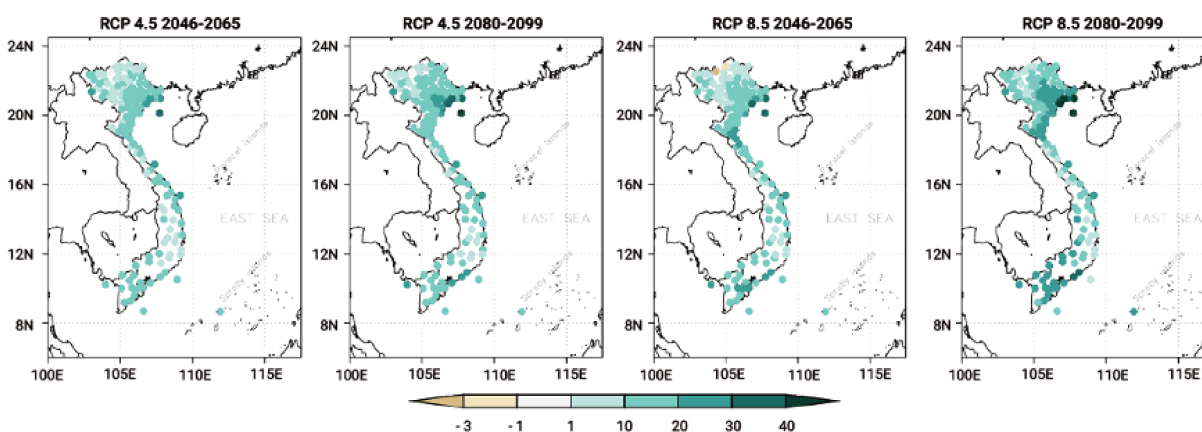
Source: Espagne et al. (2021)

Figure 6.5: Rx1day and Rx5day changes in Viet Nam for the period 1981–2018

RCP4.5 and RCP8.5. The increases for the whole country may be 10–20% by the end of the century under RCP4.5. Projected rainfall is lower in Lao Cai and Ha Giang but by a negligible amount, generally less than 5%. At the end of the century under RCP8.5, the increases are typically about 10–25% throughout Viet Nam, reaching over 40% in some parts of the Northeast region.

Changes in rainfall during the rainy and dry seasons under the two RCPs have also been considered (Figure 6.6). Rainy season precipitation increases by 10–40% by the end of the century under RCP4.5; under RCP8.5, the increases are 15–30%. Dry season precipitation is projected to increase by 10–25% by the end of the century under RCP4.5, with relatively higher increases in the coastal Northeast region and lower increases in the Central Highlands and the Northern Central region. Under RCP8.5, 5–25% rainfall increases in the dry season are projected over almost all of the country by the end of the century, except for some parts in the North Delta, southern Central Highlands and Southeast Viet Nam, where decreases of less than 5% are forecast. Annual maximum 1-day precipitation (RX-1day) and maximum 5-day consecutive precipitation (RX5day) are projected to increase throughout Viet Nam in the 21st century under RCP4.5 and RCP8.5. RX1day is generally projected to increase by 24–30% and 25–40%, respectively, under RCP4.5 and RCP8.5 by the end of the century. Projected RX5day increases by 20–30% and 25–40% by the end of the century under RCP4.5

and RCP8.5, respectively. The North Delta region has the highest increase in RX1day and RX5day by the end of the century.



Source: *IMHEN (2021)*

Figure 6.6: Annual rainfall changes under RCP4.5 and RCP8.5

Sea level rise

According to the IPCC's Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC, 2019), the global mean sea level (GMSL) rose by 0.16 m (likely range from 0.12–0.21 m) between 1902 and 2015 due to ocean thermal expansion and ice loss from glaciers and the Greenland and Antarctic ice sheets. For Viet Nam during the period 1993–2014, the trend assessment of the mean sea level at all stations shows an increase of around 3.36mm per year (Figure 6.7). However, the most important source of the relative sea-level rise in Viet Nam is the subsidence dynamic in the two major deltas, mainly local and anthropogenic. The main causes of anthropogenic subsidence are groundwater extraction and sand mining activities (Eslami et al., 2021).

According to process-based modelling studies (IPCC, 2019), the GMSL rise will continue in all climate scenarios. Up to 2050, it is argued that uncertainty in future GMSL is relatively small, with differences limited to a few centimetres between RCPs. The projections of sea level rise for Viet Nam have been updated following the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (IMHEN, 2021). Table 6.1 shows the projected sea level rise in the coastal region of Viet Nam for the different RCP scenarios compared to 1986–2005. The regional variations along the Viet Nam coastlines are limited to a few cm.



Source: *MONRE, 2016*

Figure 6.7: Changes in sea level during the period 1993-2014

However, it is worth noting that there is only medium confidence in these projections. It is currently estimated that there is a 17% chance that the global mean sea level rise will exceed 0.59 m by 2100 under RCP2.6 and 1.10 m under RCP8.5 (IPCC, 2019). According to the structured judgement of 22 glaciological and modelling experts (Bamber et al., 2019), there might even be a 5% probability of reaching the extreme forecasts.

Table 6.1: Projections of sea level rise in the coastal regions

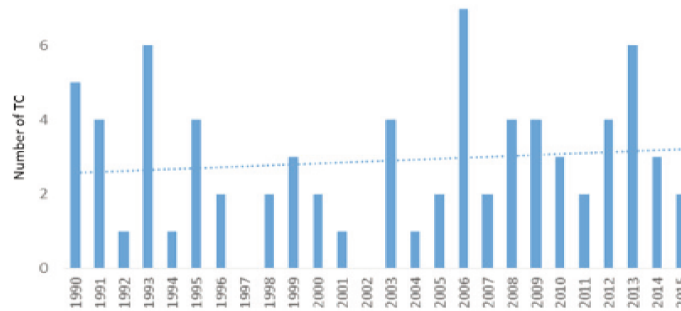
	2050	2100
RCP2.6	0.24 m (0.13÷0.32)	0.44 m (0.27÷0.66)
RCP4.5	0.23 m (0.13÷0.31)	0.53 m (0.32÷0.76)
RCP8.5	0.27 m (0.19÷0.36)	0.73 m (0.49÷1.03)

Source: *IMHEN (2021)*

Extreme events

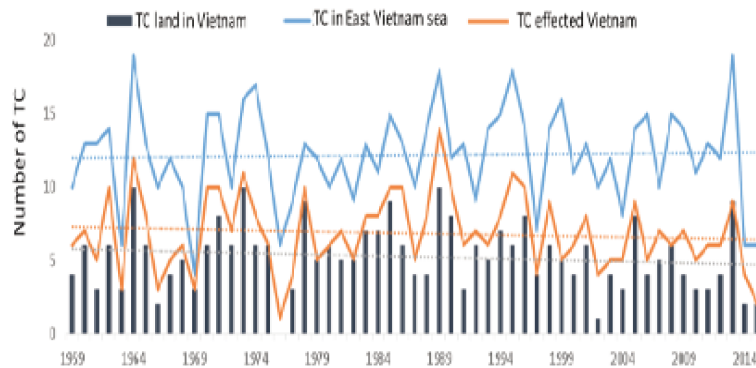
The observed trends in tropical cyclones in Viet Nam did not change significantly between 1959 and 2014 (Figure 6.8). However, the number of strong typhoons (over level 12) has increased slightly in recent years (Figure 6.9). In addition, throughout its history, Viet Nam has been constantly hit by violent climatic events, and far from being exceptional, the alternation of

droughts, floods and typhoons is Viet Nam's "normal" climatic regime due to its geographic position (intertropical and eastern coastal region of a continent). With one-minute sustained wind speeds reaching more than 64 knots, typhoons are intense storms accompanied by heavy rainfall. When they make landfall, typhoons cause flooding and trigger landslides.



Source: Nguyen et al. (2017)

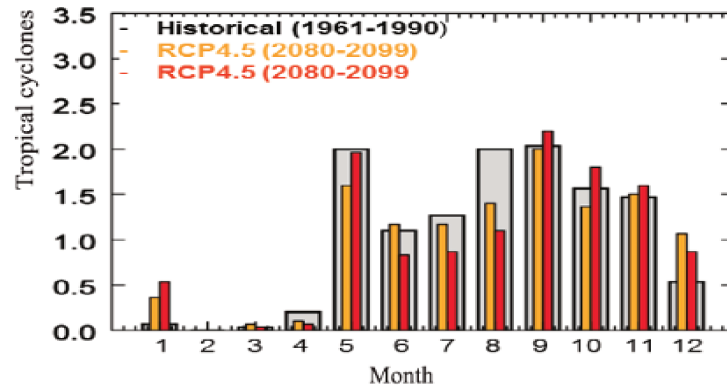
Figure 6.8: Number of tropical cyclones in the period 1959-2014



Source: Nguyen et al. (2017)

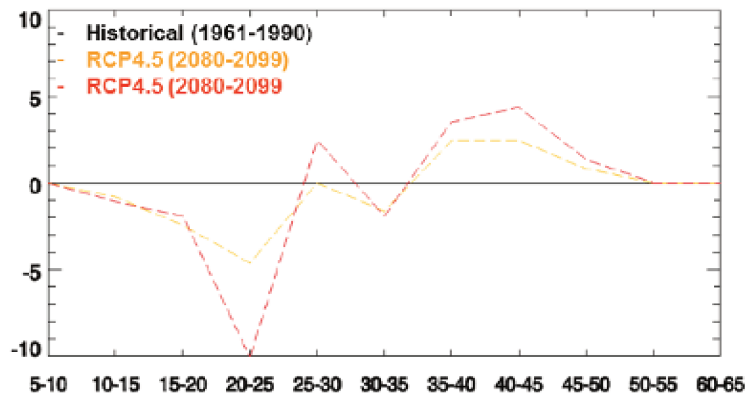
Figure 6.9: Number of typhoons over level 12 in the East Sea in the period 1990-2015

Figure 6.10 shows a downward trend for tropical cyclones in the typhoon season (June-August) under both RCP4.5 and RCP8.5 scenarios but an increase in the last typhoon season. Figure 6.11 indicates that the number of weak and normal typhoons will decrease, while the number of strong typhoons will increase significantly by the end of the 21st century.



Source: Nguyen et al. (2017)

Figure 6.10: Number of tropical cyclones at the end of the 21st century (PRECIS model)



Source: Nguyen et al. (2017)

Figure 6.11: Changes in tropical cyclones of different intensities at the end of the 21st century compared to the baseline scenario (PRECIS model)

6.2.2 Climate policy in Viet Nam

The historical and cultural evolution of the people, in particular with regard to their relation to nature, but also most obviously the socio-economic dynamics of recent decades, shape the type of concrete environmental policies that can emerge. As mentioned in Chapter 1, Viet Nam's economic development process can be divided into three main periods. The first is the 1986-1999 period associated with the Doi Moi economic reforms. The second period is from 2000 to 2009, with a rapid global integration. The last one is from 2010, with high economic

growth.

A successful structural transformation but benign neglect of environmental degradation

The major political-economic changes in Viet Nam in the 1980s and 1990s contributed to a successful structural transformation but benign neglect of environmental degradation. The Doi Moi reforms were mainly characterised by four factors: growing diversification of capital investment, land use rights as a commodity, commercialisation of the housing sector and slow changes in the planning system. Another implicit factor was the devolvement of power to local authorities. Many problems resulted from such a rapid and uncontrolled housing market and residential construction boom. The spontaneous housing boom led to chaos in urban development and drastic changes in Vietnamese cities' urban landscape. In the early days of the economic reforms, the Vietnamese government did not consider the issue of the GHG produced by wet rice agriculture, nor did it take the toxic effects of chemicals in agriculture and industrial pollution into account. For the Party, economic growth objectives took priority over environmental concerns.

This priority for rapid development did not preclude building a state environmental department. Indeed, in 1986, the Vietnamese government established a Committee for the Rational Use of Natural Resources and Environmental Protection that produced the National Conservation Strategy. The Council of Ministers Ordinance on the Transfer of Foreign Technology to Viet Nam of December 1988 also highlighted environmental protection concerns. The next important step was the Environmental Protection Law, which was approved in 1993. Viet Nam introduced a system of national pollution standards and environmental safeguards and guidelines in the mid-1990s. This framework imposed a system of environmental impact assessments for area-based land-use plans and zones. Environmental audits were conducted, and environmental management plans were imposed on existing plants. The 1993 Environmental Protection Act laid the foundations for Viet Nam's legal framework on the environment. It defined basic concepts associated with the climate and environmental protection and included specific provisions on the rights and responsibilities of organisations and individuals for environmental protection. However, the Act also revealed limitations that had to be addressed amid the country's efforts to boost industrialisation and modernisation in the frame of globalisation and world economic integration.

Climate change as a driver of Vietnam's global integration

In the 2000s, climate change could be considered a driver of Vietnam's global integration. Viet Nam ratified most international environmental framework agreements, such as the UNFCCC in 2003, the Paris Climate Agreement (COP21) in 2015, the 2030 Agenda on Sustainable Development that same year and the Nagoya Protocol on Biodiversity and, more recently, the Glasgow Climate Pact at the UN Climate Change Conference (COP26) in Glasgow. This acceleration of Viet Nam's participation in the global climate arena is concomitant to its insertion in globalisation. The achievement of WTO membership in 2006 marks a milestone in Viet Nam's integration into the world. As a result, the updated Environmental Protection Act of 2005 introduces fundamental and comprehensive amendments to adapt the country's environmental legislation to a market economy and its integration into the global economy. Other significant environmental legislation includes the 2003 Land Act, the 2004 Act on Forest Protection and Development, the 2007 Act on Chemicals, the 2008 Act on Biodiversity, the 2010 Minerals Act, the 2010 Act on Environmental Protection Tax, the 2010 Act on the Economic and Efficient Use of Energy and the 2012 Act on Water Resources.

After the Paris Agreement at COP21, the National Plan for the Implementation of this Agreement (PIPA) was approved in 2016 with adaptation, which is one of the five main components of the PIPA. The 2020 update of Viet Nam's Nationally Determined Contribution (NDC) was submitted to the Secretariat of the UNFCCC in September 2020. The updated NDC 2020 contains new policies on adaptation and response to climate change: (i) the National Adaptation Plan for the 2021–2030 period, with a vision through to 2050 (NAP) and a focus solely on adaptation; (ii) the post-2020 National Strategy on Climate Change (NSCC) and (iii) the National Action Plan to Respond to Climate Change (NAPRCC) for the 2021–2030 period. It gives ministries, sectors and localities specific directions to continue developing and implementing climate change adaptation actions in line with the socio-economic development plan.

In the past decade, the faltering “environmental state” that emerged after Doi Moi has been transformed into an all-embracing effort to envisage the potential impacts of climate change and, with the active support of the international community, to put in place adaptation strategies. Most development aid has indeed been targeted at activities and projects intended to contribute to the fulfilment of the Paris Agreement or at least to a green growth strategy. This has transformed the practices of Viet Nam's ministries and institutes without completely redirecting the country's development trajectory. Some more immediate anthropological

factors that have contributed to environmental degradation may also have been incorporated into the broad “climate adaptation” narrative in order to attract foreign investors.

Recognising that the revised Environment Protection Act of 2014 has proven too weak to tackle environmental pollution effectively, Viet Nam’s National Assembly passed a decision to revise the Act in June 2019. The new act represents the most significant modernisation of Viet Nam’s environmental law regime. The aim is to reinforce its impact and strengthen compliance with the law. Besides improved regulations and permits, better economic instruments, enhanced environmental impact assessments and improved institutional governance, one focus is on updating the chapter on climate change. Indeed, this updated environment law reflects the institutionalisation of the key national strategies of developing a low-carbon economy resilient to climate change and promoting the circular economy.

A real ecological turning point in Vietnam’s development path

As one of the countries in the world hardest hit by climate change, Viet Nam needs to make the economy grow green and do so quickly in order to protect against the risk of rising sea levels and increased extreme weather. The Green Growth Strategy was developed in order to accelerate the process of economic restructuring with the aim of making efficient use of natural resources, reducing GHG emissions through research and the application of green technologies, and developing the infrastructure in order to improve the overall economic efficiency, coping with climate change, contributing to poverty reduction and creating the momentum for sustainable economic development. The technological level of the world and Viet Nam is increasing with the fourth industrial revolution (Industry 4.0). The technology that can promote energy efficiency and enable the circular economy to be more productive through eco-innovation and technology transfer will contribute to sustainable development and the mitigation of GHG emissions. Indeed, technological advances can indirectly reduce pollution levels through the more efficient use of inputs, while filters or waste cleaning devices directly reduce pollution levels. The amounts of polluting waste from industries can drop while production increases if clean and advanced technologies induce such a rise.

