Essays on external imbalances and international trade

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Introduction

Appearances are sometimes deceptive. This also applies to commonly accepted theories in international economics. Do flexible exchange rates really help reducing external imbalances? Does globalisation always put downward pressure on production prices and markups? Does trade favour high-skilled workers at the expense of lower-skilled workers in advanced economies? This thesis empirically investigates these three questions. The dominance of the US dollar in the invoicing of trade and the development of global value chains weaken the relation between exchange rate regimes and external imbalances underlined by Friedman (1953). The increasing lack of market contestability and quality upgrading of their products allow domestic firms to keep high markups and price despite pro-competitive effects of globalisation predicted in Melitz and Ottaviano (2008)'s theoretical model. Heckscher-Ohlin theorem implies a reallocation of firms in sectors where they have a comparative advantage, most likely sectors using more high-skilled workers in the case of an advanced economy. However, the increasing granularity of trade blurs this prediction at the sector level, making predictions of trade on employment more complicated (Stehrer and Stöllinger, 2013).

Chapter 1 deals with external imbalances, and more precisely with determinants of sustained and sizeable current account adjustments. The global financial crisis has spurred renewed interest in current account imbalances in the Euro Area, as peripheral countries accumulated persistent current account deficits. Since the Euro Area countries can no longer resort to exchange rate devaluation, other macroeconomic and structural determinants need to be considered to narrow current account imbalances. Moreover, from a policy perspective, it is important to assess whether current account improvements will be sustained and sizeable. The objective of this chapter is to identify determinants of both the occurrence and magnitude of sustained current account adjustments, based on a selection model to jointly assess determinants of sustained current account reversals and of their magnitude. The dataset goes beyond Euro Are countries and includes as many countries as possible available over the longest period in order to cover a high diversity of episodes of current account reversals. These countries include advanced and emerging economies, as well as fixed, intermediate and floating exchange rate regimes. Overall, the dataset includes 126 countries over the period 1980-2016, covering about 600 episodes of current account improvements and deteriorations, with less than a third being sizeable and sustained

over at least three years. Exchange rate regimes are classified according to Reinhart and Rogoff (2004) de facto classification and macroeconomic and structural determinants are sourced from international institutes and academic works. The focus is put on current account improvements, while current account deteriorations are considered to investigate potential asymmetric behaviours. According to the main results, exchange rate flexibility matters for short and small current account adjustments. However, other determinants help improving current account balance, suggesting that countries under fixed exchange rate regimes are not penalised by the rigidity of their exchange rate. These determinants include higher level of current account balance, level of income per capita and net foreign asset, as well as higher financial integration and lower credit controls in the case of high-income countries position. More stringent business regulations are associated to sizeable and sustained current account balances, which is at odds with the usual recommendations for less stringent regulations.

Chapter 2 deals with the effects of trade liberalisation on prices, markups and productivity. Pro-competitive effects of trade liberalisation are well documented in the literature. Increased foreign competition is expected to put downward pressure on markups and the least productive firms are expected to exit the industry, thus increasing the aggregated industry productivity and decreasing prices. However there is evidence of cross-industry heterogeneous responses of prices, labour productivity and markups to increased foreign competition. The empirical analysis relies on Melitz and Ottaviano (2008) theoretical framework and its empirical setup by Chen *et al.* (2004, 2009) who use instrumented estimates from error correction models to distinguish short- and long-term effects of trade on prices, labour productivity and markups as in Melitz and Ottaviano (2008). It departs from Chen *et al.* (2004, 2009) by assessing trade-induced competitive effects at the industry-level. The objective of this chapter is to identify which industries drive these effects and investigate firms' dynamics that mitigate the competitive effect of globalisation, like market concentration and quality upgrading in response to competition from low-wage countries. Moreover, the traditional variable of gross import penetration is replaced by alternate measures to account for the development of global value chains over the past decades. For this purpose, WIOD Input-Output tables are used to compute an indicator of value added import penetration and Wang *et al.* (2016, 2017) databases are used for their indicator of participation in global value chains. The dataset covers nine manufacturing industries in five Euro Area countries (Austria, France, Germany, Italy and Spain) over the period 1995-2014. The size of the dataset is constrained by the need for long series for the error correction models, as well as the availability of Eurostat producer price indices of products sold on the domestic market, as well as BACH firm-level data to compute markups. The main findings confirm the pro-competitive effects of trade openness on prices, productivity and markups in most industries. But some industries stand out with no significant effects of trade. For instance, the industries of textile and of chemicals and pharmaceuticals are not affected by trade competition, as their industry concentration is high, while the European textile industry has moved to high-end products.

Chapter 3 deals with the determinants of changes in employment in France over the period 1982-2010. As in other advanced economies, France displays skill-biased changes in employment. Megatrends like technological change and greater integration in global value chains are reshaping labour markets, especially in terms of skills. New technologies and moving up the global value chains require higher skills, while workers with low or outdated skills are at higher risk of losing their jobs. The objective of this chapter is to understand drivers of skill-biased changes in employment in the case of France. Using Input-Output tables and a structural decomposition, changes in employment by skills and products are decomposed into three main contributions: final consumption, trade and technology (defined here as the use of production factors). The analysis builds on textbook methodologies of structural decomposition but innovative data: time series of Input-Output tables from 1980 to 2010, based on the new European System of Account (ESA2010) and both in current and previous year prices. The prices used to clear price effects and convert Input-Output tables in volume are built specifically to each use (e.g. consumption, investment, exports) and account for the price differential between domestic and imported supplies. The level of skills is based on the French occupational classification and extracted from the French Labour Survey. The main limitation of this Input-Output decomposition is that it cannot reveal the long-run causal links between employment and its determinants. This approach captures first round or partial equilibrium effects. Hence, this analysis is restricted to short-term effects of technology, trade and final consumption on employment. The main findings are as follows: the contribution of trade to employment is positive at every skill level; skill-biased changes in employment is technology-driven, whereas trade and final consumption have limited skill-bias effects; the development of high-technology manufacturing and RD mainly contributes to this skill-biased change in employment.

Chapter 1

Sustained and sizeable current account adjustments: The role of financial integration and structural policies

1.1 Introduction

In the aftermath of the global financial crisis new interest was given to current account imbalances, especially in the Euro Area. After joining the Euro Area, peripheral countries accumulated persistent current account deficits, as the monetary union's higher financial integration gave them easier access to capital. Current account deficits can be interpreted as a sign of catching up process if foreign financing is later reimbursed with future net exports or debt devaluation. However, the intertemporal budget constraint is violated if foreign financing is used for the production of non-tradable goods, as it was the case of Ireland and Spain (Giavazzi and Spaventa, 2010). Since Friedman (1953)'s essay, it is commonly accepted that flexible exchange rate helps reducing external imbalances. However, Euro Area countries can no longer resort to exchange rate devaluation. In addition, El-Shagi *et al.* (2016) find evidence of real effective exchange rate overvaluation in peripheral countries, which contributes to external imbalances. To address real exchange rate misalignment, countries can only resort to internal devaluation by reducing production costs and prices. However, internal devaluations entail slow recovery and persistent social costs (Bara and Piton, 2012; Corsetti *et al.*, 2019).

The objective of this paper is to identify the determinants of sustained and sizeable current account adjustments, i.e. reversals from deterioration to improvement of the current account balance and vice versa. Current account reversals are by no means rare, but sustained and sizeable ones are more scarce.

From a policy perspective, it is important to assess whether current account reversals will be sustained or short-lived, and whether the magnitude of the reversal will significantly narrow current account imbalances. Does the exchange rate regime matter or do other macroeconomic and structural determinants play a more important role? This paper uses a large dataset of 126 countries over the period 1980-2016 to assess the determinants of sustained current account reversals and their magnitude. These countries include advanced and emerging economies, as well as fixed, intermediate and floating exchange rate regimes.

The contribution of this paper to the existing body of research is threefold. First, the definition of current account adjustments is based on a chronological approach that addresses the usual criticisms against *ad hoc* definitions based on moving average adjustments, such as the overestimated number and inconsistent timing of reversals. It also provides information on the magnitude and the duration of the adjustments. Second, the empirical analysis is based on a selection model to jointly assess determinants of sustained current account reversals and of their magnitude, while most of the existing literature focuses on the former. Focusing on the determinants of reversals means reversals of different magnitude are considered as equal. However, increasing the current account balance by 10% GDP over 3 years can be more costly than increasing it by 5% GDP over 7 years. For countries in high deficit, improving the current account is not enough, the magnitude of this improvement needs to be sizeable. Hence, it is also important to assess why some adjustments are more sizeable than other. Third, the impact of structural policies on reversals and their magnitude is assessed in a unified empirical framework, for both positive reversals (current account improvements) and negative reversals (current account deteriorations). From a policy perspective, assessing determinants of current account improvements is of higher priority than those of current account deteriorations. Nonetheless, overlooking current account deteriorations would bias the empirical analysis if there are asymmetric behaviours for instance.

The main findings of this paper are that the dataset includes about 600 episodes of current account improvements and deteriorations, with less than a third being sizeable and sustained over a long period. Exchange rate flexibility helps reducing short and small current account imbalances. However, exchange rate regime has no significant effects on the occurrence of sustained current account improvements, which suggests that other determinants are involved. These determinants include higher level of current account balance, level of income per capita, financial integration in the case of high-income countries, net foreign asset position, as well as more stringent business regulations – as defined in World Bank Doing Business – and in the case of high-income countries less credit controls – defined in terms of reserve requirements and credit ceilings. Overall, the magnitude of sustained improvements is explained by the same determinants as their occurrence and have an additional determinant with higher trade openness.

In the remainder of this paper, Section 1.2 presents the related literature. Section 1.3 introduces the empirical framework, while Section 1.4 introduces data and descriptive analysis. Section 3.5 presents the empirical analysis on determinants of sustained current account reversals and their magnitude, based on a selection model. Finally, Section 2.7 concludes.

1.2 Related literature

Seminal paper by Friedman (1953) spurred numerous debates on the hypothesis that a more flexible exchange rate regime implies a faster adjustment of the current account balance. This hypothesis finds support in numerous papers (Clower and Ito, 2012; de Mello *et al.*, 2012; Edwards, 2006; Gervais *et al.*, 2016; Martin, 2016). However, in one of the first analyses to empirically test this hypothesis, Chinn and Wei (2008) find no robust evidence that floating regimes significantly increase the mean-reversion of current account balances compared to fixed regimes. Ghosh *et al.* (2010) reconcile both Friedman (1953) and Chinn and Wei (2008)'s analyses by accounting for asymmetric threshold effects – large and small deficits or surpluses. They find that flexible exchange rate regimes are associated with higher mean-reversion of current account balances for small deficits or for surpluses – especially large ones –, but not for large deficits. Once threshold effects are controlled for, the flexibility of exchange rate regimes has an effects for current account dynamics that are consistent with Friedman's thesis.

More recent works further question the link between exchange rate and current account balance, as international trade becomes more complex. IMF (2019) sheds light on two features of international trade that mitigate the role of exchange rate in facilitating external adjustments. First, the U.S. dollar dominates invoicing of trade and countries' trade is more sensitive to the dollar exchange rate than to the exchange rates of their immediate trading partners (Boz *et al.*, 2017). Second, for countries more integrated in global value chains, downstream and upstream exchange rates are more relevant than exchange rates of their immediate trading partners.[1] Finally, Freund (2005) points to alternative experiences of current account improvements that occurred without real or nominal depreciation: Norway's rebound in oil prices in the late 1980's, Singapore's intertemporal story in 1980 and Denmark's monetary tightening in 1987.

Denmark highlights the role of financial integration in transmitting small changes in short-term interest rates to current account balance, while exchange rates remains fixed. Chinn and Wei (2008) note that Friedman (1953)'s essay was written in a period of limited financial integration and the recent substantial increase in cross-border capital flows could lead to different conclusions. Adalet and Eichen-

[1] Higher participation to global value chains also has a direct positive impact on current account account balance by improving the competitiveness (Brumm *et al.*, 2019; European Central Bank, 2017).

green (2007) also underlines the influence of financial integration, by observing less current account reversals and smaller deficits during the Bretton Woods years where capital controls prevailed. Other empirical analyses suggest that financial integration and capital inflows are important determinants of current account reversals (de Mello *et al.*, 2012; Edwards, 2004, 2005; Schmitz and von Hagen, 2011).

Structural and macroeconomic policies also influence current account balances, by reducing the discrepancies between savings and investment or improving competitiveness. Existing work include theoretical analyses (Ju and Wei, 2007; Vogel, 2013), as well as empirical ones (Belke and Dreger, 2013; de Mello *et al.*, 2012; Kerdrain *et al.*, 2010; Ivanova, 2012; Jaumotte and Sodsriwiboon, 2010; Zemanek *et al.*, 2010). Kerdrain *et al.* (2010) and Ivanova (2012) provide a comprehensive framework for both OECD and non-OECD countries, to assess the effects of a large set of structural and tax reforms on current account balance, while de Mello *et al.* (2012) focus on the effects of fiscal and monetary policies. Belke and Dreger (2013), Jaumotte and Sodsriwiboon (2010) and Zemanek *et al.* (2010) restrict their analyses to the Euro Area. Overall, these analyses conclude that the following policies improve current account balances: fiscal consolidation, tighter business regulation and the deregulation of the labour market.

1.3 The empirical model

1.3.1 The selection model specification

The objective of this paper is to assess the determinants of sustained current account reversals, as well as the determinants of their magnitude. Numerous papers address the first part with a probit model to assess the probability of a current account improvement (Adalet and Eichengreen, 2007; Clower and Ito, 2012; Milesi-Ferretti and Razin, 1998, 2000; Edwards, 2005, 2006). The probit model is usually written as follows:

$$\delta_i^* = z_i\alpha + \epsilon_i \text{ with } \epsilon_i|zi \sim \mathcal{N}(0,1) \tag{1.3.1}$$

where δ_i^* is a latent variable for the occurrence of the current account reversal i (improvement or deterioration) defined by the dummy variable δ_i in equation (1.3.2), z_i is a vector of explanatory variables and ϵ_i is an error term.

$$\delta_i = \begin{cases} 1, \text{ if } \delta_i^* > 0 \\ 0, \text{ otherwise} \end{cases} \tag{1.3.2}$$

It is tempting to assess the determinants of the magnitude of a current account reversal in a separate

OLS regression like in equation (1.3.3):

$$y_i = x_i\beta + \mu_i \tag{1.3.3}$$

where y_i is the magnitude of the reversal, x_i is a vector of explanatory variables and μ_i is an error term.

However, y_i is observed only if a reversal occurs, i.e. if $\delta_i = 1$. As shown by Greene (2012), estimating equation 1.3.3 by least of squares over the observed sample produces inconsistent estimate of β. For instance, if the magnitude of a reversal is higher when the reversal is positive (current account improvement) than when it is negative (current account deterioration), then the estimated coefficient on exchange rate flexibility overstates the marginal effect of exchange rate flexibility for current account improvements and understates it for current account deteriorations.

de Mello *et al.* (2012) raise this issue of the selection bias that emerges if the magnitude of reversals depends on the probability of the current account to improve or deteriorate. They use a selection model to correct this bias and jointly estimate the determinants of the probability of current account reversals - improvements or deteriorations – and the determinants of their magnitude regardless of their duration. Based on Heckman (1979) two-step estimation procedure, the model is written as follows:

$$\text{Selection equation: } \delta_i^* = z_i\alpha + \epsilon_i, d_i = 1 \text{ if } \delta_i^* > 0 \text{ and 0 otherwise} \tag{1.3.4}$$

$$\begin{cases} \mathcal{P}(\delta_i = 1|z_i) = \Phi(z_i\alpha) \\ \mathcal{P}(\delta_i = 0|z_i) = 1 - \Phi(z_i\alpha) \end{cases}$$

$$\text{Outcome equation: } y_i = x_i\beta + \mu_i \text{ observed only if } \delta_i = 1 \tag{1.3.5}$$

$$\begin{pmatrix} \mu_i \\ \epsilon_i \end{pmatrix} \sim \mathcal{N}\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\epsilon^2 & \rho\sigma_\epsilon \\ \rho\sigma_\epsilon & 1 \end{pmatrix}\right]$$

where $\mathcal{N}$ denotes the normal distribution

Using the assumption of normality and Greene (2012)'s theorem on the incidentally truncated bivariate normal distribution, the conditional expectation of reversals' magnitude y_i given the probability of reversals to take place ($\delta_i^* > 0$ is computed as follows:

$$\begin{aligned} \mathcal{E}[y_i|\delta_i^* > 0] &= \mathbf{E}[y_i|\epsilon_i > -z_i\alpha] \\ &= x_i\beta + \mathbf{E}[\mu_i|\epsilon_i > -z_i\alpha] \\ &= x_i\beta + \rho\sigma_\epsilon \frac{\phi(-z_i\alpha)}{1 - \Phi(-z_i\alpha)} \\ &= x_i\beta + \rho\sigma_\epsilon \frac{\phi(z_i\alpha)}{\Phi(z_i\alpha)} \end{aligned}$$

where ϕ and Φ are respectively the normal density and cumulative distribution functions, ρ the denotes the correlation between μ_i and ϵ_i. The term $\frac{\phi(z_i\alpha)}{\Phi(z_i\alpha)}$ is also known as the inverse Mills ratio $\lambda(z_i\alpha)$.

Heckman (1979)'s method estimates the coefficients of the determinants of current account reversals and of their magnitude as follows:

1. The selection model estimates α using a Probit regression like in equation 1.3.1. For each observation in the selected sample, the inverse Mills ratio $\widehat{\lambda_i} = \frac{\phi(z_i\widehat{\alpha})}{\Phi(z_i\widehat{\alpha})}$ is computed.
2. The output model estimates β using a least squares regression that include the estimated inverse Mills ratio $\widehat{\lambda_i}$ in addition to the vector of explanatory variables x_i. Equation 1.3.5 can then be written as follows:

$$y_i|\delta_i^* > 0 = x_i\beta + \beta_\lambda\widehat{\lambda_i} + \nu_i \text{ where } \beta_\lambda = \rho\sigma_\epsilon \tag{1.3.6}$$

1.3.2 Determinants of current account reversals and their magnitude

The choice of the explanatory variables to be included in the selection regression is motivated by the empirical literature on current account reversals and determinants of current account balance. Most of these explanatory variables are also included in the outcome regression to assess whether reversals and their magnitude are driven by the same determinants. However an exclusion restriction must be imposed. Namely, at least one explanatory variable in z_i should appear in the selection equation, but not in the outcome equation. Selecting appropriate exclusion restrictions is important for identification of the parameters in the selection equation, but are not required to identify parameters in the outcome equation and are generally recommended to avoid multicollinearity (Wooldridge, 2002). These variables are listed in the following categories.

External and trade variables The exchange rate regime is one of the main variables of interest and is included using a three-way classification (see Table 1.C.1). Changes in real exchange rates capture the competitiveness channel. The level of the current account before reversal is included to control for potential pressures regarding solvency issues in the event of high deficits. The effects of trade openness are ambiguous. On one hand, higher trade integration can help trade account respond faster to real exchange rate changes and therefore be associated to faster current account reversals (Chinn and Wei, 2008). On the other hand, higher trade integration reflecting higher participation to global value chain reduces the elasticity of gross trade flows to exchange rate changes (IMF, 2019). Furthermore, Milesi-Ferretti and Razin (1998) note that more open economies have less difficulties to serve their liabilities and hence less incentives to adjust their current account deficits. Changes in terms of trade are also tested as a proxy for a country to serve its liabilities through its export revenues (Aßmann and Boysen-Hogrefe, 2010).

Financial variables Like trade integration, financial integration has an ambiguous effect on current account reversals. On one hand, higher financial integration facilitates the transmission of financial shocks and increase the probability of current account reversals. On the other hand, it facilitates access to capital for poor countries and therefore can support more persistent current account imbalances. Net foreign assets (NFA) also have an ambiguous effect. Countries with a high position in net foreign assets are expected to improve their current account balance, as net foreign assets generate net investment income which is included in the current account (Abiad *et al.*, 2009; Ivanova, 2012). However, Chinn and Prasad (2003) and Ca Zorzi *et al.* (2012) note that highly indebted economies (i.e. with negative NFA) will need to improve their current account position and preserve their long-term solvency.