In addition, the updated NDC, approved in 2020, confirms Viet Nam’s utmost commitment to cut GHG emissions – the primary cause of the earth’s rapid climate change. The target is to reduce GHG emissions by 9 per cent by 2030, 1 percentage point higher than the target set in 2015. This could be further increased to 27 per cent with international support through bilateral and multilateral cooperation and mechanisms under the Paris Agreement. This

updated NDC included not only mitigation and adaptation policies but also the impacts, advantages and challenges of NDC implementation and a plan for NDC implementation and the monitoring and evaluation of implementation. Indeed, mitigation measures are identified for the period 2021-2030 in the following sectors: energy, agriculture, waste, land use and industrial processes (IP). The possible measures in the energy sector include improving energy-saving and energy efficiency and reducing energy consumption; changing the fuel and energy structure in industry and transportation; shifting passenger and cargo transportation models; promoting the efficient exploitation of renewable energy sources; and increasing their proportion in energy production and consumption. In agriculture, reducing GHG emissions can be achieved through sustainable agricultural development: improving the effectiveness and competitiveness of agricultural production, managing and developing sustainable forests, enhancing carbon sequestration and environmental services, conserving biodiversity associated with economic development and increasing incomes for forest-dependent communities and people. Waste needs to be managed. The industrial process must replace construction materials and improve cement and chemical production. The main objectives of the adaptation component are improving adaptive capacity, enhancing resilience, and reducing the risks caused by climate change, which contributes to achieving the country's sustainable development goals. It involves strengthening state management and resources, increasing the resilience and adaptive capacity of communities, economic sectors and ecological systems and reducing disaster risks and minimising damages and preparing to cope with increased natural disasters and climate extremes due to climate change. These strategic tasks are consolidated in the National Adaptation Plan (NAP) and the National Action Plan on Climate Change.

At COP26, Viet Nam declared its commitment to achieving net zero by 2050 and phasing out coal power between 2030 and 2040. A National Steering Committee was established to direct programs, projects and prioritised tasks in response to climate change and to promote the energy transformation required to fulfil Viet Nam's commitments. The current draft of the PDP8 is expected to be significantly overhauled in order to create much more room for renewable energy and sustainable energy solutions. However, Viet Nam needs to work more on concrete strategies, plans and actions, such as reducing the use of fossil fuels (especially coal) and pushing the future development of renewable energy, green finance and the carbon market. Finance and technology will be decisive in the coming years, with international support in bilateral and multilateral collaborations crucial if Viet Nam is to reach its ambitious but essential objective.

6.3 An integrated framework to assess climate impacts

Existing studies evaluating the impacts of climate change and adaptation in Viet Nam usually focus on specific sectors or regions, as shown in the different meta-analysis and sectoral assessments in the second part of this report. Few studies seek to assess the economy-wide effect of climate change. [Arndt, Tarp, and Thurlow \(2015\)](#) evaluated climate impacts on economic growth and welfare in a dynamic computable general equilibrium (DCGE) model via three principal mechanisms: crop yields, hydropower production and regional road networks. This latest study provides insights into the potential macroeconomic effects of different climate scenarios from the previous IPCC report. [World Bank \(2022\)](#) assessed the potential economic losses associated with climate change in Viet Nam by using two complementary models. The first is the World Bank's Mitigation, Adaptation, and New Technologies Applied General Equilibrium (MANAGE) model, which aims to capture the impacts of climate change on future economic growth. The second is a probabilistic catastrophe model to estimate the economic impacts of extreme events such as typhoons.

Contrary to standard CGE models, the SFC model that we have specifically developed for the Vietnamese economy combines real side variables with financial balance sheet effects. Indeed, over the last three decades, the Vietnamese economy has been integrated into the world economy and undergone an important financialisation process. Increased integration with other countries has contributed to income growth, but it has caused an economic vulnerability in the context of rising trade tensions. The global financial crisis of 2008, the ensuing Vietnamese banking crisis of 2011, and the recent COVID-19 pandemic – all mostly macroeconomic shocks coming from the financial side – have had significant impacts in real terms as well. They have thus revealed the critical need to pay more attention to the integration of the financial sector (i.e. money, debt, and assets/liabilities) and the real economy within a single framework to gain a proper understanding of the dynamics at hand. This more coherent approach is key for any comprehensive macroeconomic analysis. It is necessary for public policies, a sound development process and macroeconomic stability in the longer term.

Our methodological approach in this paper builds on the integrated assessment approach of [Hsiang et al. \(2017\)](#), who have attempted to assess the economic cost of climate change in the US via a combination of multiple climate scenarios, quantitative meta-analysis of sectoral and social impacts based on existing studies, and integration within a macroeconomic model.

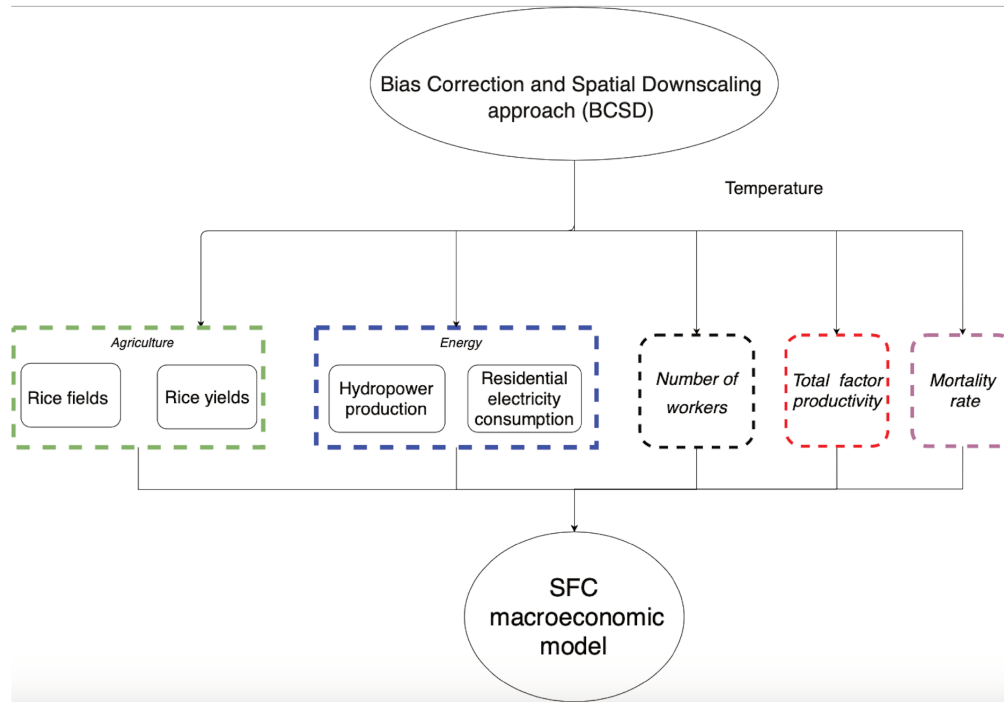


Figure 6.12: An integrated framework to assess climate change impacts

Our integrated assessment framework consists of three main steps (Figure 6.12). Firstly, we apply a monetary valuation to each sector: agriculture, energy, health, labour productivity, and total factor productivity. We use the key quantitative findings from the GEMMES Viet Nam research project of the AFD and the MONRE of Viet Nam. In the second step, we develop damage functions that represent losses in each sector as conditional on Viet Nam mean surface temperature (VNMST) change. We estimate summaries of these relationships by regressing the impact value (for all realisations) on these temperatures. Finally, we integrate the damage functions into the empirical SFC macroeconomic model of Viet Nam in order to assess the intersectoral and aggregate effects.

6.3.1 Climate damages

We include in this study several important impact channels of climate change on economic growth: agriculture, energy, labour productivity, mortality and total factor productivity (TFP). Total direct damages in each sector are valued in monetary terms, aggregated nationally, and completed with a meta-analysis of selected studies. Values are presented as a proportion of the Vietnamese GDP for all direct damage. Then, these aggregate outcomes can be

indexed against the change in average temperature in the corresponding climate realisation across the four RCPs. As such, the relative weighting of each sector follows the weighting anticipated by the Vietnamese government up to 2050 and is defined in the baseline scenario. By being expressed as a percentage change, this direct damage would scale with the economy's expansion while holding the economy's structure unchanged compared to the baseline.

Agriculture

Since the entire Vietnamese population depends on agriculture for food, and agricultural labour still accounts for a significant proportion of total labour (33% in 2020), agriculture remains one of the most important sectors. Climate change impacts the agricultural sector via direct (temperature, precipitation, sea level rise, etc.) and indirect mechanisms (water resource, saline intrusion, drought, floods, impacts on labour productivity, etc.). Despite the expected restructuring of agriculture from predominantly rice production towards higher-value products — such as coffee, rubber, fishing, etc., rice is still one of the most important crops in Viet Nam. In addition, Viet Nam is one of the largest rice exporters (top 5 rice exporting countries in 2020). In our study, agricultural yield impacts are represented as changes in rice yields. We base our analysis purely on a meta-analysis of a set of key existing studies to develop the sector-specific damage functions for agriculture, namely [Yu et al. \(2010\)](#), [Li, Wang, and Chun \(2017\)](#), [Kontgis et al. \(2019\)](#), [Deb, Tran, and Udmale \(2015\)](#), [Shrestha and Deb \(2016\)](#).

[Yu et al. \(2010\)](#) first estimate the impacts of climate change on agricultural and water systems in Viet Nam based on crop simulation, hydrological simulation, and river basin models. Then, by using a multilevel mixed-effects model, they implement a Cobb-Douglas yield function to model technology advances and policy interventions to mitigate the impact of climate change. The World Food Studies simulation model and the empirical hydro-crop model are used jointly to analyse the impacts of changes in rainfall and temperature on crop yields.

The aim of [Li, Wang, and Chun \(2017\)](#) is to assess the impact of projected climate change on rice productivity in the Indochinese Peninsula and test whether adaptive measures such as adjustment of planting dates, adoption of irrigation, and the use of heat-tolerant varieties can counter any negative climate impacts. Large-scale climate variables from the GCM HadGEM2-AO were dynamically downscaled with regional climate models, namely YSU-RSM, RegCM4, and HadGEM3-RA. The crop model chosen by the authors was the GLAM-rice

model. The paper finds that the rice yield losses due to climate change (including CO₂ gains) across all of Viet Nam are expected at 5%-10% by 2040, with similar values under both RCPs 4.5 and 8.5.

[Kontgis et al. \(2019\)](#) use management information from farmers and published information on soils collected in Can Tho, a province in the Mekong Delta. Then, with projected climate data for the RCP4.5 and RCP8.5 scenarios for the period 2040-2069, they simulate the CERES-Rice model and use the Decision Support System for Agrotechnology Transfer platform to obtain future rice paddy yields. The results show that yields decline by 5.5-8.5% annually on average for all three rice-growing seasons in Can Tho city for both emissions scenarios when CO₂ fertilisation is not considered.

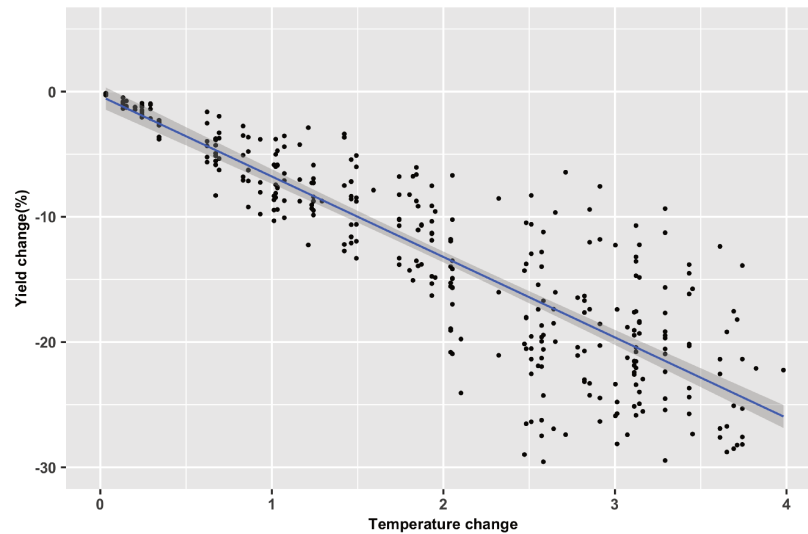
[Deb, Tran, and Udmale \(2015\)](#) investigate the impacts of climate change on rice yield. Climatic variables were derived from six general circulation models, which were further biased and corrected at Ca Mau city station for three future periods (2025s, 2055s, and 2085s). Using AquaCrop 4.0, the simulation results show that future rice yield under climate change and different salinity levels in irrigation water decline from 1.60 to 23.69 % and from 8.06 to 20.15 % by 2085s relative to baseline climate for A2 and B2 scenarios respectively in the case of the summer-autumn cropping season.

[Shrestha and Deb \(2016\)](#) investigate the impact of climate change on winter and summer rice yield using the AquaCrop model. Future climate change scenarios for the 2020s, 2050s and 2080s were projected by downscaling the outputs of the General Circulation Model (GCM), Hadley Centre Coupled Model, version 3 (HadCM3) A2 and B2 scenarios. Results show that climate change will reduce rice yield from 1.29 to 23.05 % during the winter season for both scenarios and all periods. In contrast, an increase in yield by 2.07 to 6.66 % is expected in the summer season for the 2020s and 2050s, relative to baseline yield.

We assume that a given change in rice output results in a proportional change in the value of that agricultural sector's gross output in the baseline scenario. We do not consider possible endogenous adaptation strategies at this stage and estimate an upper threshold for the corresponding damage function. However, we may also underestimate damage since non-linear tipping points of the climate system are not accounted for, even if we complete this assessment by taking sea-level rise into account in the case of rice.

We performed a meta-analysis (random effects model) of the regression results to derive an

average estimate of the change in rice yield, here as a function of temperature change and then integrated it into the macroeconomic model. With these limitations above in mind, the direct impact of climate change on rice could affect yields by up to 30% beyond a 2°C increase relative to 1997-2019 (Figure 6.13).



Average yield change over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The dark line represents the linear regression of damage values on VNMST change

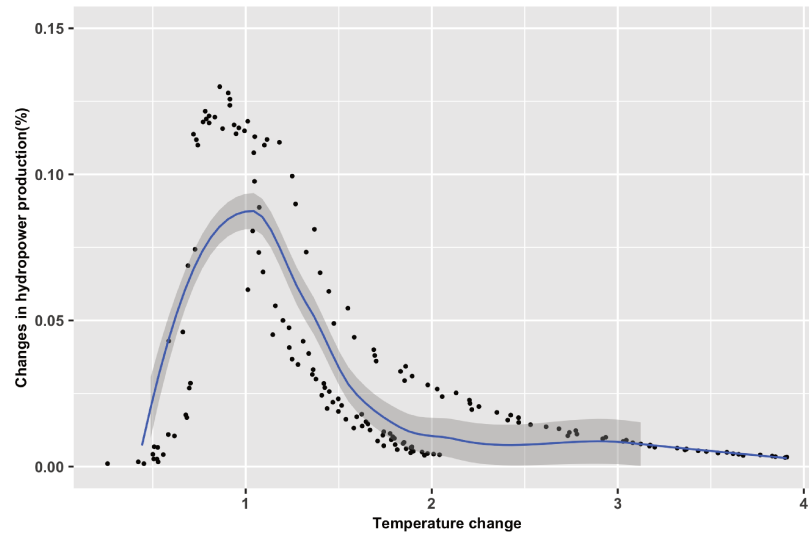
Figure 6.13: Rice damage function

Energy

The energy sector is a crucial component in any development dynamics but is affected by climate change both in terms of energy supply and demand (Auffhammer et al., 2013, Yalaw, Vliet, and al. (2020)). The direct costs and benefits of climate-driven change in energy were assessed by including the forecasted development of the Viet Nam PDP8.

On the supply side, changes in precipitation and temperature can affect energy production capacity, the transmission systems, or the infrastructure itself (World Bank, 2011, Ciscar and Dowling (2014)). Given the current dominant role of hydropower in total Vietnamese electricity production (37.7% in 2019) despite a planned reduction to 18% by 2030 and to 9% by 2045 (PDP8), we study the climate impact on hydropower production. Projections indicate that the case of hydropower is more complex, as it induces an initial surplus of production (with a maximum of 1°C increase in temperature) because of increased precipitation. Beyond

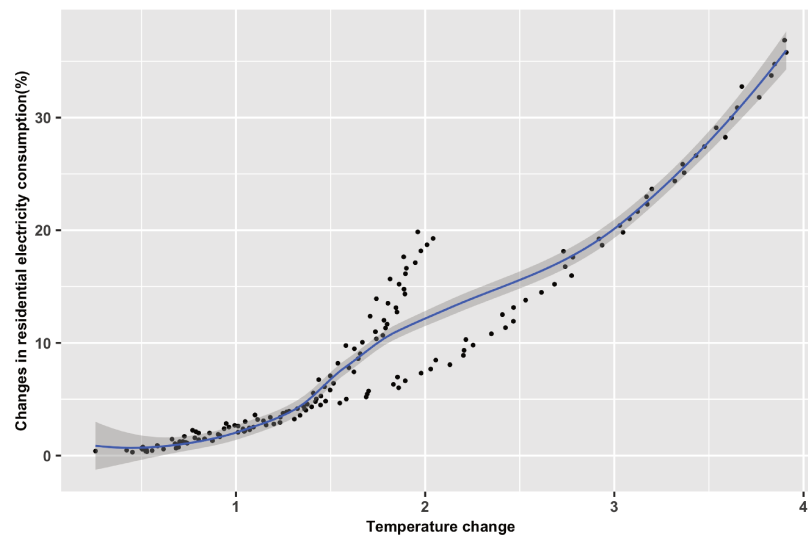
a 2°C increase, however, there is not much change compared to a baseline without further climate change (Figure 6.14).