Policy variables Current account reversals are driven by investment or by saving (Figures 1.4). Reforms of the product, financial and labour markets can promote investment or saving, as well as spur competitiveness. Their effects on current account balance can be ambiguous depending on households and firms' reactions or their impacts on investment relative to their impacts on saving (Kerdrain *et al.*, 2010). Current account deficits can also be reduced with fiscal consolidation (de Mello *et al.*, 2012; Jaumotte and Sodsriwiboon, 2010; Kerdrain *et al.*, 2010; Vogel, 2013) or monetary tightening (de Mello *et al.*, 2012). Changes in fiscal balance and short-term interest rates like the discount rates can be included in the regressions.

Macroeconomic variables The empirical analysis covers a large heterogeneous sample of countries from advanced and from emerging and developing economies. Advanced economies are usually better equipped with institutions that can help reducing current account imbalances. As for economies at early stages of development and in the process of converging, they will find it more difficult to reverse their external imbalances, according to theories of economic development and stages of balance of payment. Hence control variables include the level of development measured as the per capita GDP. Including the ratio of investment (or saving) to GDP or the real domestic demand growth may give information on the nature of the reversals, as well as channels through which policies can help reducing current account imbalances.

International environment variables Regional contagion can trigger current account reversals. Edwards (2005) measures international spillovers with the incidence of sudden stops in neighbouring countries from the same region.[2] The probability of current account improvements is expected to be higher if a country is located in a region where many countries experience a sudden stop of capital inflows. Regional GDP growth is expected to have similar effects. Current account improvements are more likely to occur when economic activity in neighbouring countries is buoyant and therefore sup-

[2] de Mello *et al.* (2012) use alternate measures of regional contagion, the incidence of current account improvements and deteriorations in the region.

ports exports of the reference country. These variables are chosen as the exclusion restrictions, i.e. they are included in the explanatory variables of the selection model z_i, but are excluded from the explanatory variables of the outcome model x_i in equation 1.3.5. The magnitude of reversals would likely be driven mainly by domestic variables, rather than regional contagion.

1.4 Data and descriptive analysis

1.4.1 Data and definitions

This paper uses a large dataset of 126 countries over the period 1980-2016.[3] These countries cover 28 advanced and 98 emerging and developing economies, as well as fixed, intermediate and floating exchange rate regimes. Data are sourced from institutional and academic works. Many of them are included as deviations from the PPP-weighted sample average in a given period, which reflects the importance of country's relative position compared to its trading partners (Ivanova, 2012). Further details on the sources and descriptions of these data are given in Annex 2.A.2 for further details on sources and descriptions of data used in this paper.

Episodes of current account adjustments

The definition of current account adjustments is in the tradition of works using *ad hoc* criteria (Milesi-Ferretti and Razin, 1998, 2000; Freund, 2005; Freund and Warnock, 2005; Edwards, 2004, 2005). These works usually rely on two common criteria. The first one describes an average reduction of the current account deficit, typically an average reduction of at least 3 or 5% over a period of three years with respect to the three years before the reversal. The second one constrains the reduction in the current account deficit to be sustained. More precisely, the maximum deficit after a reversal should not exceed the minimum deficit before the reversal. In addition to these criteria, Milesi-Ferretti and Razin (1998) and Milesi-Ferretti and Razin (2000) exclude current account reductions that occur within two years of the previous one to prevent some improvements to be associated to two separate current account reversals instead of one. Overall *ad hoc* criteria have the benefit of providing a definition of current account reversals easy to implement compared to an econometric approach.[4]

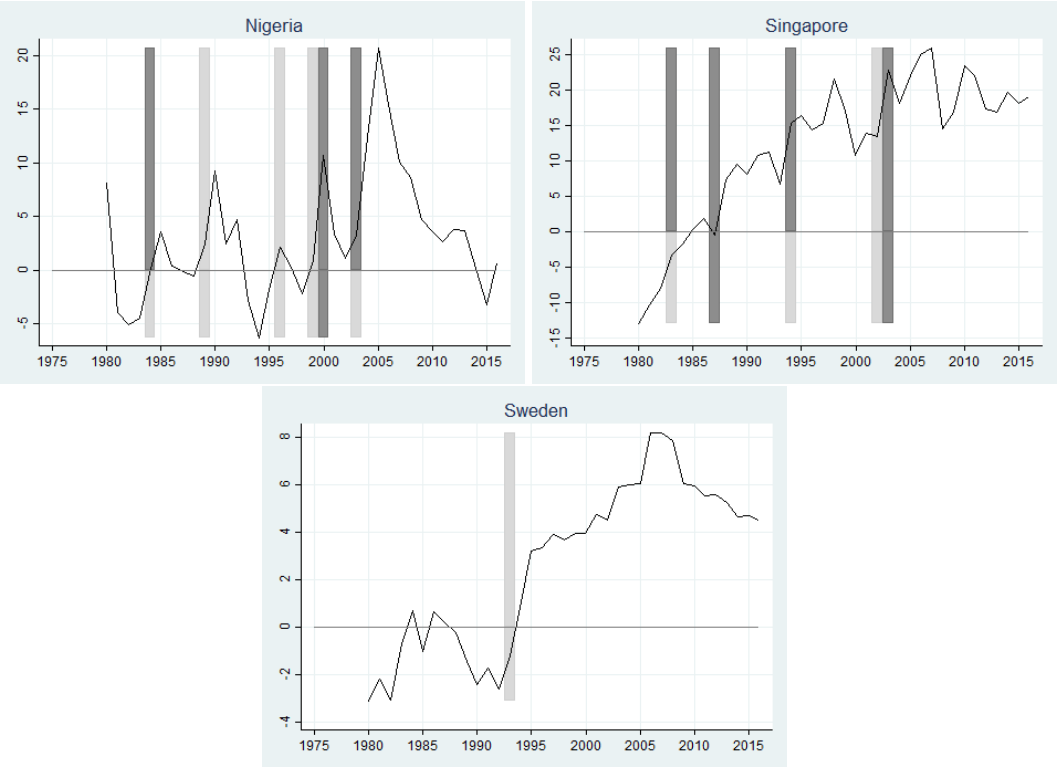
However these *ad hoc* criteria present drawbacks. First, the criteria of moving average reduction in current account deficit tends to overestimate the number of reversals and leads to an inconsistent timing of the reversals (Aßmann and Boysen-Hogrefe, 2010). Second, these works rely on an event-study

[3] See Annex 1.A for the list of countries

[4] For instance, de Mello *et al.* (2012) use structural break tests to identify current account reversals, while Aßmann and Boysen-Hogrefe (2010) and Clower and Ito (2012) use regime switching models. These methods address drawbacks related to *ad hoc* criteria, but rely on constraining econometric properties. Structural break tests require long time series and rely on linear stationarity of the first differences in these series, while estimations from Markov switching models are sensitive to the period of estimation (Chen, 2013).

approach as they focus on the event of current account reversals which are only short time intervals of the current account. As a consequence, slow and gradual current account adjustments tend to be overlooked. Moreover reversal events are treated as a dummy variable and a reversal of 5% GDP over 7 years is considered as equal to a reversal of 10% over 3 years. The problems associated with the identification of current account improvement episodes based on traditional *ad hoc* criteria are illustrated in Figure 1.1. The cases of Singapore and of Nigeria illustrate the issue of inconsistent timing as current account reversals occur up to two years earlier than what is observed for reversals of at least 3% GDP and up to one year earlier for reversals of at least 5% GDP. Understanding drivers behind these reversals may then be challenging. In addition, the case of Singapore demonstrates that excluding improvements occurring within two years of a previous one may not be sufficient to avoid counting the same improvement twice. The case of Nigeria demonstrates that the criteria of sustained reductions may not be constraining enough. Like many oil-exporting countries, Nigeria has a volatile current account balance with large but short upswings which are identified as reversals but are not sustained over a long period. Finally, in the case of Sweden, no sustained reversals are observed based on traditional *ad hoc* criteria with a threshold of 5% GDP, despite the presence of a long and gradual improvement in the current account of almost 11% GDP between 1993 and 2006.

Figure 1.1: Traditional *ad hoc* definition of current account reversals



Note: Dark grey bars correspond to *ad hoc* reversals associated to the criteria of an average current account improvement of 5% GDP. Light grey bars correspond to *ad hoc* reversals associated to an improvement of 3% GDP. When the same reversal is identified via the two criteria the upper part of the bar is dark grey and the lower part is light grey.

The purpose of this paper is to account for the magnitude of sustained current account reversals, in addition to drivers of the reversal events, while most papers focus on reversals.[5] Similarly to Le Pavec (2014), this paper uses a chronological approach. Improvement episodes start the year the current account increases after a period of deterioration and end the year before the current account deteriorates again. Like Milesi-Ferretti and Razin (1998) and Milesi-Ferretti and Razin (2000), adjacent improvement episodes occurring within two years of the previous one are considered as one single episode, provided that the trough between these two episodes is not larger than the trough preceding the first episode.[6] A similar definition is applied to episodes of current account deteriorations.

Overall episodes of current account improvements and deteriorations are numerous but less than an third of them are higher than 5% GDP and last at least 3 years, i.e. are sizeable and sustained over a long period of time (Table 1.1). Compared to other *ad hoc* definitions of current account reversals, this

[5] de Mello *et al.* (2012) simultaneously account for the magnitude and the probability of a reversal. Freund and Warnock (2005) analyse the magnitude of current account improvements, but only after 3 years.

[6] Milesi-Ferretti and Razin (1998) include a similar condition, but this does not prevent some improvements to be associated to two separate current account reversals instead of one.

definition is more constraining. For instance, in the case of Nigeria, two episodes of current account improvements are retained in the 250 sizeable and sustained episodes (1983-1985 and 2003-2005), instead of the three episodes displayed in Figure 1.1. In the case of Singapore, two episodes are retained (1981-1998 and 2001-2010), instead of four. Gradual and slow improvements like in the case of Sweden are retained conversely to papers using traditional *ad hoc* criteria, but they are more seldom. In the descriptive analysis, the episodes covered are those longer than 3 years and higher than 5% GDP. However, the empirical analysis in Section 3.5 covers the 349 and 340 episodes of current account improvements and deteriorations of at least 3 years, since the objective of these regressions is to assess what determines the magnitude of sustained current account adjustments.

Table 1.1: Episodes of current account adjustments

	Improvement episodes		**Deterioration episodes**	
Number of:	episodes	countries	episodes	countries
Total	597	128	614	128
$\geq$ 5% GDP	361	120	372	121
$\geq$ 3 years	**349**	**128**	**340**	**128**
$\geq$ 3 years, $\geq$ 5% GDP	250	118	239	117

Note: 349 episodes of current account improvements took place in 128 countries over the period 1980-2016.
Source: Author's calculations.

Exchange rate regime

Exchange rate regimes are classified according to Reinhart and Rogoff (2004) *de facto* classification and its subsequent updates in Ilzetzki *et al.* (2011) and Ilzetzki *et al.* (2017b). This classification presents several advantages compared to other classifications.

Compared to a *de jure* classification, Ilzetzki *et al.* (2017b) consider the actual rather than the official regime for a given country at a given year. Besides countries' public announcements about pegging their currencies to an anchor currency, Ilzetzki *et al.* (2017b) also use hard data on nominal exchange rates to assess their degree of stability following the announcements. Compared to other *de facto* classifications like IMF, Levy-Yeyati and Sturzenegger (2005, 2016) and Shambaugh (2004), Ilzetzki *et al.* (2017b) present three main advantages. First, they put special emphasis on identifying the relevant anchor currency, based on criteria such as the currency used in the trade invoice, the share of reserve holding in this currency and the share of a nation's external debt in this currency. Second, they account for the existence of active dual markets (official or illegal) or multiple exchange rates to gauge the true extent of exchange rate flexibility, which is particularly relevant when the difference between the official and

the parallel rate is large.[7] Third, they exclude "freely falling" regimes where the twelve-month rate of inflation exceed 40%. Other classifications lump these regimes with floating regimes, while Reinhart and Rogoff (2004) and Ilzetzki *et al.* (2017a) consider such "dysfunctional" regimes with "an utter lack of monetary control" should not be lumped with low inflation floating regimes. [8]

Their fine classification ranges the exchange rate regimes from more to less fixity using 15 categories. In this paper these 15 categories are aggregated either into 3 categories: fixed, intermediate and float.[9] A fourth category includes non classified regimes: freely falling regimes and dual market in which parallel market data is missing. Based on this classification, fixed and intermediate exchange rate regimes are the most prevalent regimes both in advanced and in emerging economies. As expected, freely falling regimes or regimes with missing data on parallel market are more widespread in emerging economies. On the contrary, float regimes are less common in these economies, which is consistent with Calvo and Reinhart (2002)'s hypothesis of their "fear of floating".

Table 1.2: Exchange rate regimes' prevalence over 1980-2016

	Countries	**Obs.**	**Incidence of exchange rate regime**			
			Fixed	Intermediate	Float	Non classified
Total	128	4,736	40%	39%	12%	9%
Advanced economies	27	999	37%	40%	22%	1%
Emerging and dev. economies	101	3,737	40%	39%	10%	11%

Note: The distinction between advanced economies and emerging and developing economies is based on IMF classification.

In most cases, current account adjustments occurred under one single exchange rate regime. However, the event of regime switching is higher the longer the adjustment. Current account adjustments under such "mixed exchange rate regimes" are classified according to the exchange rate regime of the year before the reversal occurred.[10]

[7] In the presence of multiple exchange rates or parallel markets, the focus is put on the market-determined rates instead of the official exchange rates.

[8] Reinhart and Rogoff (2004) compare bilateral exchange rates against the US dollar for two countries which are both classified as floating by the IMF: Canada after 1962 and Argentina during its hyperinflation period before 1991. The difference in magnitude is such that when Canadian dollar-US dollar exchange rate is plotted against Argentina's scale, it looks like a fixed rate. For other countries experiencing "freely falling" episodes, the bilateral exchange rate against the US dollar is more similar to Argentina's than to Canada's.

[9] See details in Table 1.C.1. Euro Area countries are listed as fixed unlike IMF and Levy-Yeyati and Sturzenegger (2005, 2016) classifications. This classification presents several advantages. First, Ilzetzki *et al.* (2017b) set their classification of exchange rate regimes at the country level and not at the currency level. Second, the monetary policy of the European Central Bank is not set in response to country-specific shock or economic condition.

[10] Edwards (2004) uses this rule to classify all his current account adjustments. Robustness checks are run in Section 1.5.3 to verify mixed exchange rate regimes have no influence on the results.

Financial and policy data

Traditional measures of financial integration include Lane and Milesi-Ferretti (2003) *de facto* indicator (sum of stock of external assets and liabilities divided by GDP) and Chinn and Ito (2008) *de jure* indicator of capital account openness. Similarly to the exchange rate regime, the *de facto* indicator of Lane and Milesi-Ferretti (2003) is privileged for the empirical analysis, while the *de jure* indicator is used as robustness check. The definition of sudden stops is based on Agosin *et al.* (2019)'s: a country experiences a sudden stop episode in a given year if the annual decline in the capital inflows is at least one standard deviation larger than the country's average and larger than 5% GDP. Like Eichengreen and Gupta (2016), capital flows only include portfolio and other liabilities, since they are the volatile component of capital flows, conversely to FDI flow.

Policy and institution data are constructed from the World Bank Doing Business database, as well as Fraser Institute database for labour market regulations and Abiad *et al.* (2008) for credit controls. Given a rather small time coverage for these variables, they are averaged over all available years to construct an indicator at the country-level that captures the long-term institutional characteristics of each country. These averaged variables are then added to the baseline specification.

1.4.2 Descriptive analysis

Figures 1.2a and 1.2b display the number of current account adjustments by exchange rate regimes and by decades. The total number of current account improvements has steadily decreased over decades, while it remained relatively stable between the 1990's and the 2000's for deteriorations. Such patterns are not observed when adjustments are restricted to longer and more sizeable ones, i.e. longer than three years and higher than 5% points of GDP. The sharp increase in the number of sustained and sizeable current account deteriorations between 2000 and 2009 reflects the consequences of the 2008-2009 crisis. Floating exchange rate regimes are less associated with long and sizeable adjustments. This is consistent with Ghosh *et al.* (2010) and Martin (2016)'s observations. Improvements under fixed exchange rate regimes are almost as frequent as those under intermediate regimes and they are more frequent for long and sizeable adjustments. These finding can be read as higher build-up of current account imbalances under fixed exchange rate regimes, which would support Friedman (1953)'s hypothesis. However, this also imply that countries under fixed exchange regimes can improve their current account balances without the support of external devaluation.

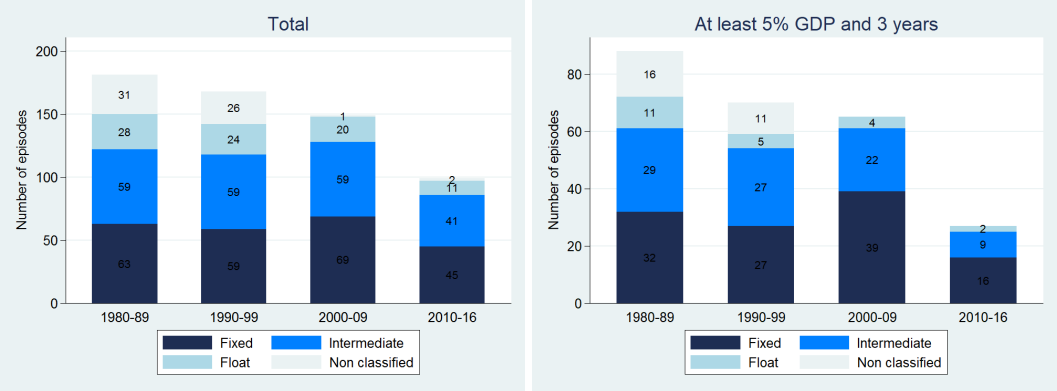
International financial integration has sharply increased in industrial economies. In emerging and developing economies, it steadily increased and has closely tracked the trend of industrial economies until the early 1990's (Figure 1.3, panel a). Since then, the gap between the two country groups has widened. The gap is even starker when the development of financial integration is compared with the

development of trade openness (panel b), as trade openness has increased more rapidly in emerging and developing countries than in industrial economies. This suggests that financial integration has a more important role in current account adjustments than trade openness in high-income countries.

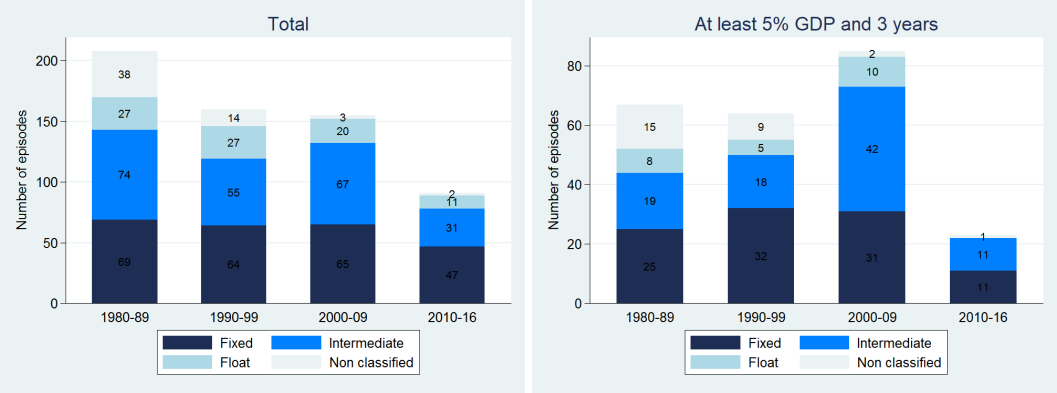
From an accounting approach, current account balances can be decomposed as the difference between savings and investment. Changes in current account balances can then driven by changes in savings and in investment, which can be directly influenced by macroeconomic and structural policies. Overall in advanced economies, current account improvements are driven by decrease in investment rather than increase in savings, conversely to emerging and developing economies. However, after periods of crises, improvements are driven by increase in savings, reflecting rise in precautionary savings and weak domestic demand. Current account deteriorations in advanced economies reflect decline in savings rather than increase in investment. In emerging and developing economies, both higher investment and lower savings pull down the current account balance, which is consistent with theories of economic development and stages of balance of payment.