Average yield change over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The dark line represents the linear regression of damage values on VNMST change

Figure 6.14: Hydropower production damage function

On the demand side, the rising temperature and weather extremes in recent years have strongly affected residential electricity demand (27% of total end-use consumption in 2016). The main electricity use in households is for air conditioners, refrigerators, and electric fans. The response functions are derived from the outputs of the Long-range Energy Alternatives Planning (LEAP) model in 2040 under a range of temperature scenarios. Beyond a 2°C increase, electricity demand could increase by as much as 12% and more than 20% above a 3°C increase (Figure 6.15).

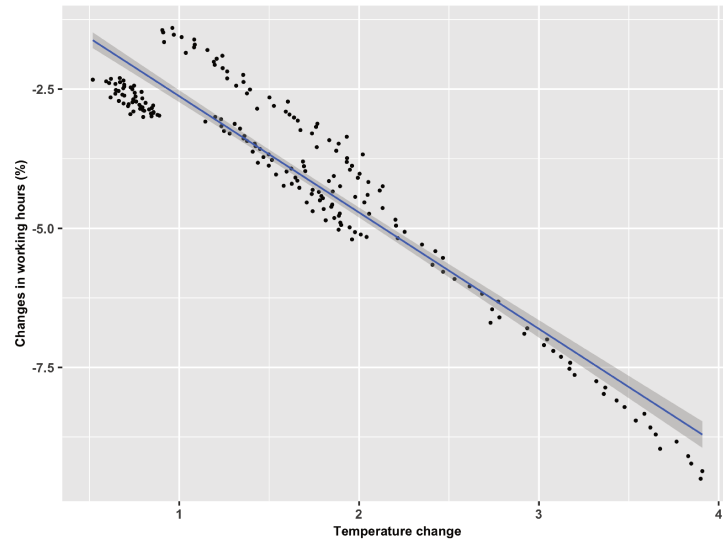


Average residential electricity demand changes over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The dark line represents the linear regression of damage values on VNMST change.

Figure 6.15: Electricity demand damage function

Labor productivity

Several studies show that heat stress can have negative impacts on human health as well as worker productivity (Orlov et al., 2020; ILO, 2019; ILO, 2016; Kjellstrom, Holmer, and Lemke, 2009). Kjellstrom and B. Lemke (2012) describe how heat stress reduces work capacity leading to lower economic output in the case of South-East Asia. Dao et al. (2013) found that in Da Nang, the temperature rise has particularly affected the working conditions of low-income outdoor workers. Opitz-Stapleton et al. (2016) demonstrates that heat stress induced by climate change will increase workers' occupational heat exposure. Kjellstrom et al. (2014) emphasise that in 2030, heat loss could represent 5.7% of Viet Nam's GDP. In our case, we consider the results of the GEMMES Viet Nam project to quantify an impact function in terms of working hours lost. A 1°C rise in temperature is associated with a decrease of 2.5% in working hours. The value of labour productivity impact is calculated by multiplying the equivalent number of workers, which is proportional to the working hours lost by GDP per worker.



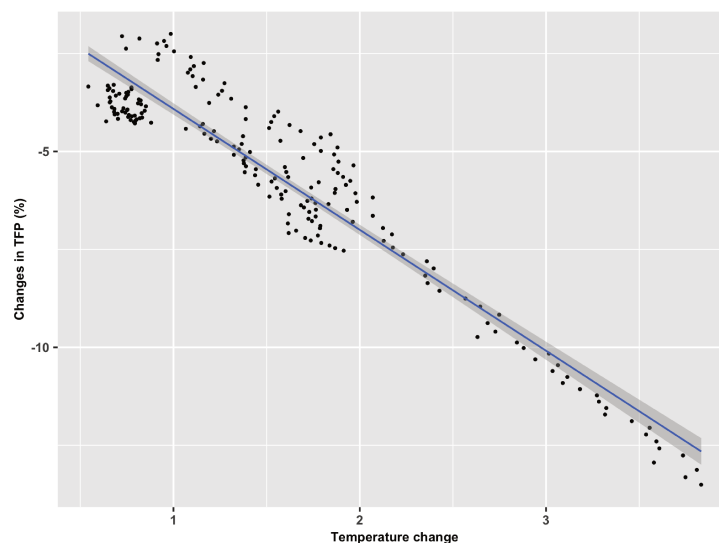
Average working hours lost over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The black line represents the linear regression of damage values on VNMST change.

Figure 6.16: Labor productivity damage function

Total factor productivity

Total factor productivity (TFP) plays an important role in long-run economic growth. In Viet Nam, according to GSO data, TFP contributed 43.5% to the national economic growth in 2018. In addition, the approved National Assembly's resolution for Viet Nam's socio-economic development indicates that the TFP is expected to contribute 45-47 % of GDP growth during the coming years. Several studies in the recent literature found a negative impact of climate change on TFP. [Letta and Tol \(2016\)](#), by using macro TFP data from the Penn World Tables, examine the relationship between annual temperature shocks and TFP growth rates in the period 1960–2006. They found only a negative relationship in poor countries but indistinguishable from zero in rich countries. [Dietz and Stern \(2015\)](#) marginally change the Dynamic Integrated model of Climate and the Economy (DICE) model of William Nordhaus and test the macroeconomic impacts when TFP is hit. [Moore and Diaz \(2015\)](#) test a modified DICE model, calibrated on [Dell, Jones, and Olken \(2012\)](#) and obtain increased impacts. Another theoretical study of [Moyer et al. \(2013\)](#) also has hypothesised a future impact of global warming on TFP growth. Chapter 6 of the GEMMES Viet Nam project's report found that an increase in temperature would reduce the TFP. Specifically, an increase in the average

temperature of 1°C leads to a 3.6 per cent decline in the TFP (Figure 6.17). The value of TFP impact is calculated through its impact on GDP growth which is then translated to the changes in GDP level.



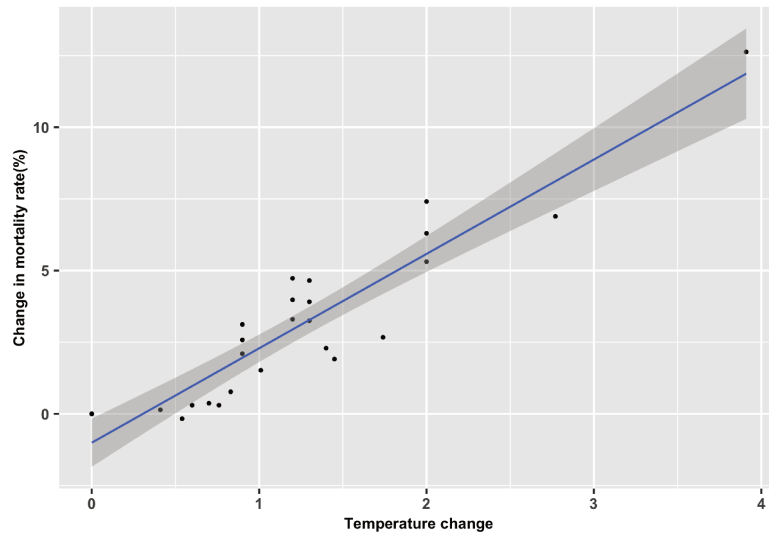
Change in TFP over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The black line represents the linear regression of damage values on VNMST change.

Figure 6.17: Total factor productivity damage function

Mortality

Most studies show negative impacts of climate change on health outcomes (e.g. physical health, mortality, infectious diseases, mental health, dietary outcomes) (Rocque et al., 2021). Regarding the effect on mortality, Gasparri (2017) investigate the projections of temperature-related excess mortality under climate change scenarios, assuming no adaptation or population changes. This study shows the negative impacts of climate change, which potentially increases mortality in most regions. Guo et al. (2018) projected excess mortality in relation to heatwaves in the future under each RCP scenario, with or without adaptation and with three population change scenarios (high variant, median variant, and low variant). They found that if there is no adaptation, heatwave-related excess mortality is expected to increase the most in tropical and subtropical countries/regions. Hales et al. (2014) shows climate change-attributable heat-related deaths by world region. They find that the relative increase in excess deaths from 2030 to 2050 is significant in some regions, including South-East Asia. In addition,

countries with high populations and pre-existing disease burdens will be more vulnerable to the health impacts of climate change. Another study by [Vicedo-Cabrera, Guo, and al. \(2018\)](#) suggests that the Paris Agreement's commitment to hold warming below 2°C could prevent an increase in temperature-related mortality. Based on these above studies, we obtain the damage function of change in mortality related to the temperature change (Figure 6.18).



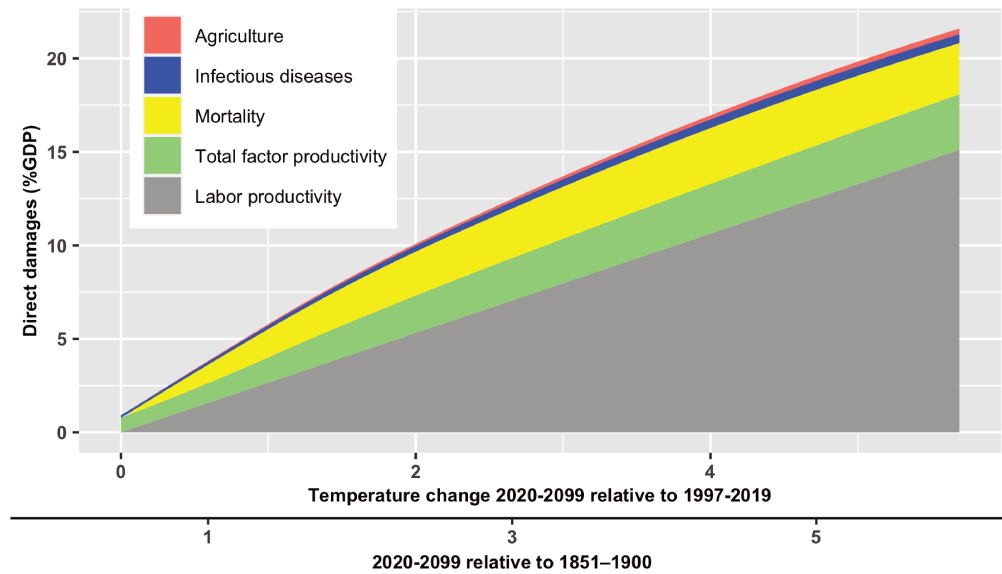
Change in mortality rate over the period 2020-2099 as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The black line represents the linear regression of damage values on VNMST change.

Figure 6.18: Mortality damage function

Several methods exist to value mortality damage in monetary terms. We do not necessarily want to make a theoretical decision about them, as this should be the policy-makers choice. As a practical solution, despite the problems on both theoretical issues of interpretation and difficult problems of measurement of the Value of Statistical Life (VSL) ([Ashenfelter, 2006](#)), we use the Value of Statistical Life from a study of [Ohno et al. \(2012\)](#) on measurement of VSL by Evaluating Diarrhoea Mortality Risk due to Water Pollution in Viet Nam. VSL has been calculated as 65,726-209,660 US\$ for Viet Nam. Concerning the impact channel in the macroeconomic model, it is possible to consider an impact on population growth, affecting aggregate demand, the labour supply and thus economic growth.

Aggregate direct damages

We get aggregate damages in different climate scenarios by summing the sectoral damage functions described above. Figure 6.19 gives us a hint of the aggregate direct damage in different RCPs, considering the uncertainty from the different climate scenarios (but not from the socio-economic side). It shows that direct damage can reach up to a 12% loss in annual GDP relative to the baseline scenario in the case of a temperature increase above 2.5°C. Remaining below a temperature increase of 1°C allows for a minimal loss of up to 6% of GDP compared to the baseline scenario.



Total direct damage to the Vietnamese economy summed across different sectors as a function of VNMST change 2020-2099 relative to 1997-2019. Dots indicate the distribution of direct damages corresponding to VNMST change in each combination of climate models and scenario projection. The black line represents the linear regression of damage values on VNMST change.

Figure 6.19: Estimates of total direct damage under RCPs

6.3.2 Integrating damage functions

We integrate the damage functions into the equations that determine agriculture production, energy production, final consumption of households, and the number of workers. It also enters into the equations related to the population growth and total factor productivity, which will affect the potential GDP (EQ.30). Annexe C contains estimated parameters used.

We define the effective agricultural production ($Q_{A_t}^*$)

$$Q_{A_t}^* = (1 - D_{AGR_t} * \gamma_{RICE}) * Q_{A_t} \quad (\text{EQ.DMG.1})$$

where γ_{RICE} is the part of rice in agriculture; Q_{A_t} is the agricultural production of baseline scenario and D_{AGR_t} is the production loss due to climate change.

The agriculture damage function is given by:

$$D_{AGR_t} = \nu_{AGR} * \Delta T \quad (\text{EQ.DMG.2})$$

where ΔT denotes the temperature change. Following the same modelling implication, [EQ.DMG.3](#) represents the effective energy production ($Q_{E_t}^*$) with climate change damage (D_{E_t}) on the hydropower production.

$$Q_{E_t}^* = (1 + D_{E_t} * \gamma_{HP}) * Q_{E_t} \quad (\text{EQ.DMG.3})$$

where γ_{HP} is the part of hydropower on the energy sector; Q_{E_t} is energy production of baseline scenario.

$$D_{E_t} = \nu_{HPP} * \Delta T + \nu_{HPP}^2 * \Delta T^2 \quad (\text{EQ.DMG.4})$$

Regarding the damage to energy demand, the effective final consumption depends on the part of electricity consumption in the total consumption (γ_{RE}) and the climate impact (D_{RE_t}).

$$C_t^* = (1 + D_{RE_t} * \gamma_{RE}) * C_t \quad (\text{EQ.DMG.5})$$

[EQ.DMG.6](#) is the damage function which shows how the temperature change affects the residential electricity consumption of households.

$$D_{RE_t} = \nu_{RE} * \Delta T \quad (\text{EQ.DMG.6})$$

We assume that climate damage affects labour productivity through the number of workers ([EQ.DMG.7](#)). There is a positive impact from both the demand and supply side on the number of workers. The higher level of economic activity, the higher demand for workers. The number of employed individuals depends on the size of the active population considered as the labour supply.

$$\ln(NBW_t) = [\lambda_0 + \lambda_1 * \ln(y_{t-1}) + \lambda_2 * \ln(pop_{ACTIV_t})] * (1 - D_{L_t}) \quad (\text{EQ.DMG.7})$$

We define the labour productivity loss due to climate change as follows:

$$D_{L_t} = \nu_L * \Delta T \quad (\text{EQ.DMG.8})$$

The climate impact on the mortality rate equation is represented as:

$$MORT_{GR_t}^* = (1 + D_{M_t}) * MORT_{GR_t} \quad (\text{EQ.DMG.9})$$

where $MORT_{GR_t}$ is the mortality rate of the baseline scenario and D_{M_t} is the mortality damage which is a function of temperature change.

$$D_{M_t} = \nu_M * \Delta T \quad (\text{EQ.DMG.10})$$

The equation that determines the total factor productivity is equal to:

$$TFP_t^* = (1 - D_{TFP_t}) * TFP_t \quad (\text{EQ.DMG.11})$$

where TFP_t denotes the TFP of baseline scenario and D_{TFP_t} is the damage function on TFP

$$D_{TFP_t} = \nu_{TFP} * \Delta T \quad (\text{EQ.DMG.12})$$

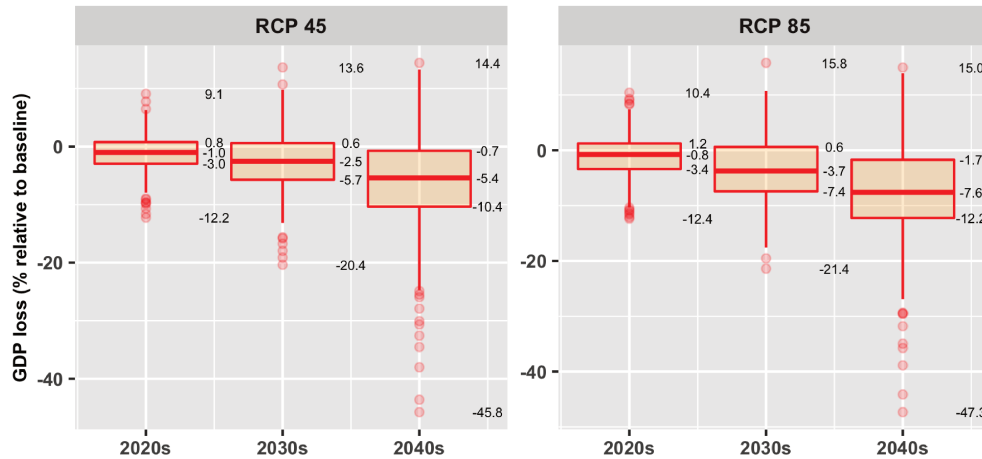
6.3.3 Simulation

To simulate different climate change and adaptation scenarios, we create a baseline scenario broadly aligned with current Vietnamese greener industrialisation and modernisation strategies and the socio-economic development trends of Viet Nam and the world.