Figure 1.2: Current account improvements and deteriorations, by exchange rate regime

(a) Episodes of current account improvements

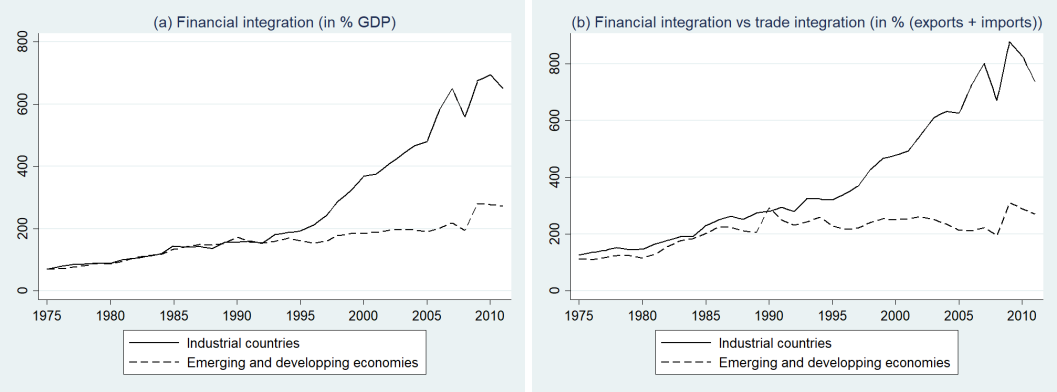


(b) Episodes of current account deteriorations



Note: Episodes are classified in a given decade based on the year of the current account reversal. If an episode of current account improvement spans 2009-2015, it will be included in the 2000-2009 decade.

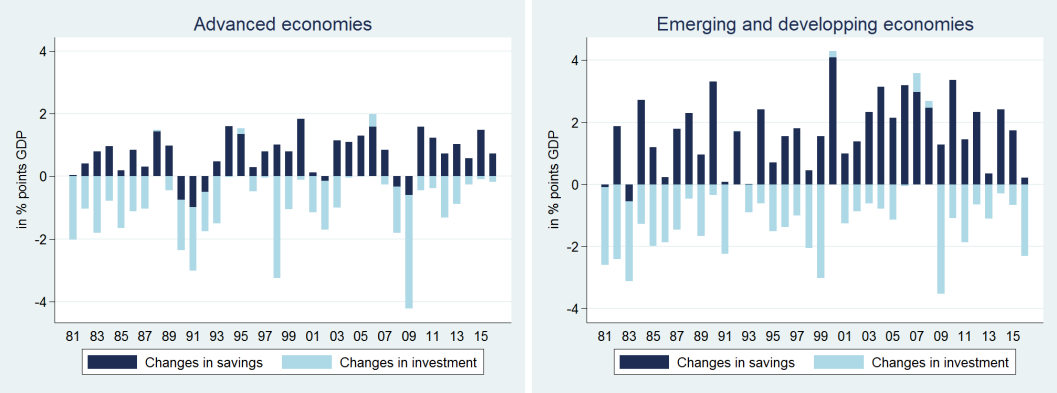
Figure 1.3: Financial vs trade integration



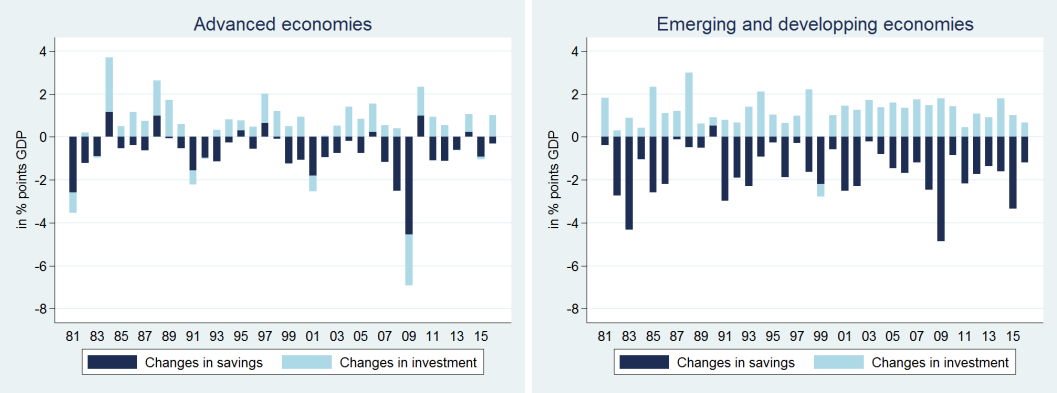
Note: Industrialised countries include long-standing OECD countries (see Annex 1.A).

Figure 1.4: Contributions of changes in savings and in investment

(a) Current account improvements



(b) Current account deteriorations



1.5 Empirical results

1.5.1 Baseline specification

Table 1.3 reports the result of the selection and of the outcome equations for episodes of current account improvements. Regimes that belong to the unclassified category are dropped in the empirical analysis. The significance of the inverse Mills ratio λ in the outcome equation confirms the validity of using a selection model to analyse the magnitude of reversals. The main results are summarised below.[11]

[11] The following variables were tested and found non-significant: ratio of investment (or saving) to GDP, domestic demand growth, changes in real exchange rate and terms of trade.

Table 1.3: Magnitude of current account improvements: Baseline specification

	(1) All	(2) $\geq$ 5% GDP	**(3) $\geq$ 3 years**	(4) $\geq$ 3 years, 5% GDP
Selection equation (marginal effects)				
Fixed ERR	-0.159***	-0.099**	**-0.068**	-0.041
	(0.056)	(0.042)	**(0.043)**	(0.034)
Float ERR	-0.072	-0.138***	**-0.068**	-0.104***
	(0.070)	(0.046)	**(0.052)**	(0.036)
Initial CAB[1]	-0.070***	-0.042***	**-0.028*****	-0.021***
	(0.006)	(0.004)	**(0.003)**	(0.002)
Trade openness[2]	0.000	0.002***	**-0.000**	0.001
	(0.001)	(0.001)	**(0.001)**	(0.000)
Relative level of income (log)[2,3]	0.163***	0.103***	**0.100*****	0.066***
	(0.033)	(0.026)	**(0.025)**	(0.020)
Financial integration (FI)[2,3]	-0.098**	-0.083**	**-0.049**	-0.049*
	(0.048)	(0.036)	**(0.033)**	(0.026)
FI $\times$ Rel. lev. income (log)[2,3,4]	0.104**	0.040	**0.094****	0.057*
	(0.039)	(0.030)	**(0.035)**	(0.030)
NFA[2]	0.001***	0.001***	**0.000***	0.000*
	(0.000)	(0.000)	**(0.000)**	(0.000)
Regional contagion[5]	0.004	0.005***	**0.004****	0.004***
	(0.003)	(0.002)	**(0.002)**	(0.001)
Regional GDP growth[2,6]	0.018	0.014	**0.003**	0.003
	(0.014)	(0.011)	**(0.011)**	(0.009)
Outcome equation: Magnitude of reversal				
Fixed ERR	-2.229*	-1.732	**-1.996**	-1.776
	(1.183)	(1.578)	**(1.867)**	(2.123)
Float ERR	-2.745*	-4.357*	**-4.706***	-7.469**
	(1.496)	(2.468)	**(2.463)**	(3.592)
Initial CAB[1]	-1.076***	-1.121***	**-1.208*****	-1.212***
	(0.091)	(0.124)	**(0.184)**	(0.196)
Trade openness[2]	0.046***	0.066***	**0.041***	0.065**
	(0.016)	(0.022)	**(0.023)**	(0.028)
Relative level of income (log)[2,3]	2.424***	2.930***	**3.720*****	3.746***
	(0.592)	(0.843)	**(1.130)**	(1.257)
Financial integration (FI)[2,3]	-2.355***	-2.594**	**-2.539****	-3.082**
	(0.797)	(1.024)	**(1.218)**	(1.393)
FI $\times$ Rel. lev. income (log)[2,3,4]	1.446**	1.115	**3.102****	3.225**
	(0.716)	(0.884)	**(1.285)**	(1.358)
NFA[2]	0.026***	0.028***	**0.022*****	0.023**
	(0.005)	(0.007)	**(0.008)**	(0.009)
Inverse Mills ratio	9.830***	11.342***	**13.791*****	14.359***
	(1.638)	(2.145)	**(4.243)**	(4.200)
Observations	645	645	**645**	645
Selected	317	191	**200**	138
Pseudo-R^2	0.34	0.33	**0.18**	0.22
AUC	0.86	0.85	**0.79**	0.81
Correctly classified	77.05%	81.24%	**73.64%**	83.41%

Note: This table reports regressions of the magnitude of current account improvements on trade and financial variables (baseline specification) using alternate definitions of current account adjustments (sizeable, sustained and both). Column (3) in bold is the reference baseline specification for the following regressions. Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

The initial current account level and the relative level of income are consistently significant across the specifications and with the expected signs for both the selection and the outcome equations. The level of the current account before the reversal has a significant and robust negative impact on both the occurrence and the magnitude of the reversal. Higher levels of deficit spur current account reversals and further improvement after the reversal, which is in line with solvency considerations, especially in the

case of "forced adjustments" of the current account in a context of financial stress and market pressure (Le Pavec, 2014).[12] As for the relative level of income, it has a positive impact on the occurrence and the magnitude of the reversal, which is consistent with the balance of payment stages hypothesis.

Countries under fixed exchange rate regimes are less likely to experience current account improvements that are short-lived. The dummy for fixed exchange rate regimes becomes not significant once a minimum duration of three years is set to current account improvements (columns 3 and 4).[13] In the case of floating exchange rate regimes, they are less associated with the occurrence of a sizeable improvements (columns 2 and 4). Once the current account has improved, the flexibility of the exchange rate has the same impact on the reversal's magnitude in the case of floating regimes, but not anymore for fixed regimes.[14] These results are consistent with Friedman (1953)'s hypothesis that flexible exchange rate promote current account adjustments before imbalances get large, especially since Ghosh *et al.* (2010) and Martin (2016) note that floating exchange rate regimes are less associated with large current account surpluses and deficits. It is also worth underlining that when it comes to sustained current account improvements, the flexibility of the exchange rate has no significant impact on their occurrence. Therefore, Euro Area countries are not put at a disadvantage to improve their current accounts in a sustained and sizeable way.

In the case of trade openness, the lack of significant results in the selection equation can reflect the ambiguous effect of trade reaction to exchange rate developments. An interpretation of the positive impact of trade openness on the magnitude of the reversal can rely on Milesi-Ferretti and Razin (1998) and Edwards (2004)'s findings about better growth performance after current account improvements in countries more open to trade. Better growth performance can in turn stimulate investment which can increase future exports and current account balance.

When included alone, financial integration has no significant impact on the occurrence or the magnitude of current account improvements. There is however evidence that financial integration has differentiated effects on current account balance depending on the level of income. Higher degree of financial integration helps poor countries get more inflows of capital and therefore sustain current account deficit, while it leads richer countries to lend more abroad (Abiad *et al.*, 2009; Ivanova, 2012). After including an interaction term between financial integration and the relative level of income, results are in line

[12] Le Pavec (2014) defines three kinds of current account adjustments. Forced adjustments include adjustments mainly driven by policies to adjust the current account after countries are put under markets pressure and financial stress. Supported adjustments include adjustments mainly driven by external factors like transfers, improvements in the terms of trade or nominal depreciation, and internal factors unrelated to government policies like the exploitation of natural resources, better meteorological conditions or recovery from political turmoil. Autonomous adjustments include adjustments driven by structural, fiscal or monetary policies, with little market pressure and little or no contribution from external factors.

[13] Results are robust for improvement episodes of at least four years.

[14] Edwards (2004) find similar results, as he observes that the probability to experience abrupt and large current account reversals is lower with flexible exchange rates.

with these findings.[15] In line with Abiad *et al.* (2009) and Ivanova (2012), NFA have a positive impact on both the occurrence and the magnitude of current account improvements. This suggests that the net investment income generated by positive NFA prevails on the incentive effect of negative NFA to improve the current account balance to preserve the long-term solvency.

Finally, regional contagion defined as the incidence of sudden stops in capital in the region (excluding the country of interest) increases the probability of current account improvements, whereas regional GDP growth has no significant effects. This result is related to Le Pavec (2014)'s definition of "forced adjustments".

1.5.2 Effects of structural policies

From a policy perspective, it is important to assess whether current account reversals will be sustained or short-lived, and whether the magnitude of the reversal will significantly narrow current account imbalances. These policies are expected to have an impact on the occurrence and the magnitude current account improvements, through investment and saving (Kerdrain *et al.*, 2010), or through increased competitiveness (Jaumotte and Sodsriwiboon, 2010). Overall, apart from variables related to financial integration, the remaining variables from the baseline specification remain significant and with the same sign. Once credit controls are added to the baseline specification, financial integration and its interaction with the relative level of income become non significant. This suggests a correlation between financial integration and credit controls.

Based on the estimates displayed in Table 1.4, policies that are positively correlated with the occurrence and magnitude of current account improvements are at odds with what is usually recommended. From a competitiveness approach, less business regulations should be recommended to decrease markups. This in turns lower domestic prices relative to foreign prices and decrease real exchange rate, and hence could lead to more sizeable improvements. However, less business regulations can also spur investment, therefore exacerbating current account deficit. In this analysis, the investment channel prevails. Countries with less business regulations, i.e. with a higher ranking in the World Bank's indicators of doing business, are associated with less sizeable improvements (column 1).[16] This is in line with Figure 1.4b which highlights the contribution of increases in investment to current account deficits. Analysing the components of the "Ease of doing business" indicators gives further details to understand this counterintuitive result. Reduced costs of starting a business – higher ranking of the indicator – spur investment, therefore reducing the probability of an improvement as well as its size (column 2). Likewise, easing trade across borders stimulates investment, as well as imports by firms that outsource part of their production to reduce their import costs. By contrast, the result on insol-

[15] Using the *de jure* indicator of Chinn and Ito (2008) leads to similar results.
[16] This result is consistent with findings from Kerdrain *et al.* (2010).

vency leads to more consensual recommendation. A strong insolvency framework can also stimulates investment and decrease improvements' occurrence and magnitude. However, in this analysis, it has a positive impact on the size and occurrence of current account improvement. This can be explained by the positive impact of such a framework on firm reallocation and hence the aggregate productivity and competitiveness. Based on a firm-level analysis Adalet McGowan *et al.* (2017a) find that a more efficient insolvency regime increases productivity, as it strengthens market selection by facilitating the exit of non-viable (and less productive) firms and the successful restructuring of viable firms, and as it helps reallocating resources trapped in these "zombie" firms to more productive firms.

Similar to results on higher financial integration in richer countries, lower credit controls increase the probability of current account improvements and their magnitude for richer countries (column 3). Kerdrain *et al.* (2010) underline this differentiated impact of financial market deregulation depending on the level of income of countries. In countries at earlier stages of financial development, lower credit controls reduce savings and stimulate investment by relaxing borrowing constraints. At later stages of financial development, considering lower credit controls reflect higher financial market development, they can be associated with higher savings, as financial market development offers broader supply of financial services which widen saving opportunities and lowers transaction costs which increases expected return rates.

In this analysis, reforms of the labour market have no significant effects on current account improvements (column 4). This results can be explained by their ambiguous effects on current account balance. On one side, stringent labour market regulations may decrease current account balance, by decreasing savings and increasing investment. Higher employment protection lowers the probability of losing jobs, which should decrease precautionary savings. In addition, it can trigger substitution of capital for labour and increase investment, as they increase labour costs, for instance by increasing dismissal costs (Cette *et al.*, 2016; Pak and Schwellnus, 2019). This increase in labour costs raises domestic prices relative to foreign prices, which lower the competitiveness. On the other side, Kerdrain *et al.* (2010) note that stringent labour market regulations may increase precautionary savings and therefore current account balance, since they increase the expected length of unemployment after dismissal.

Results hold when all institutional factors are included together, with the exception of insolvency regime which becomes non significant. Further investigations are required for fiscal and monetary policies. Changes in fiscal balance and in the discount rate were not significant. This lack of significance may be related to a problem of samples, since these variables are unavailable for numerous countries. Hence it is too early to dismiss the efficiency of fiscal consolidation and monetary tightening in improving current account balances.

Table 1.4: Magnitude of current account improvements: Effects of structural policies

	(1) ≥ 3 years	(2) ≥ 3 years	(3) ≥ 3 years	(4) ≥ 3 years	(5) ≥ 3 years	(6) ≥ 3 years
Selection equation (marginal effects)						
Fixed ERR	-0.067	-0.035	0.031	-0.004	0.032	0.053
	(0.044)	(0.044)	(0.064)	(0.048)	(0.065)	(0.067)
Float ERR	-0.068	-0.077	-0.057	-0.057	-0.040	-0.068
	(0.052)	(0.052)	(0.060)	(0.056)	(0.063)	(0.061)
Initial CAB[1]	-0.028***	-0.030***	-0.058***	-0.033***	-0.059***	-0.060***
	(0.003)	(0.003)	(0.006)	(0.003)	(0.006)	(0.006)
Trade openness[2]	-0.000	0.000	0.001	0.000	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Relative level of income (log)[2,3]	0.099***	0.082***	0.136***	0.066**	0.215***	0.200***
	(0.030)	(0.029)	(0.051)	(0.033)	(0.064)	(0.064)
Financial integration (FI)[2,3]	-0.049	-0.060*	0.049	-0.018	0.029	0.026
	(0.033)	(0.034)	(0.072)	(0.048)	(0.073)	(0.073)
FI × Rel. lev. income (log)[2,3,4]	0.094**	0.099**	-0.096	0.010	-0.078	-0.070
	(0.036)	(0.037)	(0.081)	(0.056)	(0.096)	(0.082)
NFA[2]	0.000*	0.001**	0.003***	0.001**	0.003***	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Regional contagion[5]	0.004**	0.003*	0.004*	0.003*	0.004*	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Regional GDP growth[2,6]	0.003	-0.003	0.016	0.001	0.020	0.016
	(0.011)	(0.011)	(0.014)	(0.012)	(0.014)	(0.014)
Ease of doing business ranking	**-0.000**				**0.002****	
	(0.001)				**(0.001)**	
Starting a business ranking		**0.001****				**0.001**
		(0.000)				**(0.001)**
Trading across borders ranking		**0.001**				**0.001***
		(0.001)				**(0.001)**
Resolving insolvency ranking		**-0.002*****				**-0.000**
		(0.001)				**(0.001)**
Credit controls[3]			**-0.048**		**-0.042**	**-0.033**
			(0.032)		**(0.033)**	**(0.033)**
Credit controls × Rel. lev. income (log)[2,3,4]			**0.069***		**0.077***	**0.077***
			(0.038)		**(0.042)**	**(0.042)**
Labour market regulations[3]				**0.004**	**-0.005**	**-0.014**
				(0.023)	**(0.031)**	**(0.031)**
Outcome equation: Magnitude of reversal						
Fixed ERR	-2.701	-0.388	-0.109	0.040	-0.290	0.513
	(1.726)	(1.606)	(1.273)	(1.788)	(1.086)	(1.126)
Float ERR	-3.947*	-3.976*	-2.301	-5.000**	-1.268	-1.769
	(2.271)	(2.164)	(1.431)	(2.396)	(1.237)	(1.272)
Initial CAB[1]	-1.131***	-1.129***	-1.072***	-1.216***	-0.951***	-1.084***
	(0.172)	(0.162)	(0.306)	(0.182)	(0.248)	(0.265)
Trade openness[2]	0.044**	0.058***	0.068***	0.050**	0.078***	0.082***
	(0.021)	(0.021)	(0.017)	(0.025)	(0.014)	(0.015)
Relative level of income (log)[2,3]	5.021***	4.297***	1.254	3.761***	2.625*	2.820*
	(1.148)	(1.014)	(1.327)	(1.064)	(1.429)	(1.447)
Financial integration (FI)[2,3]	-2.058*	-2.171*	0.932	-2.444**	0.564	0.060
	(1.129)	(1.112)	(1.448)	(1.227)	(1.237)	(1.271)
FI × Rel. lev. income (log)[2,3,4]	2.857**	2.912***	-3.061	1.902	-2.486	-1.430
	(1.179)	(1.111)	(2.043)	(1.205)	(1.709)	(1.765)
NFA[2]	0.020***	0.020***	0.051**	0.021**	0.041**	0.036*
	(0.008)	(0.008)	(0.024)	(0.009)	(0.019)	(0.020)
Ease of doing business ranking	**0.049****				**0.045*****	
	(0.020)				**(0.014)**	
Starting a business ranking		**0.060*****				**0.035*****
		(0.019)				**(0.013)**
Trading across borders ranking		**0.051*****				**0.040*****
		(0.019)				**(0.012)**
Resolving insolvency ranking		**-0.055****				**-0.024**
		(0.024)				**(0.015)**
Credit controls[3]			**-0.423**		**-0.041**	**0.191**
			(0.711)		**(0.594)**	**(0.601)**
Credit controls × Rel. lev. income (log)[2,3,4]			**1.563***		**1.794****	**1.917****
			(0.882)		**(0.771)**	**(0.778)**
Labour market regulations[3]				**1.127**	**-0.711**	**-1.043***
				(0.889)	**(0.565)**	**(0.570)**
Inverse Mills ratio	12.593***	11.976***	7.075**	13.181***	5.314**	6.014**
	(3.926)	(3.485)	(2.932)	(4.005)	(2.370)	(2.495)
Observations	645	645	412	567	412	412
Selected	200	200	135	181	135	135
Pseudo-R^2	0.18	0.20	0.26	0.19	0.27	0.28
AUC	0.79	0.79	0.83	0.82	0.84	0.84
Correctly classified	73.64%	76.28%	76.94%	73.90%	77.67%	77.67%