Climate change impacts are simulated by adding the damage functions. The baseline scenario is the scenario in which climate change impacts are ignored, and the alternative scenario is that in which climate change impacts are simulated.

Regarding the climate scenarios, low, intermediate, high and very high GHG emissions scenarios (RCP2.6, RCP4.5, RCP6.0 and RCP8.5, respectively). A common set of reference years and periods are adopted for assessing climate change impacts: the reference period 1980-2019, the period 1850-1900, which approximates pre-industrial global surface temperature, and the future reference period covers the period 2020-2050. The annual temperature changes are the difference between the projected temperature of the future reference period and the reference period 1980-2019.

Figure 6.20 shows the damages within the macroeconomic model by decade (the 2020s, 2030s, 2040s) in the simulation where all sectoral damages (agriculture, energy, labour productivity, total factor productivity, mortality) are integrated simultaneously. By the 2040s, averaged losses ranged between 0.7 and 10.4 % under RCP 4.5 and between 1.7 and 12.2 % under RCP 8.5.



Boxes = interquartile range (25th (Q1) and 75th (Q3) percentile); Black line = median value; Dots = outliers (maximum = $Q3 + 1.5 \times \text{interquartile range (IQR)}$; minimum = $Q1 - 1.5 \times \text{interquartile range (IQR)}$). Damage functions (agriculture, energy, labour productivity, total factor productivity, mortality) are considered.

Figure 6.20: Macroeconomic damage (Real GDP loss relative to baseline scenario)

Then, we consider the climate impacts when the global warming levels (GWLs) of 1.5°C and 2°C are reached for RCP8.5 in 2023 and 2039, respectively (Figure 6.21). The top graph shows the distribution of 1.5°C, 2°C and 3°C VNMST change in RCP8.5 according to the different climate models. The bottom graph represents the average macroeconomic damage relative to the baseline scenario up to 2050 in RCP8.5. The vertical green line indicates the median date when the GWL 1.5°C is reached. The red line indicates the median date when the GWL 2°C is reached. The GWL 3°C threshold median date appears after 2050, but there is still an increasing probability of crossing it between 2040 and 2050.

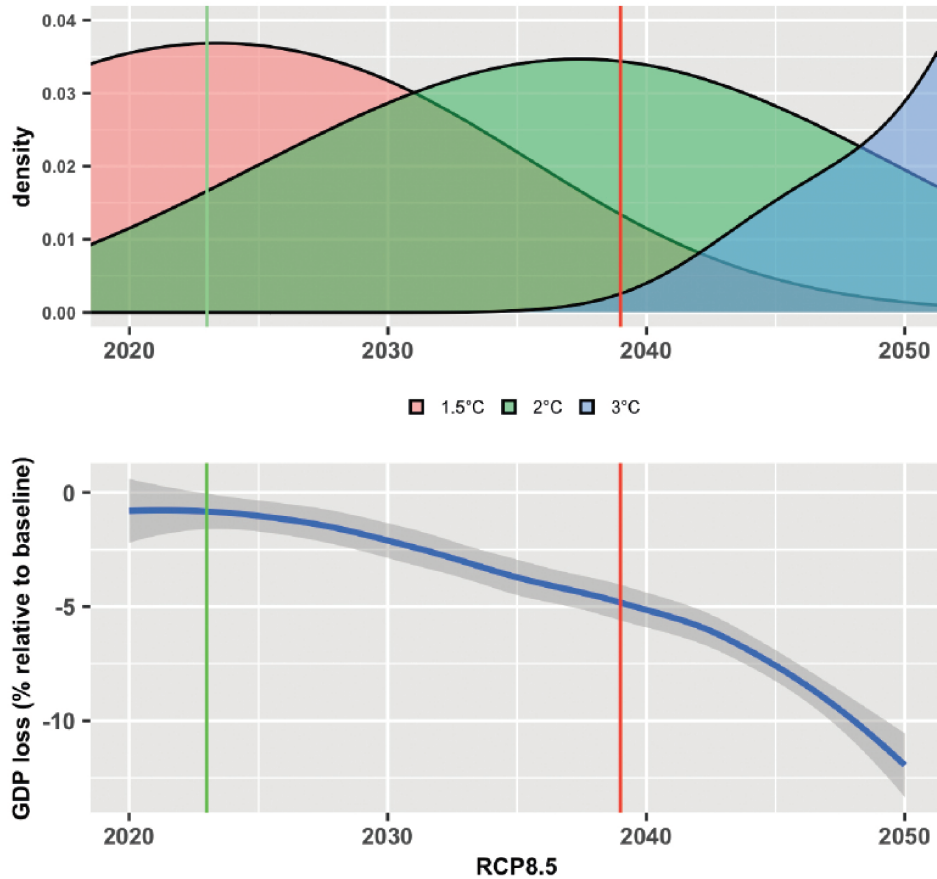


Figure 6.21: Macroeconomic damage when the GWLs 1.5°C and 2°C are reached for RCP8.5

We also compare macroeconomic adjusted losses with direct damage losses. Figure 6.22 shows that the direct damages of one sector in the macroeconomic model can be larger or smaller than the corresponding direct damages valuation, depending on the sector. The case of mortality is much smaller in the macroeconomic model due to the way of valuation of mortality by using VSL. In the case of TFP, the macro impact is much larger due to the role of TFP in the model, which contributes to the production and investment decisions. Overall, the macroeconomic impacts are larger than direct damages by around 30%.

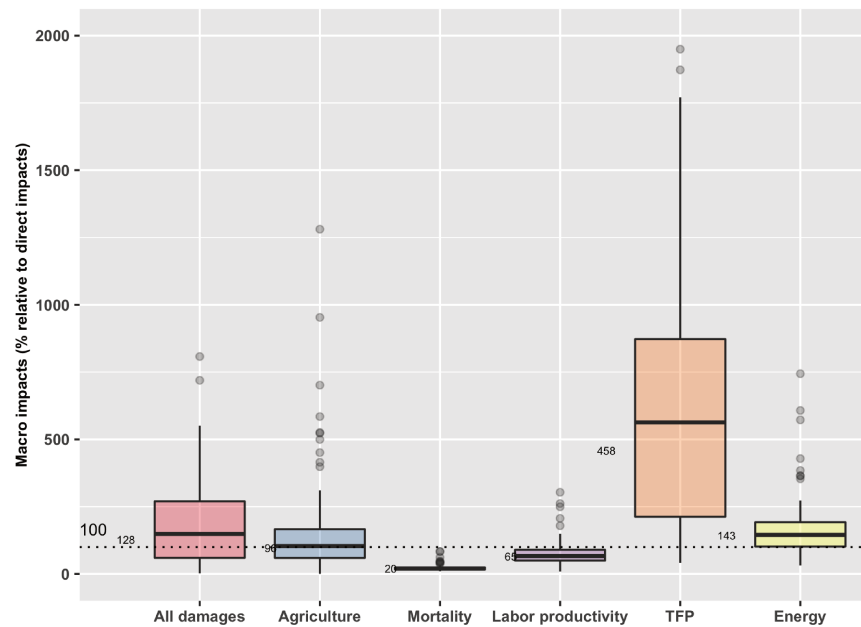


Figure 6.22: Distributions of GDP loss in the macroeconomic model compared with direct damages.

So far, our integrated framework allows us to integrate the climate change impacts on agriculture, energy, labour productivity, total factor productivity and mortality rate. This estimate will certainly not be the last, as multiple known sectors of the Vietnamese economy for which no suitable studies exist have been omitted from the analysis so far. We could mention the impacts of climate change on tourism, forestry management, aquaculture and fisheries, the informal sector, and biodiversity losses, to name a few. Our approach, therefore, allows for updates based on new econometric/sectoral modelling results, climate model projections, and incorporating adaptation. Therefore, in the next section, we will try integrating adaptation into our framework and update the climate scenario following the latest IPCC report - the IPCC Sixth Assessment Report. The main objective is to analyse not only the economic impacts of climate change but also adaptation measures in the context of a greener industrialisation process for Viet Nam.

6.4 Adaptation and net zero strategy

6.4.1 Adaptation strategy

As mentioned above, climate change and its impacts are projected to intensify in Viet Nam urging Viet Nam to pay more attention to climate change adaptation strategy. Different official documents are dedicated to climate change adaptation, such as NSCC, NAPRCC and Law on Environmental Protection 2020. Climate change responses are mainstreamed in the national strategy to ensure that they align with the country's socio-economic and sustainable development plans. Especially, Viet Nam has adopted the National Adaptation Plan (NAP), representing a comprehensive and specific framework at the national level for planning, designing, and implementing climate adaptation measures. Adaptation investments are classified into three categories corresponding to three main adaptation targets, including (i) strengthening resilience and enhancing adaptive capacity; (ii) mitigating risk and damage from climate change-related disasters and enhancing preparedness to respond to extreme weather and natural disasters; and (iii) strengthening national adaptive capacity through institutional improvement, capacity-building, securing resources, promoting international cooperation, and implementing international obligations. The NAP provides direction towards an effective and efficient allocation of resources, financial and technical management, and cross-sectoral and multilevel coordination. Following national adaptation policies, ministries and provincial authorities will develop their adaptation policies. Regarding budget, adaptation costs are mainstreaming in national budgets, and Viet Nam was the first to prepare Climate Change Public Expenditure and Institutional Reviews (CPEIRs) among Asian countries.

The priority sectors for adaptation include agriculture, transport, infrastructure and urbanisation, natural resources, industry and trade, public health, and tourism. These sectors are also the most affected by climate change. Financial help for implementation shall be mobilised through different channels, including the state budget (central and local budgets), international funding, the private sector, and community contributions. One of the key components of adaptation policies is investing in infrastructure resilience. Still, it is also the costliest (GCA 2018a), which leads to a crucial question of the source of financing. IMF (2021) distinguish three types of adaptation investment: (i) upgrading new projects to foster the resilience of capital stock against climate hazards over time, (ii) retrofitting existing assets which aims to modify existing capital stock exposed to natural hazards to improve resilience,

and (iii) developing coastal protection infrastructure such as dikes and storm surge barriers (Rozenberg and Fay, 2019). Both public and private sectors can implement these adaptation investments, and it will raise their financing needs. However, it is also known that the different types of infrastructure have different socio-economic impacts.

6.4.2 Integrating adaptation investment

Analysing the effects of adaptation with model-based simulations is still new in the literature. We based on two main references related to the adaptation investment. The first one is the working paper of the World Bank named Climate modelling for macroeconomic policy: A case study for Pakistan (World Bank, 2022). The article describes the changes made to the World Bank's standard macro-structural model, MFMod, in integrated climate outcomes, climate policies, and the economic impacts of climate on Pakistan's economy. PAKMod represents the mechanism of the effects of adaptation investment to reduce the damages from climate events. The costs of adaptation investments will be assumed to be recorded in a budget tagging exercise. They do not consider private-sector adaptation. The effectiveness of adaptation is represented via a protection function. The approach here follows that of De Bruin, Dellink, and Tol (2009) and De Cian et al. (2016). Adaptation investment is an adaptation in the capital that does not have productive use. Adaptation capital works only to reduce damages. PAKMod considers adaptation public investment.

The second study is the International Monetary Fund paper on the fiscal policies to address climate change in Asia and the Pacific (IMF, 2021). They analyse how Asia and the Pacific adapt to climate change and the fiscal costs of adaptation measures. To assess the implications of adaptation investment, they consider an annual increase in public investment of 2 per cent of GDP and compare it with the baseline scenario of no additional investment. They analyse the effect of public investment efficiency, calibrated at 60 per cent in the baseline, and 30 and 90 per cent in low- and high-investment efficiency scenarios, respectively.

To sum up, the economy-wide effects of adaptation investments depend mainly on the extent of the investments (their protection level) and how they are financed. Following Lecocq and Shalizi (2007), De Bruin, Dellink, and Tol (2009), Bosello, Carraro, and Cian (2010), Millner and Dietz (2015), and World Bank (2021), adaptation is produced via an adaptation capital stock. This adaptation capital stock is the accumulation of adaptation investment and depreciates at the same rate as productive capital.

According to the Intergovernmental Panel on Climate Change (IPCC), adaptation seeks to moderate or avoid harm or exploit beneficial opportunities in human systems. Different entities may have appropriate adaptation strategies to deal with climate change. However, the national adaptation policies also define essential principles that need to be applied, such as: using an integrated and systems-based approach; taking into account uncertainties; applying proactive strategies; addressing vulnerability and risk; mainstream adaptation into development planning and policies; actively mobilise and engage all relevant stakeholders; to promote multi-benefit actions, soft measures, and ecosystem-based and community-based adaptation measures; and to develop and implement a monitoring and evaluation system for climate change adaptation. These principles indicate the high quality of adaptation policies, which aim to promote integrated, holistic, and inclusive approaches and account for the interrelationships between sectors and regions, short-term and long-term actions, and climate change uncertainties. Therefore, in our model, we consider both private and public adaptation investments. We suppose that each sector will decide its adaptation level considering the expected damage.

Suppose that firms and households anticipate the direct damage to their activity sector, and the government will anticipate the damage to the whole economy. Given that productive investment is forgone to pay for adaptation investment, the productive capital stock and, therefore, the potential supply of the economy will suffer. These effects are important drivers of the results in our model simulations. Thus, the level of adaptation investment of firms will depend on the opportunity cost of the money spent on the productive investments represented by the profit reduction related to this amount of investment and the effectiveness of different levels of protection. The reduction of profit related to the adaptation investment amount will be proportional to the profit generated by the productive investment. However, given that the investment decision in adaptation can impact the productive investment of firms, firms have to dedicate a part of their total investment to adaptation, and the residual will go to productive investment. The same convention is applied to households. The public adaptation investments could make the economy more resilient to climate events and the damaging effects (lower productivity) of higher temperatures ([World Bank, 2021](#)). The government will decide the level of adaptation investment only by considering their effectiveness in reducing the damages from climate change.

The effectiveness of adaptation is represented via a protection function ([De Bruin, Dellink,](#)

and Tol, 2009 and De Cian et al. (2016)) which determines the residual damages and depends on the stock of adaptation capital and the temperature changes. Firstly, we assume a declining marginal increase in protection in line with the literature (De Bruin, Dellink, and Tol, 2009, World Bank, 2021). Secondly, the more global warming is, the less adaptation space we have. Therefore, the protection function is a negative function of global warming (increase in temperature). Assuming that the protection function is homogenous for all sectoral damages, the residual damage is equal to the product of gross damage and the level of protection.

Even if the adaptation is not considered a productive capital, the adaptation investment will still be considered in calculating GDP, firms and government expenses. Consequently, the economy-wide effects of adaptation investments depend strongly on how each sector finances its adaptation investments. It will affect their debt structure and, thus, imply important macro-financial impacts on the economy.

Regarding modelling implications, we suppose that adaptation investment (i^A) is implemented by different institutional sectors in the economy, including government, firms and households.

$$i^A = i_f^A + i_h^A + i_g^A \quad (\text{EQ.AD.1})$$

Thus, the accumulated stock of adaptation capital with the depreciation rate of each capital's sector (public and private) is given by:

$$k_f^A = (1 - \delta_{K_{t-1}}^f) * k_{f_{t-1}}^A + i_f^A \quad (\text{EQ.AD.2})$$

$$k_h^A = (1 - \delta_{K_{t-1}}^h) * k_{h_{t-1}}^A + i_h^A \quad (\text{EQ.AD.3})$$

$$k_g^A = (1 - \delta_{K_{t-1}}^g) * k_{g_{t-1}}^A + i_g^A \quad (\text{EQ.AD.4})$$

The total adaptation capital is:

$$k^A = k_f^A + k_h^A + k_g^A \quad (\text{EQ.AD.5})$$

This adaptation investment has to be taken into account within the accounting framework. The GDP is calculated as follows:

$$y_t = c_t + g_t + i_t^f + i_t^g + i_t^h + i_{12t} + x_t - im_t + i_t^A \quad (\text{EQ.AD.6})$$

Net financing capacity of firms

$$NFC_t^f = S_t^f - i_t^f p_{K_t} - i_{12t}^f p_{K_{12t}} - i_{f_t}^A p_{K_t} \quad (\text{EQ.AD.7})$$

Net financing capacity of households

$$NFC_t^h = S_t^h - i_t^h p_{K_t} - i_{h_t}^A p_{K_t} \quad (\text{EQ.AD.8})$$

Net financing capacity of government

$$NFC_t^g = S_t^g - i_t^g p_{K_t} - i_{g_t}^A p_{K_t} \quad (\text{EQ.AD.9})$$

Adaptation decision

Each sector decides its adaptation level, considering the expected gross damage. Suppose that firms and households anticipate the direct damage to their activity sector, and the government will anticipate the damage to the whole economy.

The level of adaptation investment of firms (i_f^A) will depend on the opportunity cost of the money spent on the productive investments represented by the profit reduction related to this amount of investment and the effectiveness of adaptation investment represented by the expected residual damages.

$$i_f^A = \alpha_1 * (1 - p) * GD_f^e + (1 - \alpha_1) * \left(\frac{k_{f_{t-1}}^A}{k_{t-1}} * \frac{F_{t-1}^f}{k_{t-2}} \right) \quad (\text{EQ.AD.10})$$

where α_1 represents the preference parameter ($0 < \alpha_1 < 1$). If $\alpha_1 = 1$, firms will invest in reducing all anticipated damage. The profit reduction related to the adaptation investment amount will be proportional to the profit generated by the productive investment.

where p denotes the protection function.

However, suppose that the investment decision in adaptation can impact the productive investment of firms. It means that firms have to dedicate a part of their total investment to adaptation, and the residual will go to productive investment. Total desired investment is defined by the following:

$$i_f^e = f(\text{profit rate, interest rate, capacity utilisation rate, financial profitability})$$

Realised productive investment is given by:

$$i^f = i_f^e - i_f^A \quad (\text{EQ.AD.11})$$

The same convention holds for households.

Government

Expected gross Damage (GD^e) on the whole economy depends on the economic growth rate (g) and temperature change (ΔT). Thus, the level of adaptation investment of the government is given by:

$$i_g^A = (1 - p) * GD_g^e \quad (\text{EQ.AD.12})$$

We assume a declining marginal increase in protection in line with the literature (de Bruin, Dellink, and Tol 2009, World Bank 2021). The protection function is defined by the level of total adaptation capital k^A .

$$p = \frac{1 - \gamma_T * \Delta T}{1 + e^{-k_{t-1}^A}} \quad (\text{EQ.AD.13})$$

where γ_T represents that the higher ΔT , the more difficult it is to adapt and protect.

Assume that the protection function is homogenous for all damages \rightarrow residual damage (RD_j)

$$RD_j = (1 - p) * GD_j \quad (6.170)$$

where j denotes agriculture, energy, labour productivity, mortality, and TFP.

6.4.3 Simulation

As mentioned above, we aim to analyse the adaptation measures in the context of a greener industrialisation process for Viet Nam. Net-zero emissions require profound structural change and will demand substantial new investments in green technologies, sustainable infrastructure and increased resource productivity. Thus, it will raise the financing needs of the economy. A green industrial policy is represented in our model by a decreasing import proportion of intermediate consumption. It means that a green industrial policy is supposed to help substitute for green product inputs combined with different options of financing (private, public or PPP investments). The investment size is taken from the preliminary technical report of the updated National Climate Change Strategy of MONRE, mentioning plans to achieve net-zero emissions. This preliminary technical report suggests three plans to achieve net-zero emissions. - Option 1 uses the TIMES model (optimising the simulation calculation system - the environment with the lowest cost). - Option 2 uses the TIMES model combined with the LEAP model (a long-term alternative quantitative planning model system). The

main difference between Option 1 and Option 2 is that the proportion of renewable energy in 2050 in Option 1 (73%) is higher than in Option 2 (48.5%), in which the proportion of electricity Fixed solar energy in Option 1 is about 4-5 times higher than that of Option 2. Option 2 has a higher proportion of fossil energy than Option 1, so prevention and landfilling measures must be applied. - Option 3 is Option 2 but with partially replaced electricity, applied for the period after 2035 when the level of safety and cost is appropriate.

Climate change impacts are simulated by adding the damage functions, and adaptation measures will be reflected by imposing changes in model parameters. The model simulation will generate a baseline scenario, in which climate change impacts are ignored with no adaptation, and alternative scenarios, in which climate change impacts are simulated and adaptation measures are taken into account.

Regarding the climate scenarios, according to the IPCC report released in 2022, low, intermediate, high and very high GHG emissions scenarios are considered in this section (SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5, respectively). Under the four illustrative scenarios, in the near term (2021–2040), the 1.5°C global warming level is very likely to be exceeded under the very high GHG emissions scenario (SSP5-8.5), likely to be exceeded under the intermediate and high GHG emissions scenarios (SSP2-4.5 and SSP3-7.0), more likely than not to be exceeded under the low GHG emissions scenario (SSP1-2.6).

A common set of reference years and periods are adopted for assessing climate change impacts and potential impacts of adaptation measures: the reference period 1980-2019 and the period 1850–1900 approximates pre-industrial global surface temperature, and the future reference period covers the period 2020-2050. The annual temperature changes are the difference between the projected temperature of the future reference period and the reference period 1980-2019.

6.5 Viet Nam's development and climate change

6.5.1 Economic impacts

The model was run with four damage functions on agriculture, energy, labour productivity and mortality rate and against four climate scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5). Considering the uncertainty from the different climate scenarios (but not from

the socio-economic side), we considered the climate impacts when the global warming levels (GWLs) of 1.5°C, 2°C, and 3°C are reached for SSP5-8.5 in 2029, 2036 and 2047, respectively. The macroeconomic damage can reach up to a loss of 8% in annual GDP relative to the baseline scenario under SSP5-8.5 (Figure 6.23).

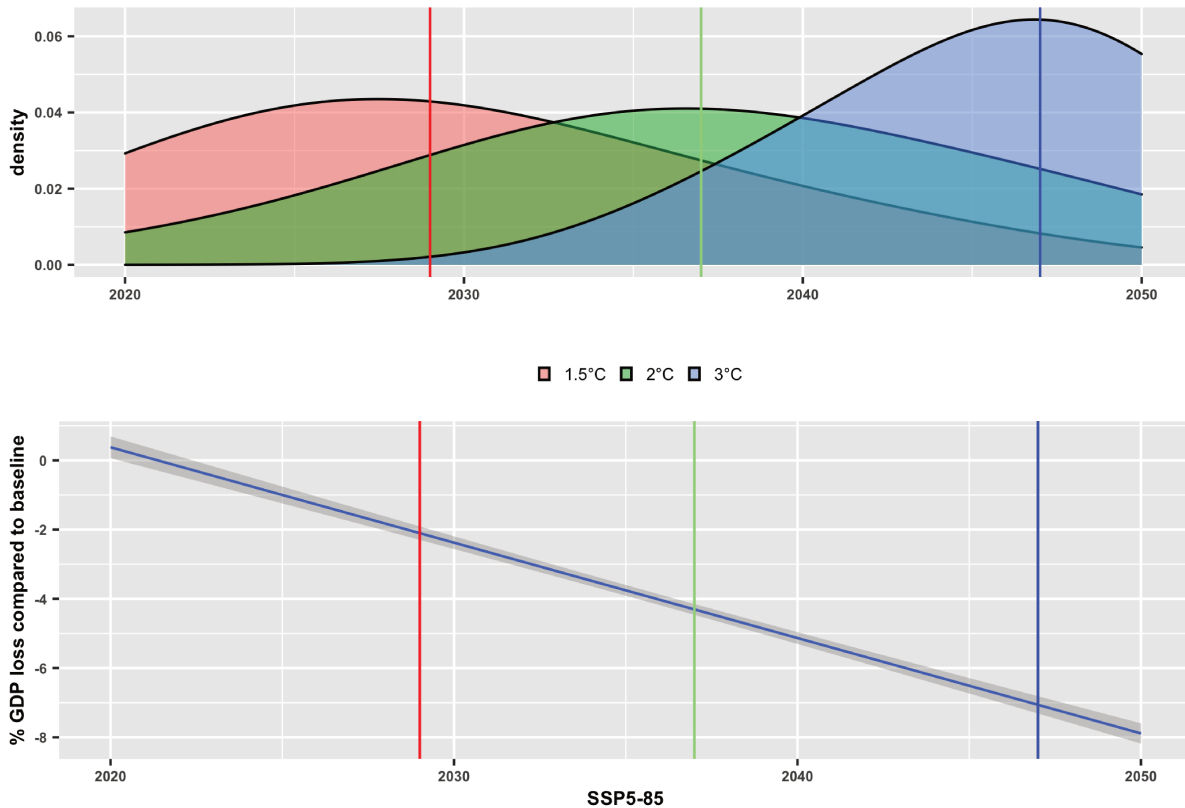


Figure 6.23: Without adaptation - Impacts on Real Gross Domestic Product

Temperature changes adversely affect the government budget and increase public debt (Giovanis and Ozdamar, 2022). Figure 6.24 shows the impacts of temperature changes on the public debt over time. The average temperature can increase debt up to 3.7% annually in 2040–2050 under the assumption of a medium GHG emission scenario (SSP2-4.5) and up to 4.5% under the high GHG emission scenario (SSP5-8.5). The public financing need without adaptation measures can be explained by the loss in economic activity due to the climate change, which can lead to a loss in government revenues.

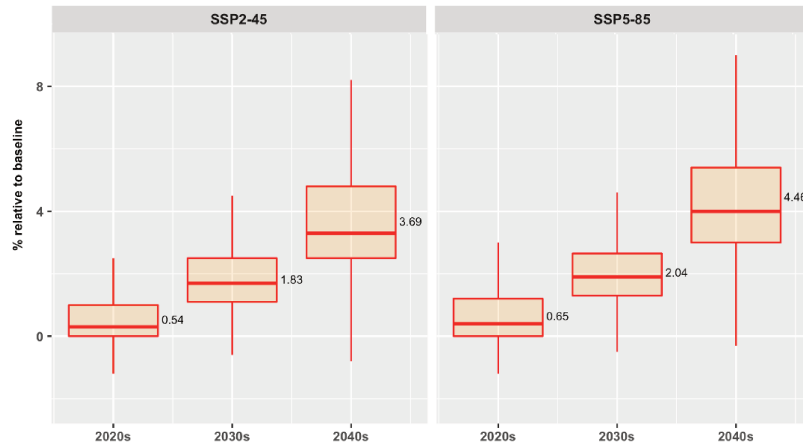


Figure 6.24: Without adaptation - Impacts on public debt

6.5.2 National adaptation

The loss will be smaller with adaptation compared to the scenarios without adaptation investment. The higher the adaptation investment efficiency, the more output resilience improves. However, adaptation investment seems to be effective when the temperature changes remain below a certain threshold. The more global warming, the more challenging it is to adapt. In both cases, without and with adaptation, the impacts will be higher in higher GHG emissions scenarios. Adaptation cannot replace mitigation. Mitigation efforts will contribute to stabilising global temperature; then adaptation would become not too expensive. Figure 6.25 shows that remaining below a temperature increase of 2°C allows for a smaller loss of 2% of GDP on average compared to the scenario without adaptation.

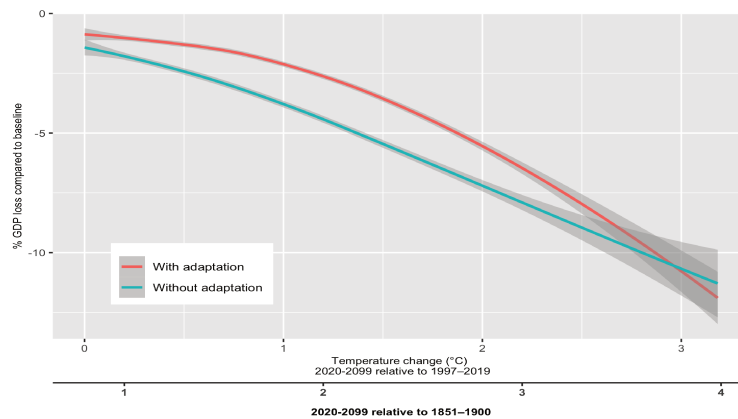


Figure 6.25: With adaptation - Impacts on Real Gross Domestic Product

Adaptation can also be macrocritical because financial needs may be substantial given the context of financial constraints and, thus, raise the question about public debt sustainability. The public debt increases in general (Figure 6.26). The increase in public adaptation investment implies a higher public debt. Especially the higher increase in temperature will reduce the level of efficiency of adaptation investment. Therefore, the public debt strongly increases over time with the temperature change. It implies that the adaptation decision has to take into account the budget constraints to obtain more efficient adaptation options.

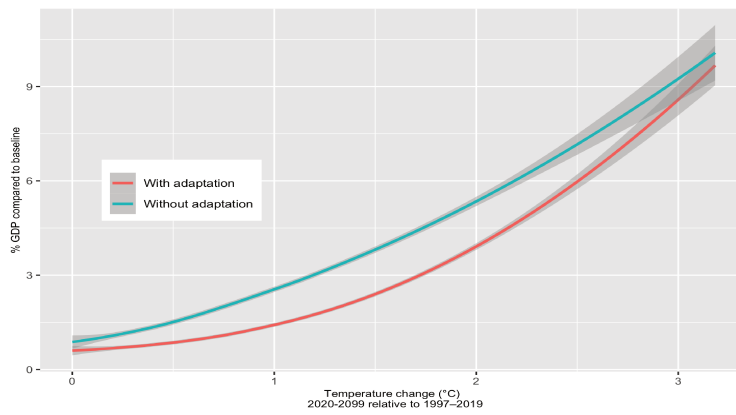


Figure 6.26: With adaptation - Impacts on public debt

Private sectors will increase their financing needs due to the additional adaptation investment. Especially, the needs will be higher in the initial years. However, the adaptation capital accumulates over time and will contribute to reducing losses due to climate damage and improving their activities in the long term.

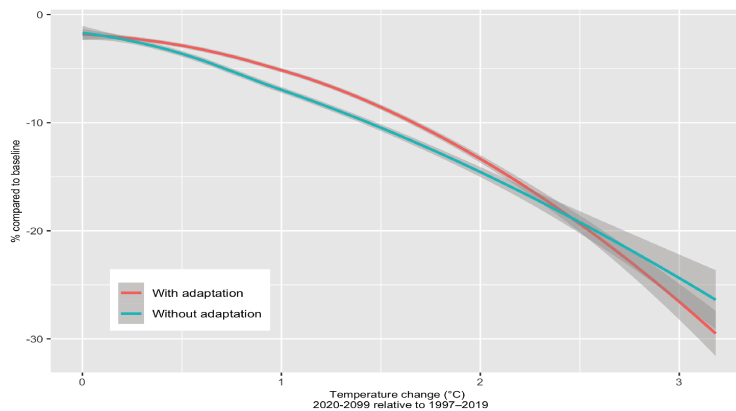


Figure 6.27: With adaptation - Impacts on private financing needs

6.6 Conclusion

Our results provide a new economy-wide assessment of the social and economic effects of climate change on the Vietnamese economy as a whole, using an integrated macroeconomic framework based on empirical analyses of climate impacts and available regional and global climate models. Summing across sectoral direct impacts as a function of VNMST change 2020–2099 relative to the pre-industrial period 1851–1900, we found that the expected annual GDP loss is 1.8% relative to the baseline scenario at +1°C of warming. This loss becomes 4.5% for a 1.5°C increase, 6.7% for a 2°C increase and up to 10.8% for a 3°C increase. The cross-sectoral and macroeconomic effects of these sectoral impacts by 2050 will lead to average losses, which are larger than direct damages by around 30%.

This national estimate is built using the first empirical stock-flow coherent macroeconomic model of the Vietnamese economy. In that sense, growth is demand-driven, while production capacities are affected by the direct impacts of temperature increases on agriculture, energy, labour productivity and health (mortality and infectious diseases) and by the indirect impacts of sea level rise and typhoons on capital stock and agriculture. This estimate will certainly not be the last, as multiple known sectors of the Vietnamese economy for which no suitable studies exist have been omitted from the analysis so far. We could mention the impacts of climate change on tourism, forestry management, aquaculture and fisheries, the informal sector, and biodiversity losses, to name a few. We will complete the work in some of those directions over the remaining duration of the project. However, more generally, the GEMMES Viet Nam architecture is designed to be open to contributions from rigorous future studies, which would quantify climate impacts in these “missing sectors”. Our approach, therefore, allows for updates based on new econometric/sectoral modelling results or climate model projections.