Note: This table reports regressions of the magnitude of current account improvements on structural policies (in bold). Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

1.5.3 Extensions and robustness checks

Asymmetries in current account reversals

To shed light on potential asymmetrical behaviour between current account improvements and deteriorations, the same model specifications are applied to estimate the probability of deteriorations and their magnitude. Overall, results on improvement episodes hold for deterioration episodes with an symmetrical effects (Tables 1.5 and 1.6). However, the significance of some variables is driven only by improvement episodes. For instance, the relative level of income is not consistently significant for deterioration episodes in the selection and in the outcome equation. As for trade openness and insolvency regime they have no significant impact on deterioration episodes. Interestingly, the flexibility of the exchange rate regime has no impact on the occurrence and the size of current account deteriorations.

These findings highlight that the occurrence and the size of current account improvements and of current account deteriorations are driven by different macroeconomic, external, financial and institutional factors and current account deteriorations differ. Further investigations are needed to identify drivers of current account deteriorations. Especially, alternate indicators of regional contagion in the excluded variables are needed. Regional contagion defined as the incidence of sudden stops has also no impact on the occurrence of deterioration. This does not come as a surprise since sudden stops act as a pressure to improve the current account balance.

Table 1.5: Magnitude of current account deteriorations: Baseline specification

	(1) All	(2) $\geq$ 5% GDP	**(3) $\geq$ 3 years**	(4) $\geq$ 3 years, 5% GDP
Selection equation (marginal effects)				
Fixed ERR	0.159***	0.152***	**0.037**	0.053
	(0.056)	(0.047)	**(0.044)**	(0.035)
Float ERR	0.072	0.004	**-0.042**	-0.049
	(0.070)	(0.060)	**(0.052)**	(0.039)
Initial CAB[1]	0.070***	0.044***	**0.031*** **	0.023***
	(0.006)	(0.004)	**(0.003)**	(0.002)
Trade openness[2]	-0.000	0.002***	**-0.000**	0.001
	(0.001)	(0.001)	**(0.001)**	(0.000)
Relative level of income (log)[2,3]	-0.163***	-0.135***	**-0.035**	-0.055***
	(0.033)	(0.025)	**(0.025)**	(0.019)
Financial integration (FI)[2,3]	0.098**	0.026	**0.025**	0.013
	(0.048)	(0.036)	**(0.036)**	(0.026)
FI $\times$ Rel. lev. income (log)[2,3,4]	-0.104**	-0.099**	**-0.019**	-0.034
	(0.039)	(0.038)	**(0.035)**	(0.031)
NFA[2]	-0.001***	-0.001**	**-0.001*** **	-0.001***
	(0.000)	(0.000)	**(0.000)**	(0.000)
Regional contagion[5]	-0.004	-0.001	**-0.002**	-0.001
	(0.003)	(0.002)	**(0.002)**	(0.002)
Regional GDP growth[2,6]	-0.018	-0.010	**-0.015**	-0.006
	(0.014)	(0.011)	**(0.011)**	(0.008)
Outcome equation: Magnitude of reversal				
Fixed ERR	5.054***	7.447***	**4.891**	8.200
	(1.763)	(2.705)	**(4.677)**	(6.341)
Float ERR	0.684	-0.220	**-3.840**	-6.429
	(2.214)	(3.492)	**(6.109)**	(8.821)
Initial CAB[1]	1.466***	1.712***	**2.515*** **	2.861**
	(0.202)	(0.318)	**(0.899)**	(1.178)
Trade openness[2]	0.031	0.064*	**-0.001**	0.079
	(0.023)	(0.033)	**(0.060)**	(0.076)
Relative level of income (log)[2,3]	-3.017***	-4.279***	**-3.201**	-6.618
	(0.945)	(1.641)	**(2.517)**	(4.332)
Financial integration (FI)[2,3]	0.963	0.236	**2.307**	1.628
	(1.330)	(1.762)	**(3.649)**	(4.143)
FI $\times$ Rel. lev. income (log)[2,3,4]	-4.137***	-5.006***	**-4.118**	-5.383
	(1.274)	(1.789)	**(3.873)**	(4.644)
NFA[2]	-0.021*	-0.019	**-0.058**	-0.065
	(0.011)	(0.014)	**(0.046)**	(0.055)
Inverse Mills ratio	15.135***	18.584***	**36.259****	39.694*
	(3.194)	(4.705)	**(17.322)**	(20.277)
Observations	645	645	**645**	645
Selected	328	201	**209**	139
Pseudo-R^2	0.34	0.32	**0.18**	0.22
AUC	0.86	0.86	**0.80**	0.83
Correctly classified	77.05%	80.93%	**70.85**%	80.00%

Note: This table reports regressions of the magnitude of current account deteriorations on trade and financial variables (baseline specification) using alternate definitions of current account adjustments (sizeable, sustained and both). Column (3) in bold is the reference baseline specification for the following regressions. Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

Table 1.6: Magnitude of current account deteriorations: Effects of structural policies

	(1) ≥ 3 years	(2) ≥ 3 years	(3) ≥ 3 years	(4) ≥ 3 years	(5) ≥ 3 years	(6) ≥ 3 years
Selection equation (marginal effects)						
Fixed ERR	0.063	0.039	0.008	0.001	0.023	0.004
	(0.045)	(0.045)	(0.062)	(0.048)	(0.063)	(0.064)
Float ERR	-0.054	-0.036	-0.066	-0.056	-0.095	-0.084
	(0.051)	(0.052)	(0.060)	(0.055)	(0.059)	(0.060)
Initial CAB[1]	0.032***	0.032***	0.037***	0.032***	0.040***	0.041***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)
Trade openness[2]	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Relative level of income (log)[2,3]	-0.082***	-0.095***	-0.010	-0.046	-0.065	-0.108*
	(0.030)	(0.031)	(0.048)	(0.031)	(0.061)	(0.062)
Financial integration (FI)[2,3]	0.022	0.020	-0.033	0.045	-0.035	-0.028
	(0.036)	(0.036)	(0.070)	(0.046)	(0.072)	(0.072)
FI × Rel. lev. income (log)[2,3,4]	-0.034	-0.036	0.082	-0.023	0.082	0.078
	(0.038)	(0.039)	(0.092)	(0.052)	(0.098)	(0.100)
NFA[2]	-0.001***	-0.001***	-0.002**	-0.001	-0.002**	-0.002**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Regional contagion[5]	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Regional GDP growth[2,6]	-0.017*	-0.016	-0.003	-0.015	-0.008	-0.013
	(0.011)	(0.011)	(0.014)	(0.012)	(0.014)	(0.014)
Ease of doing business ranking	**-0.001*** **				**-0.001****	
	(0.000)				**(0.001)**	
Starting a business ranking		**-0.000**				**0.000**
		(0.000)				**(0.001)**
Trading across borders ranking		**-0.001****				**-0.001**
		(0.001)				**(0.001)**
Resolving insolvency ranking		**-0.000**				**-0.002***
		(0.001)				**(0.001)**
Credit controls[3]			**0.017**		**0.008**	**0.007**
			(0.033)		**(0.033)**	**(0.034)**
Credit controls × Rel. lev. income (log)[2,3,4]			**-0.043**		**-0.062***	**-0.063***
			(0.033)		**(0.035)**	**(0.036)**
Labour market regulations[3]				**0.015**	**0.048**	**0.057***
				(0.023)	**(0.030)**	**(0.031)**
Outcome equation: Magnitude of reversal						
Fixed ERR	4.471	3.582	0.868	0.841	1.240	0.770
	(4.284)	(4.259)	(2.887)	(4.901)	(2.470)	(2.271)
Float ERR	-4.217	-2.530	-1.794	-4.129	-2.265	-1.459
	(5.196)	(5.382)	(3.801)	(6.176)	(3.351)	(2.852)
Initial CAB[1]	2.272***	2.439***	1.560	2.606***	1.431*	1.405*
	(0.776)	(0.824)	(1.090)	(0.950)	(0.829)	(0.717)
Trade openness[2]	0.001	-0.007	-0.033	-0.059	-0.039	-0.038
	(0.051)	(0.054)	(0.046)	(0.069)	(0.044)	(0.036)
Relative level of income (log)[2,3]	-3.310	-4.741	-3.474	-4.700	-3.830	-5.062*
	(3.061)	(3.464)	(2.225)	(3.090)	(2.533)	(2.617)
Financial integration (FI)[2,3]	1.882	1.434	1.421	4.602	1.311	1.926
	(3.029)	(3.147)	(3.513)	(4.456)	(2.912)	(2.672)
FI × Rel. lev. income (log)[2,3,4]	-4.082	-3.792	-0.058	-5.030	-0.291	-0.980
	(3.351)	(3.551)	(5.958)	(5.879)	(4.779)	(4.312)
NFA[2]	-0.049	-0.054	-0.039	-0.037	-0.032	-0.030
	(0.038)	(0.040)	(0.063)	(0.060)	(0.047)	(0.043)
Ease of doing business ranking	**-0.012**				**-0.019**	
	(0.056)				**(0.042)**	
Starting a business ranking		**-0.024**				**0.007**
		(0.047)				**(0.025)**
Trading across borders ranking		**-0.083**				**-0.032**
		(0.060)				**(0.031)**
Resolving insolvency ranking		**0.044**				**-0.020**
		(0.058)				**(0.044)**
Credit controls[3]			**0.536**		**0.260**	**0.080**
			(1.607)		**(1.282)**	**(1.208)**
Credit controls × Rel. lev. income (log)[2,3,4]			**-2.480**		**-2.783**	**-2.622**
			(2.411)		**(2.238)**	**(1.952)**
Labour market regulations[3]				**1.844**	**1.580**	**1.576**
				(2.297)	**(1.447)**	**(1.349)**
Inverse Mills ratio	30.373**	31.546**	16.854	35.754*	13.914	12.758
	(14.095)	(14.447)	(16.954)	(18.468)	(11.957)	(10.092)
Observations	645	645	412	567	412	412
Selected	209	209	139	190	139	139
Pseudo-R^2	0.19	0.19	0.15	0.16	0.16	0.17
AUC	0.80	0.80	0.78	0.79	0.78	0.79
Correctly classified	71.47%	72.258%	72.82%	70.02%	72.33%	72.09%