Even if not all effects have been accounted for, the loss could possibly reach up to about 12.2% GDP relative to the baseline scenario by 2050 under RCP8.5. This could prevent Viet Nam from achieving its development target, which is set at about 7% GDP growth annually during 2021–2030 and becoming an industrialised country by 2045. This urges Viet Nam to pay more attention to climate change adaptation strategy in order to improve resilience, mitigate possible negative impacts and achieve the country’s development targets. Viet Nam is currently quite active in responding to climate change. The recently revised

Environmental Protection Law, unlike the previous version, dedicates a separate article on climate change adaptation with concrete regulations on climate change impact assessment, adaptation activities, monitoring and responsibilities. In the National Adaptation Plan during 2021–2030, a vision for 2050, Viet Nam is preparing for a separate Law on climate change. These provide a basic framework for planning, designing and implementing climate adaptation. The macroeconomic simulation results in this chapter suggest some policy recommendations for more effective adaptation:

Promoting a resilient adaptation and net-zero transition

Being aware of the urgency of climate change responses, the Vietnamese authorities started to, as soon as 2008, draw action plans and policies for climate change response with a strong focus on adaptation (Pannier et al., 2020). To implement these adaptation policies, the Vietnamese government has allocated its own budget and received significant financial support from international organisations, especially bilateral and multilateral partners. At the local level, communities have made many efforts to mobilise resources for dealing with sudden climate-related hazards. This adaptation progress by the government could be assessed by some conceptual framework, including “leadership, organisation, and policy” (Ford, Berrang-Ford, and Paterson, 2011); “adaptive capacity” focusing on the strength and existence of governance structures and policy processes that determine whether adaptation takes place (Ford and King, 2015).

Adaptation investment and effectiveness

The effectiveness of adaptation investment has been concerned by the national strategy, especially the national plan for adaptation to climate change for the period 2021–2030, with a vision for 2050. Various international institutions have evaluated the financing mechanism and resources mobilised for adaptation in countries. “Climate finance readiness”, proposed by the United Nations Development Program (UNDP), was defined as “the capacities of countries to plan, access, deliver, monitor, and report on climate finance, both international and domestic, in ways that are catalytic and fully integrated with national development priorities and the achievement of the Millennium Development Goals”. To support developing countries in strengthening their capacities in climate finance, the German Agency for International Cooperation (GIZ) has developed a “Ready for Climate Finance” approach which emphasises the involvement of the private sector.

Financing and prospective macro-financial scenarios

The simplified simulation of adaptation investment suggests a reduction in GDP losses compared to the situation without adaptation. The higher efficiency of adaptation, the larger benefit from adaptation would be for both the public and private sectors. However, the more global warming, the less adaptation space we have. Climate action will be taken in the context of uncertainties, and using comprehensive analytical work as our provided framework can help to carefully examine the potential impacts and results.

General conclusion

Main findings and achievements

Economic and financial globalisation offer great opportunities for developing countries like Viet Nam to grow faster. Viet Nam, one of the most open to the world, has achieved remarkable economic development successes since the reform in 1986. Behind this successful story, international trade has been considered one of the key drivers. However, participation in globalisation has also increased interdependence among countries, increasing the risks of economic instability and environmental degradation. Hence, the ultimate goal of this thesis is to understand the macroeconomic interactions of different sectors in the Vietnamese economy under globalisation and, thereby, to build an empirical SFC model intended for scenario analysis and policy simulations.

In Chapter 1, the Post-Keynesian approach allows us to understand the main features, dynamics and interaction between domestic features of the Vietnamese economy and its external features. The economy still relies on the external sector. Indeed, the export-led growth model must focus on developing the national/domestic productive capacity. The trade depends mainly on foreign multinational corporations, FDI firms and joint venture companies.

SFC models bring real and financial variables together in the same framework and are therefore best suited to address the challenges facing Viet Nam. As far as we know, we are the first to develop an empirical SFC model of the Vietnamese economy and contribute to the macroeconomic modelling literature of Viet Nam. In addition, despite a growing interest in empirical SFC models for whole countries, there were few models for developing countries. Our work contributes to this gap in the literature. Chapter 2 not only introduced the methodology of SFC modelling and the related literature but also allowed us to understand how to develop an empirical SFC model for a whole country step-by-step.

One of the most challenging steps in developing an empirical SFC model is the construction of the accounting framework, which consists of the balance sheet and the flow matrix (Chapter 3). The development of the national balance sheet consists of three main steps. We began with the balance sheet of the central bank and commercial banks, then extended to other sectors and finally, combined with other relevant financial instruments. The flow matrix is based on the sequence of national accounts and the accounting principles of SFC modelling

described in Chapter 2. The lack of data compiled for the different institutional sectors challenged the development of our SFCVN model and imposed us to make some simplifying assumptions.

Our SFCVN model described in detail in Chapter 4 provides a theory-consistent representation of the general structure of the Viet Nam economy and offers policy/scenario simulation capabilities to the needs of policymakers. The model comprises six institutional sectors with behaviours that integrate both the real and financial sides of the economy. There were two types of equations: accounting and behavioural equations. Several structural parameters were estimated using annual data from 1996-2019 with Vector Error Correction Models (VECMs), which lead to the corresponding Error Correction Mechanisms (ECMs) for each specification, or OLS regression. The simulation results show the model's overall performance in replicating the system's dynamics by comparing it with the historical data.

We made use of the model to simulate the effects of different economic policies or shocks on the Vietnamese economy. The model served as a macroeconomic analysis framework focusing on various transmission channels, which is helpful for discussions of policy relevance (Chapter 5). In the case study of the policy responses to cope with the COVID-19 pandemic, the simulation results from the model show that stimulus packages and recovery plan are effective policy interventions to cope with the COVID-19 pandemic. However, it raised the financing need of the government and then could cause the deterioration in public deficit and an increase in public debt.

Our SFCVN model also contributed to the research related to the assessment of the macroeconomic impacts of climate change and adaptation measures on Viet Nam (Chapter 6). The loss due to climate change could prevent Viet Nam from achieving its development target and urge Viet Nam to pay more attention to climate change adaptation strategy in order to improve resilience. Albeit time-consuming, the model proved its capacity/potential as a useful macroeconomic analysis/policy simulation, taking into account the different economic and social development objectives of Viet Nam, its ambitious net-zero emissions target by 2050 and just transition in the coming years.

Limitations and further research

We are aware that this type of model used for policy simulation still needs continuous improvements. We identify two main types of areas which will need to be addressed: technical and theoretical considerations.

Regarding technical considerations, updating data will need to be performed to reflect the economy's dynamics correctly. So far, it is very difficult to find detailed financial data for all types of financial instruments in the economy. However, with the rapid development of the financial sector and the rapid digital transformation process in Viet Nam, more series could be available and allow to have accounting matrices which are close to the reality as much as possible. More sophisticated econometric methods can be used to estimate behavioural equations.

Regarding theoretical considerations, the model is, by definition, a simplification and aggregates away many additional details about the Vietnamese economy. There are a number of areas where the analyses based on the model could be expanded, such as production and distribution of income.

Firstly, the actual model focuses on the aggregate effects of production with the integration of a simplified Input-Output matrix in the model. However, we can develop an unconsolidated formulation of the production process, which would be helpful in analysing intra-firm dynamics. Given the strong interdependencies between industries, Input-output analysis is indispensable to analyse the transactions that take place within the production sectors in a complete system. It allows for the study of the structural change of the economy toward a greener growth. The input-output analysis allows having different levels of productivity in various sectors. It potentially identifies industries playing the role of the main drivers of production, relevant in terms of value-added. Other sectors can have an important impact on the labour market. The dependency on the rest of the world will also be analysed through the export/import share of each sector. Especially climate change leads to a tightening of Vietnam's external constraint, meaning that adjustments in patterns of international trade can worsen the burden of climate impacts ([Mania et al., 2022](#)).

Secondly, assessing the impacts of climate change should be further developed by disaggregating production capacities. As mentioned in Chapter 6, multiple known sectors of the Vietnamese

economy have been omitted. Our perspective will be to complete the work by designing the Gemmes-VN architecture with multi-sector modelling. In fact, treatment of the supply side needs to be improved.

Lastly, income distribution is one of the core issues in economic policy analysis. The actual model allows only to analyse the functional income distribution, which means the distribution of income among the factors of production (labour, capital). It consists of the factor shares at the macro level. An extension of the model can be the integration of the personal income distribution, i.e. the distribution among the groups of the society ([Dafermos and Papatheodorou, 2015](#)). It consists of the integration of various household groups that receive income. The dynamic linkage between functional and personal income distribution is formulated as part of a complete macroeconomic system. Inequality simulation exercises can be conducted and potentially contribute to providing important policy recommendations with the long-term goal of reducing inequalities and improving well-being.

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Appendices

A Perpetual Inventory Methods, Revaluation matrix

In our model, the value of non-financial assets should evolve according to the perpetual inventory method. It means that the current period's worth is defined by cumulating flows to the previous period's value and adjusting for the depreciation of capital and the variation of capital prices.

$$p_{K_t} k_t = p_{K_{t-1}} k_{t-1} + p_{K_t} i_t + \Delta p_{K_t} * k_{t-1} \quad (171)$$

Table A.1: Perpetual inventory method for Firms

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Non-financial assets	$p_{K_{-1}} k_{-1}^f$	$p_K i^f$	$k_{-1}^f \Delta p_K$	$p_K k^f$
Inventories	$p_{K_{12-1}} k_{12-1}$	$p_{K_{12}} i_{12}$	$k_{12-1} \Delta p_{K_{12}}$	$p_{K_{12}} k_{12}$
Dong Deposits	DM_{-1}^f	ΔDM^f		DM^f
Foreign deposits	$FM_{us-1}^f xr_{-1}$	$\Delta FM_{us}^f xr$	$FM_{us-1}^f \Delta xr$	$FM_{us}^f xr$
Loans	L_{-1}^f	ΔL^f		L^f
Foreign loans	$FL_{us-1}^f xr_{-1}$	$\Delta FL_{us}^f xr$	$FL_{us-1}^f \Delta xr$	$FL_{us}^f xr$
Equity	$p_{E_{-1}} E_{-1}^f$	$p_E \Delta E^f$	$E_{-1}^f \Delta p_E$	$p_E E^f$
Foreign direct investment	$p_{FDI_{-1}} FDI_{us-1} xr_{-1}$	$p_{FDI} \Delta FDI_{us} xr$	$FDI_{us-1} xr_{-1} \Delta p_{FDI}$ $+ FDI_{us-1} p_{FDI_{-1}} \Delta xr$	$p_{FDI} FDI_{us} xr$
Other accounts r/p*	OTA_{-1}^f	ΔOTA^f		OTA^f
Net Wealth	NW₋₁^f	NLP^f	REVAL^f	NW^f

Table A.2: Perpetual inventory method for Central Bank

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Intl. reserves	$RES_{us-1}xr_{-1}$	$\Delta RES_{us}xr$	$RES_{us-1}\Delta xr$	$RES_{us}xr$
Cash	H_{-1}	ΔH		H
Bank's Reserves	MB_{-1}^{cb}	ΔMB^{cb}		MB^{cb}
Governments's Deposits	GM_{-1}^{cb}	ΔGM^{cb}		GM^{cb}
Bonds	B_{-1}^{cb}	ΔB^{cb}		B^{cb}
Advances	LB_{-1}^{cb}	ΔLB^{cb}		LB^{cb}
Other accounts r/p*	OTA_{-1}^{cb}	ΔOTA^{cb}		OTA^{cb}
Net Wealth	NW_{-1}^{cb}	0	$REVAL^{cb}$	NW^{cb}

Table A.3: Perpetual inventory method for Banks

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Bank's Reserves	MB_{-1}^{cb}	ΔMB^{cb}		MB^{cb}
Governments's Deposits	GM_{-1}^b	ΔGM^b		GM^b
Dong Deposits	DM_{-1}	ΔDM		DM
Bonds	B_{-1}^b	ΔB^b	B_{-1}^b	B^b
Advances	LB_{-1}^{cb}	ΔLB^{cb}		LB^{cb}
Loans	L_{-1}	ΔL		L
Foreign loans	$FL_{us-1}^b xr_{-1}$	$\Delta FL_{us}^b xr$	$FL_{us-1}^b \Delta xr$	$FL_{us}^b xr$
Equity	$p_{E-1} E_{-1}^b$	$p_E \Delta E^b$	$E_{-1}^b \Delta p_E$	$p_E E^b$
Other accounts r/p*	OTA_{-1}^b	ΔOTA^b		OTA^b
Net Wealth	NW_{-1}^b	NLP^b	$REVAL^b$	NW^b

Table A.4: Perpetual inventory method for Government

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Non-financial assets	$p_{K-1}k_{-1}^g$	$p_K i^g$	$k_{-1}^g \Delta p_K$	$p_K k^g$
Governments's Deposits	GM_{-1}	ΔGM		$-GM$
Foreign deposits	$FM_{us-1}^g xr_{-1}$	$\Delta FM_{us}^g xr$	$FM_{us-1}^g \Delta xr$	$FM_{us}^g xr$
Bonds	B_{-1}	ΔB		B
Foreign loans	$FL_{us-1}^g xr_{-1}$	$\Delta FL_{us}^g xr$	$FL_{us-1}^g \Delta xr$	$FL_{us}^g xr$
Other accounts r/p*	OTA_{-1}^g	ΔOTA^g		OTA^g
Net Wealth	NW₋₁^g	NLP^g	REVAL^g	NW^g

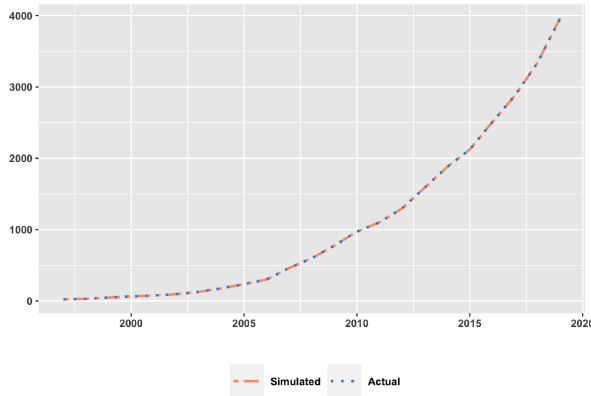
Table A.5: Perpetual inventory method for Households

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Non-financial assets	$p_{K-1}k_{-1}^h$	$p_K i^h$	$k_{-1}^h \Delta p_K$	$p_K k^h$
Cash	H_{-1}	ΔH		H
Dong Deposits	DM_{-1}^h	ΔDM^h		DM^h
Foreign deposits	$FM_{us-1}^h xr_{-1}$	$\Delta FM_{us}^h xr$	$FM_{us-1}^h \Delta xr$	$FM_{us}^h xr$
Bonds	B_{-1}^h	ΔB^h		$p_B B^h$
Loans	L_{-1}^h	ΔL^h		L^h
Equity	$p_{E-1}E_{-1}^h$	$p_E \Delta E^h$	$E_{-1}^h \Delta p_E$	$p_E E^h$
Other accounts r/p*	OTA_{-1}^h	ΔOTA^h		OTA^h
Net Wealth	NW₋₁^h	NLP^h	REVAL^h	NW^h

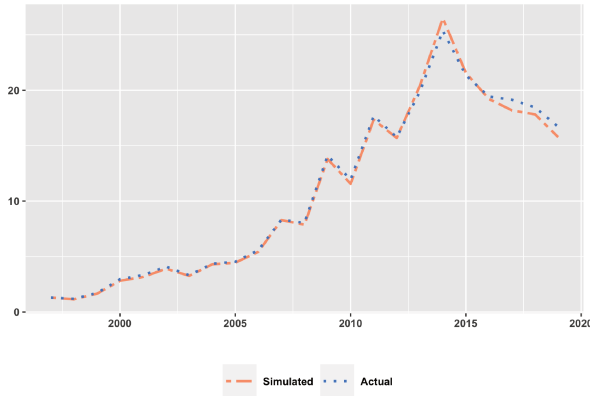
Table A.6: Perpetual inventory method for Rest of the World

	$Stock_{t-1}$	$Flows$	$Revaluation$	$Stock_t$
Intl. reserves	$RES_{us-1}^{cb} xr_{-1}$	$\Delta RES_{us}^{cb} xr$	$RES_{us-1}^{cb} \Delta xr$	$RES_{us}^{cb} xr$
Foreign deposits	$FM_{us-1} xr_{-1}$	$\Delta FM_{us} xr$	$FM_{us-1} \Delta xr$	$FM_{us} xr$
Foreign loans	$FL_{us-1} xr_{-1}$	$\Delta FL_{us} xr$	$FL_{us-1} \Delta xr$	$FL_{us} xr$
Equity	$p_{E-1}E_{-1}^r$	$p_E \Delta E^r$	$E_{-1}^r \Delta p_E$	$p_E E^r$
Foreign direct investment	$p_{FDI-1} FDI_{us-1} xr_{-1}$	$p_{FDI} \Delta FDI_{us} xr$	$FDI_{us-1} xr_{-1} \Delta p_{FDI}$ $+ FDI_{us-1} p_{FDI-1} \Delta xr$	$p_{FDI} FDI_{us} xr$
Other accounts r/p*	OTA_{-1}^r	ΔOTA^r		OTA^r
Net Wealth	NW₋₁^r	NLP^r	REVAL^r	NW^r

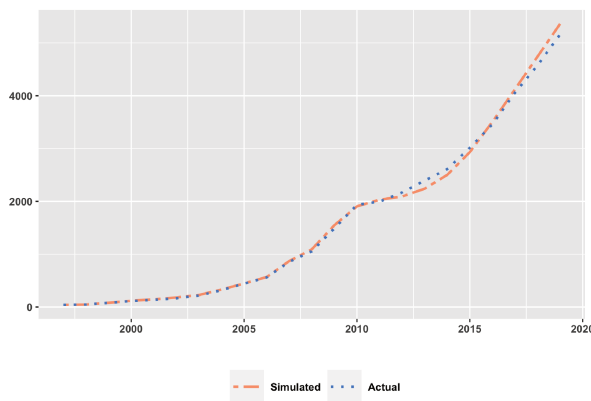
B Simulated results



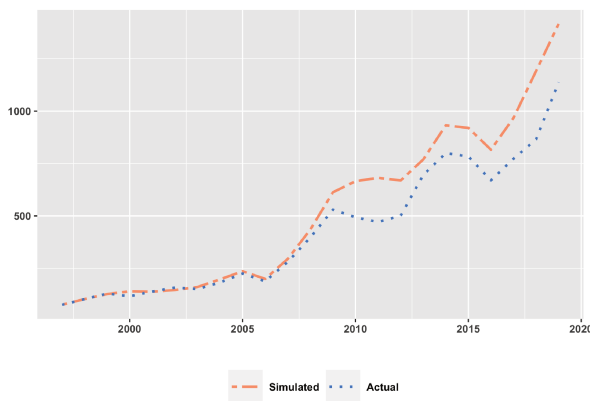
(a) Dong Deposits



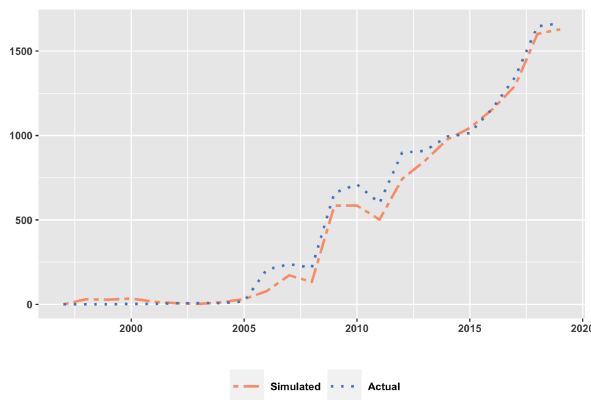
(b) Foreign Deposits



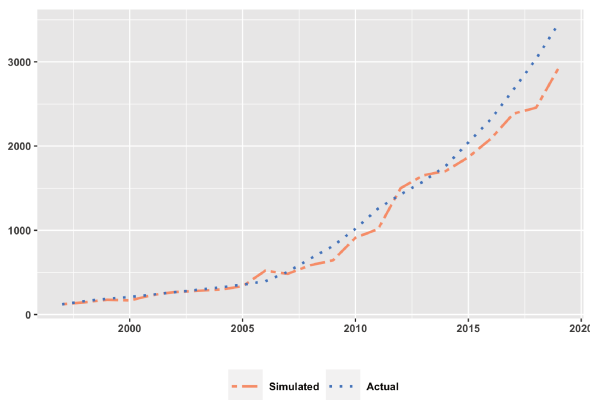
(c) Domestic Loans



(d) Foreign Loans

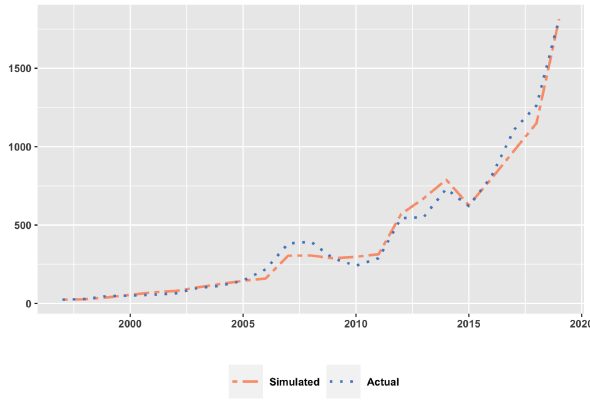


(e) Equities

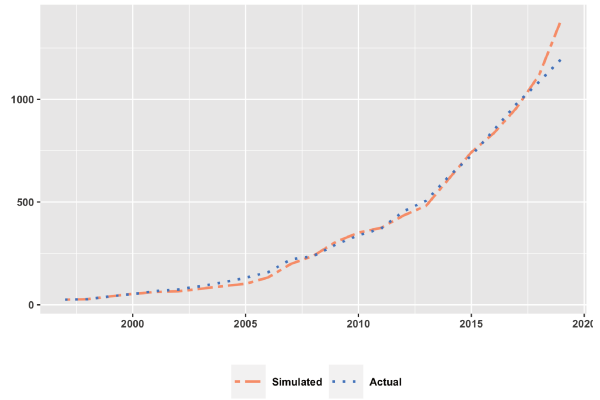


(f) Foreign Direct Investment

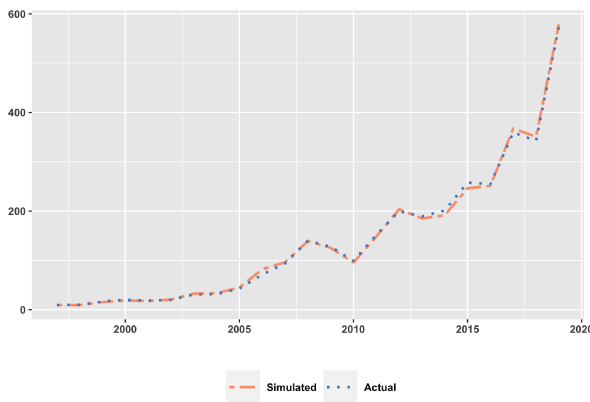
Figure B.1: Firms - Financial assets & liabilities



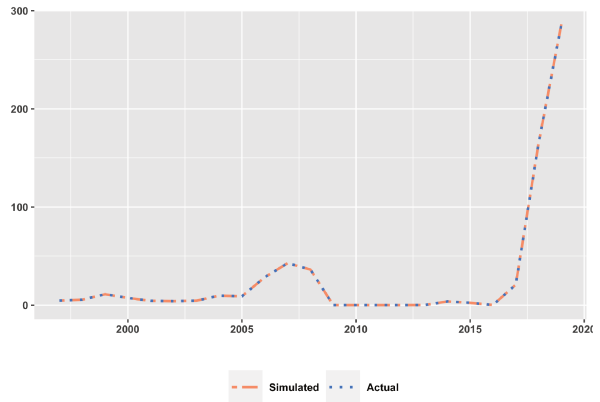
(a) International Reserves



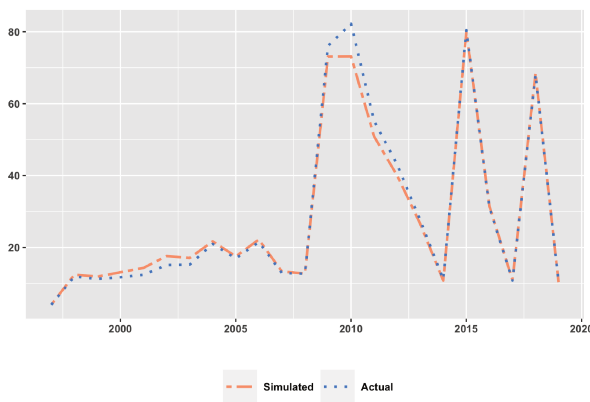
(b) Cash



(c) Bank's Reserves



(d) Government's deposits

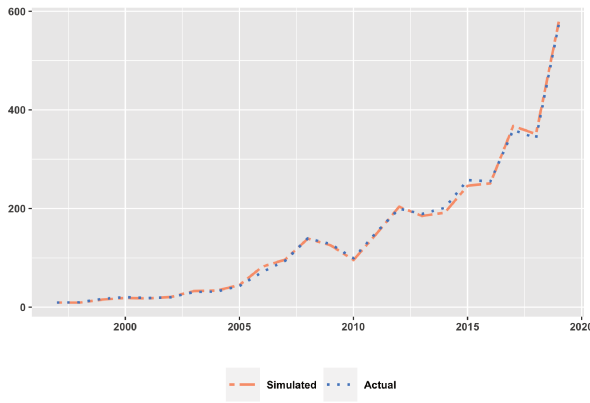


(e) Government bonds

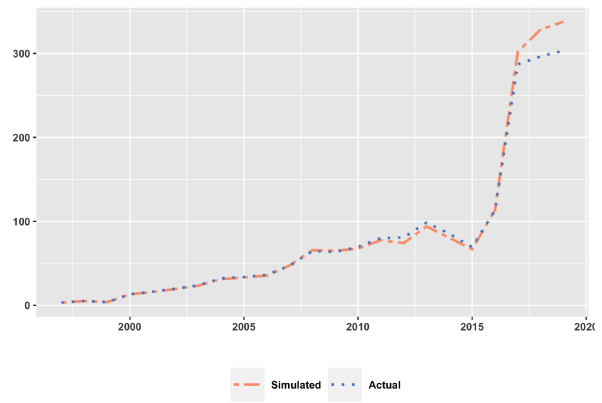


(f) CB's Refinancing

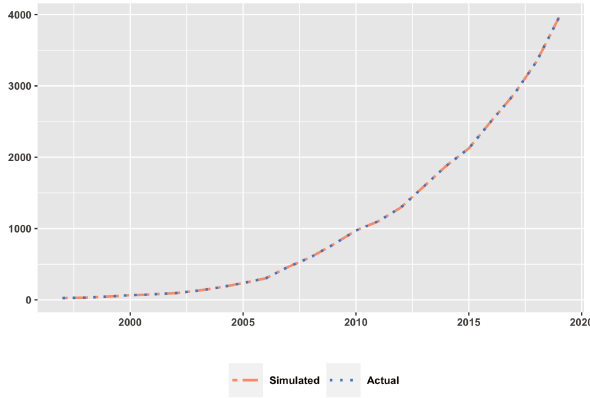
Figure B.2: Central Bank - Financial assets & liabilities



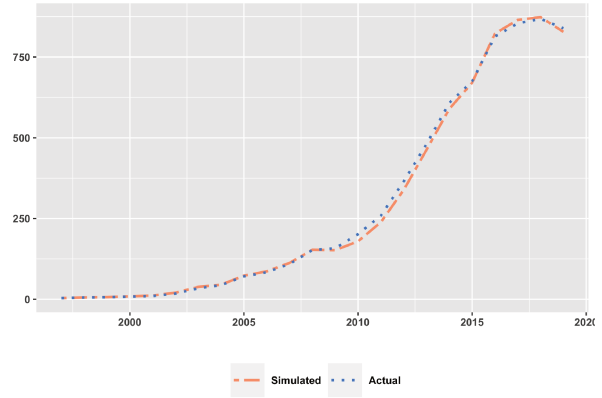
(a) Bank's Reserves



(b) Government's Deposits



(c) Dong deposits

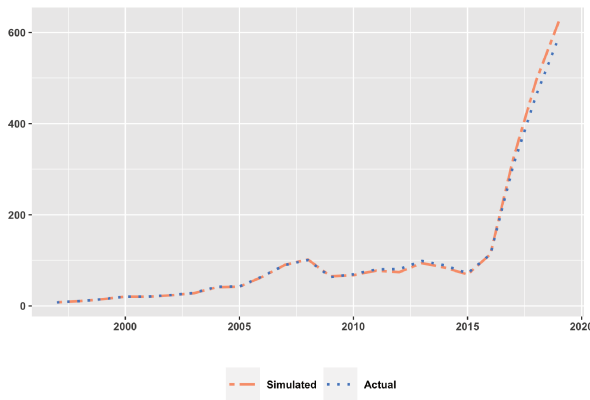


(d) Government bonds

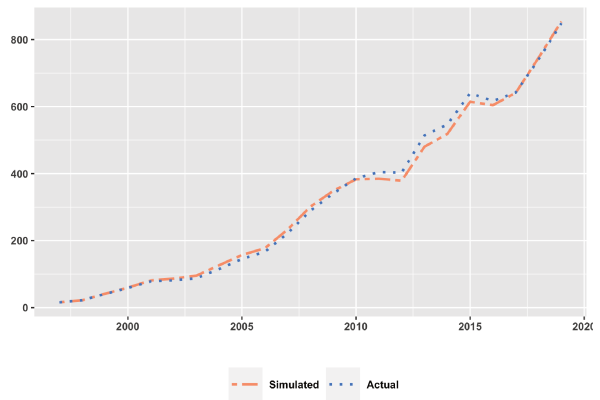


(e) CB's refinancing

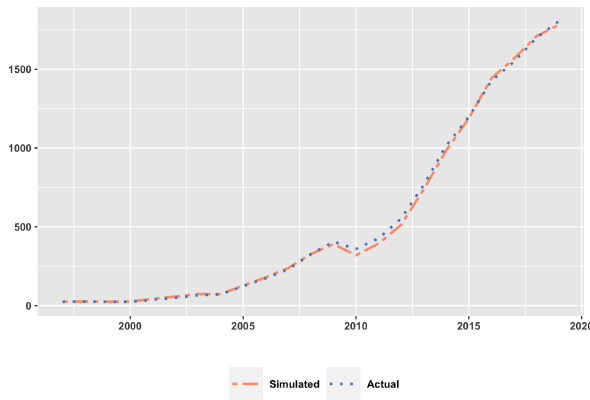
Figure B.3: Commercial banks - Financial assets & liabilities



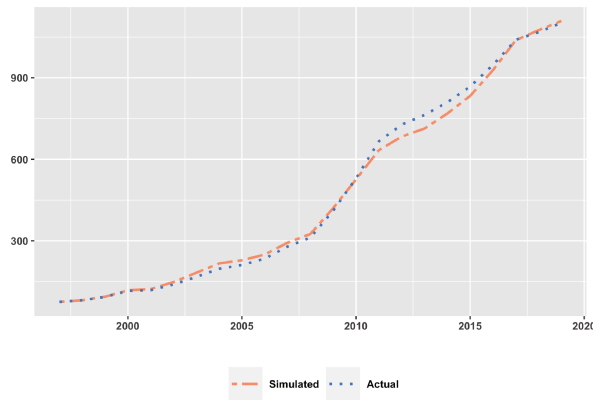
(a) Government's deposits



(b) Government's foreign deposits

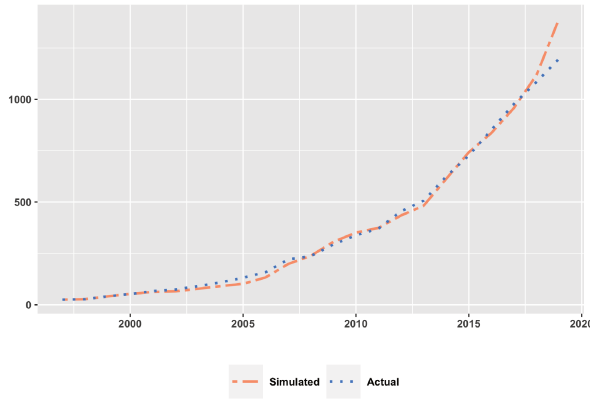


(c) Government bonds

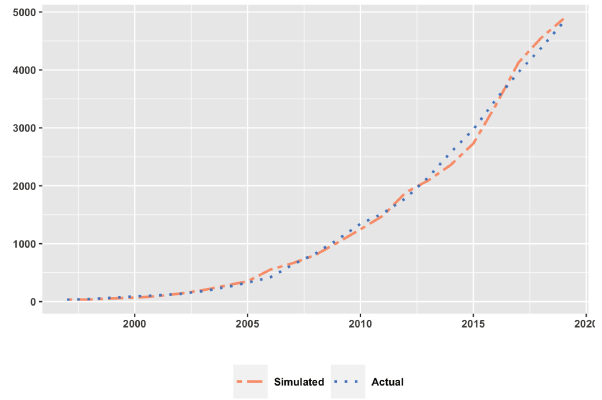


(d) Public external debt

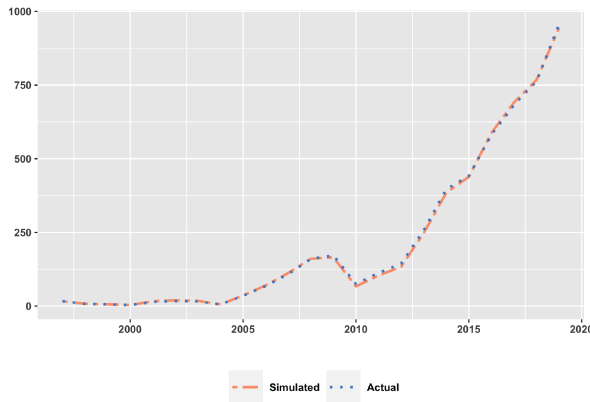
Figure B.4: Government - Financial assets & liabilities



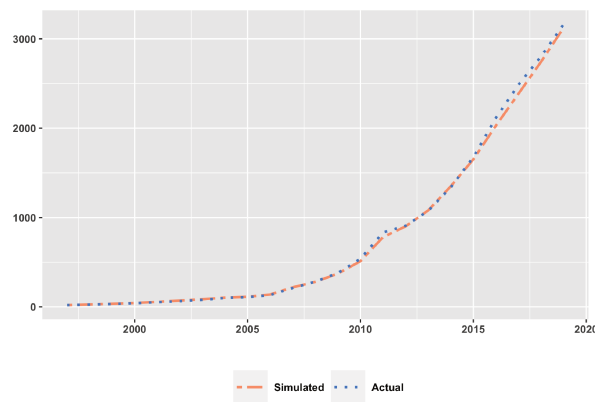
(a) Cash



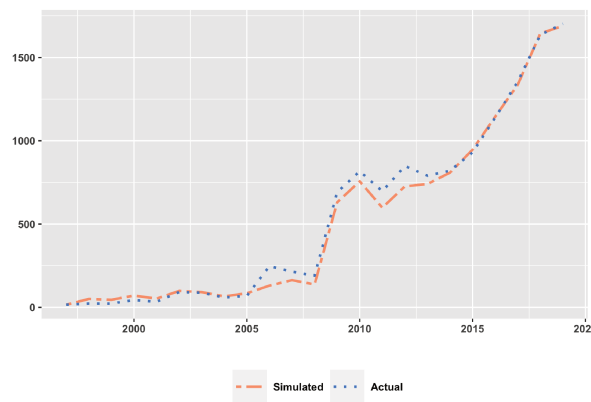
(b) Dong deposits



(c) Government bonds

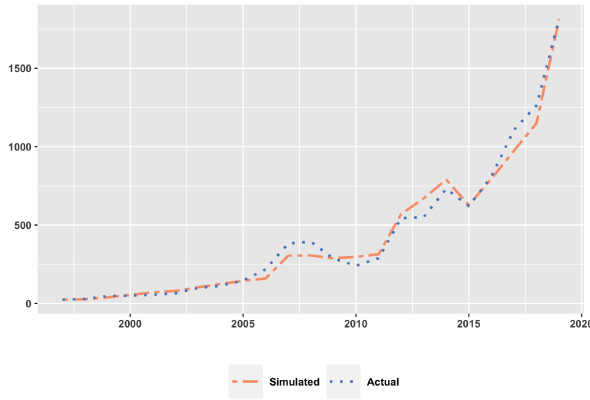


(d) Public external debt

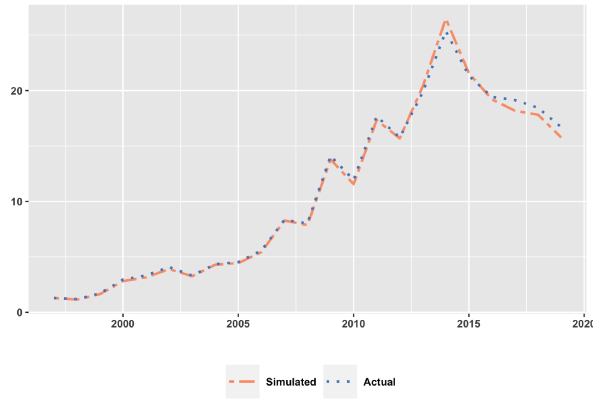


(e) Equities

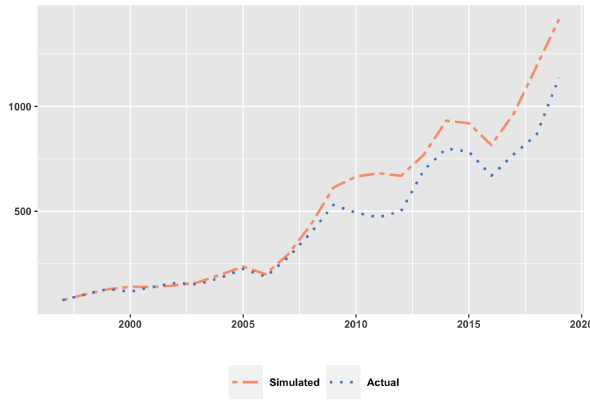
Figure B.5: Households - Financial assets & liabilities



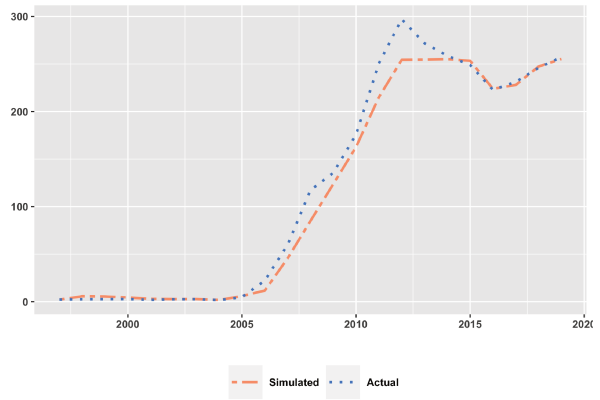
(a) International reserves



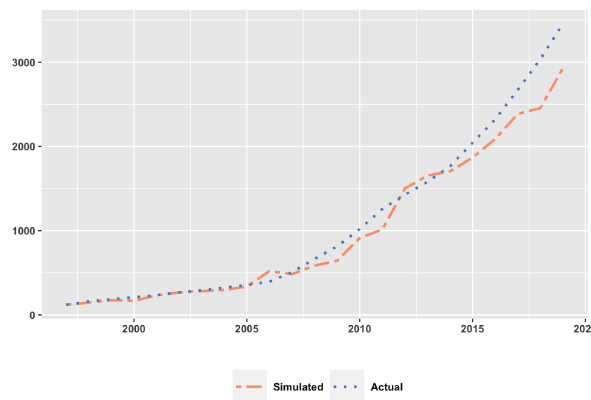
(b) Foreign deposits



(c) Foreign loans

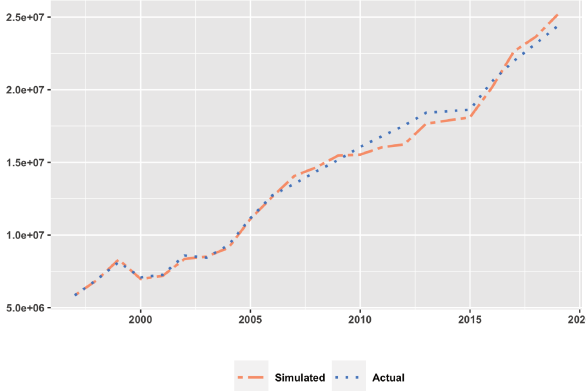


(d) Portfolio investment

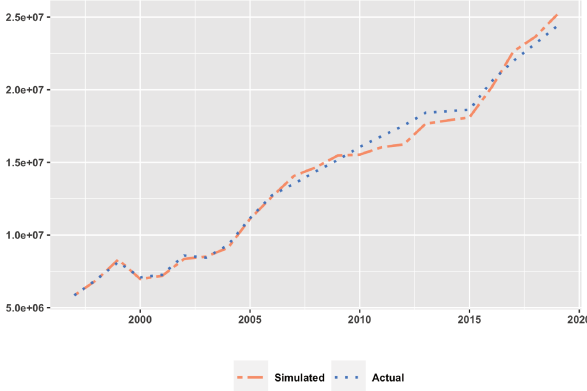


(e) Foreign Direct Investment

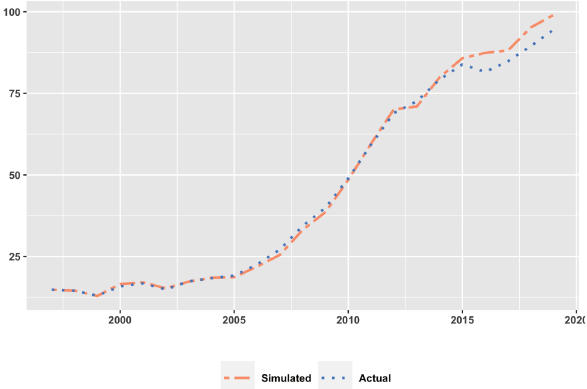
Figure B.6: Rest of the world - Financial assets & liabilities



(a) Employment

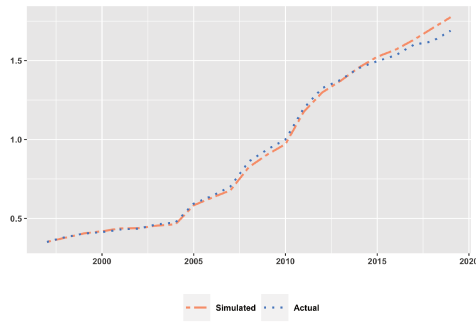


(b) Number of workers

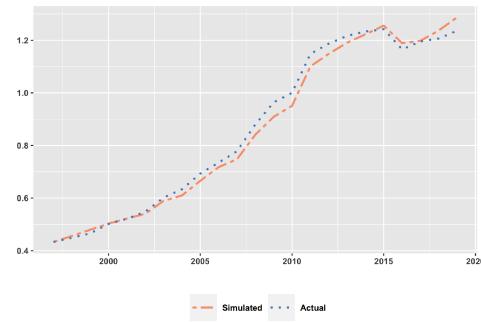


(c) Wage rate

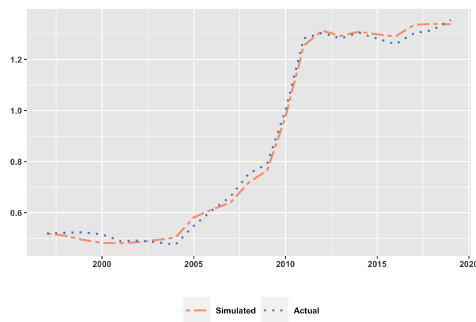
Figure B.7: Labor market



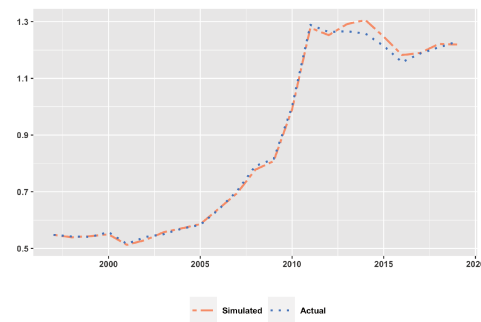
(a) GDP Deflator



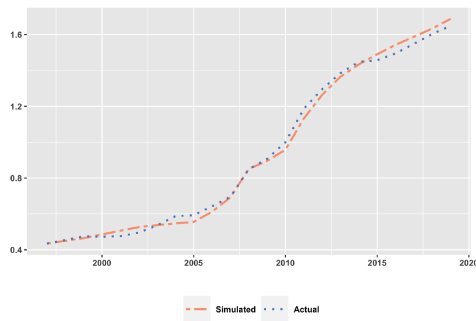
(b) Price of capital



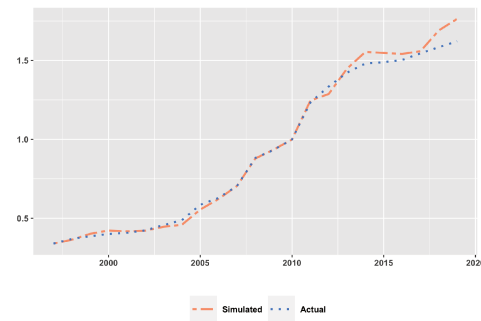
(c) Price of exports



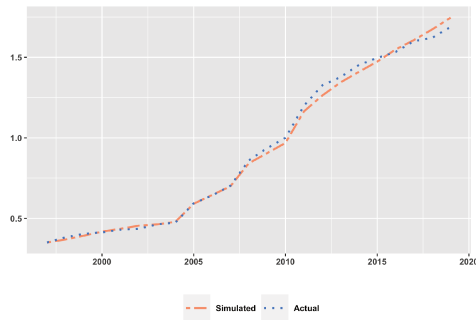
(d) Price of imports



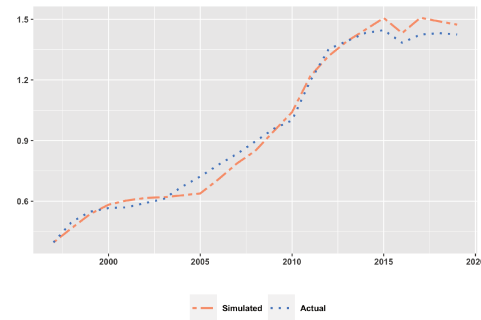
(e) Price of public expenditures



(f) Price of consumption

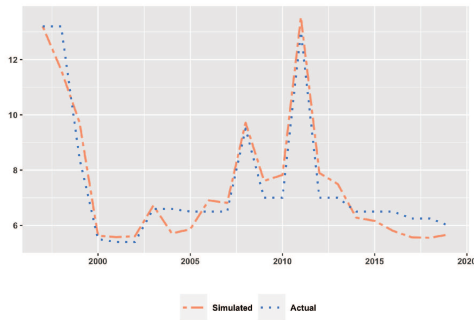


(g) Price of output

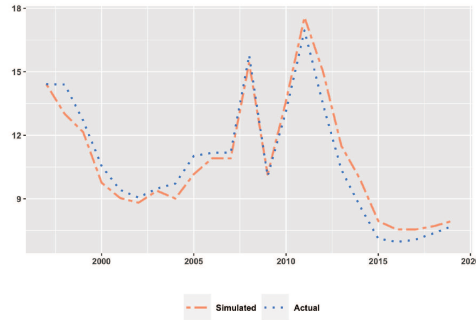


(h) Price of inventory

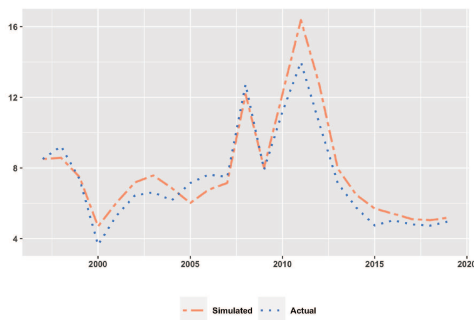
Figure B.8: Prices



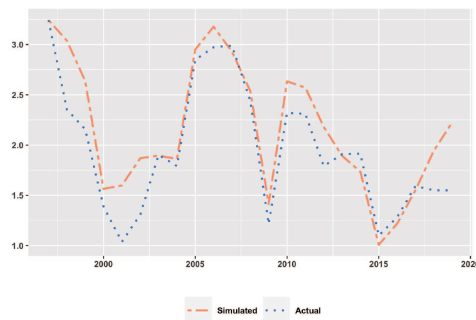
(a) Refinancing rate



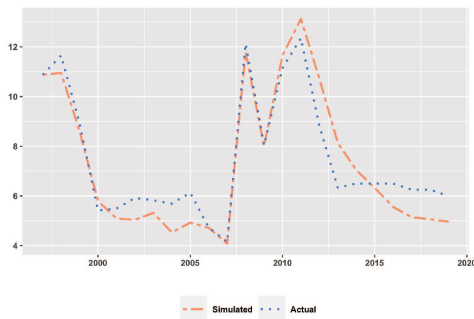
(b) Lending rate



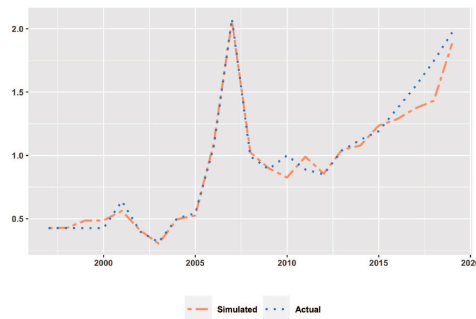
(c) Deposit rate



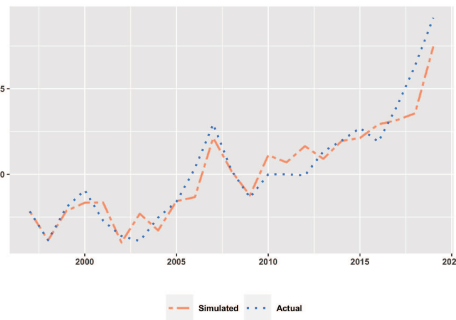
(d) Interest rate on foreign loans



(e) Rate of return of government bonds



(f) Price of equity



(g) Price of FDI

Figure B.9: Interest rates

C Parameters

Table C.1: Parameters of damage functions

Parameters	Value
ν_{AGR}	-0.06945
ν_{HPP}	0.00055
ν_{HPP}^2	-0.00016
ν_{ED}	0.01033
ν_{LP}	-0.02731
ν_{TFP}	-0.0359
ν_{MORT}	0.02389