Note: This table reports regressions of the magnitude of current account deteriorations on structural policies (in bold). Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

Table 1.7: Magnitude of current account improvements ($\geq$ 3 years): Robustness to sample selection

	(1) All	(2) excl. fuel	(3) excl. SST	(4) excl. mixed ERR
Selection equation (marginal effects)				
Fixed ERR	0.053	0.057	0.052	0.034
	(0.067)	(0.070)	(0.067)	(0.062)
Float ERR	-0.068	-0.063	-0.073	-0.090*
	(0.061)	(0.066)	(0.061)	(0.052)
Initial CAB[1]	-0.060***	-0.067***	-0.060***	-0.051***
	(0.006)	(0.007)	(0.006)	(0.006)
Trade openness[2]	0.001*	0.001	0.002*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Relative level of income (log)[2,3]	0.200***	0.209***	0.202***	0.173***
	(0.064)	(0.069)	(0.064)	(0.057)
Financial integration (FI)[2,3]	0.026	0.043	0.019	0.002
	(0.073)	(0.076)	(0.074)	(0.066)
FI $\times$ Rel. lev. income (log)[2,3,4]	-0.070	-0.082	-0.071	-0.029
	(0.082)	(0.089)	(0.083)	(0.074)
NFA[2]	0.003***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Regional contagion[5]	0.004*	0.004**	0.004*	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Regional GDP growth[2,6]	0.016	0.022	0.015	0.009
	(0.014)	(0.015)	(0.014)	(0.013)
Starting a business ranking	0.001	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Trading across borders ranking	0.001*	0.001	0.001**	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Resolving insolvency ranking	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Credit controls[3]	-0.033	-0.046	-0.039	-0.022
	(0.033)	(0.035)	(0.034)	(0.030)
Credit controls $\times$ Rel. lev. income (log)[2,3,4]	0.077*	0.080*	0.078*	0.065
	(0.042)	(0.044)	(0.043)	(0.042)
Labour market regulations[3]	-0.014	-0.020	-0.010	-0.014
	(0.031)	(0.033)	(0.031)	(0.029)
Outcome equation: Magnitude of reversal				
Fixed ERR	0.513	0.814	0.534	0.901
	(1.126)	(0.842)	(1.170)	(1.228)
Float ERR	-1.769	-1.683*	-1.917	-2.955**
	(1.272)	(0.976)	(1.341)	(1.388)
Initial CAB[1]	-1.084***	-0.955***	-1.116***	-1.110***
	(0.265)	(0.182)	(0.282)	(0.264)
Trade openness[2]	0.082***	0.075***	0.084***	0.069***
	(0.015)	(0.011)	(0.016)	(0.017)
Relative level of income (log)[2,3]	2.820*	1.489	3.042**	3.022**
	(1.447)	(1.066)	(1.543)	(1.450)
Financial integration (FI)[2,3]	0.060	0.197	-0.152	-0.953
	(1.271)	(0.931)	(1.351)	(1.248)
FI $\times$ Rel. lev. income (log)[2,3,4]	-1.430	-1.856	-1.296	0.157
	(1.765)	(1.307)	(1.851)	(1.762)
NFA[2]	0.036*	0.042***	0.037*	0.037*
	(0.020)	(0.015)	(0.021)	(0.019)
Starting a business rank	0.035***	0.023**	0.034**	0.025**
	(0.013)	(0.010)	(0.013)	(0.013)
Trading rank	0.040***	0.022**	0.042***	0.042***
	(0.012)	(0.010)	(0.014)	(0.013)
Resolving insolvency rank	-0.024	-0.027**	-0.026	-0.033**
	(0.015)	(0.011)	(0.016)	(0.015)
Credit controls[3]	0.191	0.020	0.088	0.191
	(0.601)	(0.456)	(0.656)	(0.620)
Credit controls $\times$ Rel. lev. income[2,3,4]	1.917**	1.735***	1.999**	1.725**
	(0.778)	(0.567)	(0.821)	(0.734)
Labour market regulations[3]	-1.043*	-0.945**	-0.987*	-0.939
	(0.570)	(0.435)	(0.593)	(0.605)
Inverse Mills ratio	6.014**	3.237*	6.249**	5.246**
	(2.495)	(1.682)	(2.628)	(2.422)
Observations	**412**	**390**	**408**	**374**
Selected	**135**	**128**	**133**	**101**
Pseudo-R^2	0.28	0.29	0.27	0.27
AUC	0.84	0.84	0.83	0.84
Correctly classified	77.67%	78.21%	77.45%	79.14%

Note: This table reports regressions of the magnitude of current account improvements on structural policies over restricted samples (columns (2) to (4)) to test the robustness of the coefficients assessed in column (6) of Table 1.4 (reported in column (1) as a reminder). Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

Sample selection

In this section, the robustness of the results from Table 1.4 to the selection of specific samples of countries or observations are tested. Column 1 of Table 1.7 is a reminder of the previous results estimated on the full sample of countries and observations (column 6 of Table 1.4).

The sample of countries for results in column 2 of Table 1.7 excludes fuel exporters exporters[17] as their external position heavily depends on specific factors such as oil prices. For column 3, the sample excludes small states[18] which are sensitive to external factors, foreign aid or coordinated relief programs (Le Pavec, 2014; Martin, 2016). For column 4, episodes under mixed exchange rate regimes are dropped, as Martin (2016) underlined potential reverse causality between current account developments and switch in exchange rate regimes.

Results displayed in column 1 are robust to different samples of countries and observations and the estimated coefficients are quantitatively similar

Emergency and exchange rate devaluation

In reference to Le Pavec (2014), so far only autonomous adjustments driven by structural policies have been analysed. In this section, "forced adjustment" driven by market pressure and "supported adjustments" driven by exchange rate devaluation are analysed in Table 1.4.

Le Pavec (2014) points to countries under fixed peg regimes experiencing "forced adjustments" of their current account in a context of financial stress and market pressure. This is in line with Alesina *et al.* (2006) who find that stabilization of increasing budget deficits occur in time of crisis. In the case of current account imbalances, crises can be reflected in a persistent the reversal. Freund and Warnock (2005) define persistent deficits as deficits that lasted at least five years before reversal. Edwards (2005) uses a similar definition for persistently high deficits, where high deficits are defined as deficits that are in the 10th percentile of the distribution of countries from the same region as the reference country in a given year. In this analysis, the definition of persistently high deficit is maintained, but the threshold to define high deficits is lowered to the 25th percentile of countries' distribution in a given year. A country with a current account deficit of 10% GDP before increases the probability to experience a sustained current improvement by 40% if the deficit is not considered as high in the country's region, by 54% ($4.0\% \times 10 + 1.4\% \times 10 - 0.054$) if the deficit is high (column 2) and by 50% ($3.5\% \times 10 + 1.5\% \times 10 + 0.173$) if the deficit is persistently high (column 3). Once the current account has improved, the fact that the deficit before reversal was high or persistently high has no impact on the

[17] Fuel exporters are defined as countries whose average share of fuel exports over their total exports is higher than the 90th percentile of the countries' distribution

[18] Based on the World Bank's classification.

size of the improvement. This suggests that for countries with high deficits, current account adjustments may be abrupt rather than gradual.

Alternate indicators of market pressure were considered but their effects were not significant. For instance, low levels of foreign exchange reserves may also trigger current account improvements, since countries with low levels of reserves will have more difficulties to sustain large current account deficits and get lending from foreign investors (Milesi-Ferretti and Razin, 2000).[19] Sudden stops in capital inflows can pressure countries into narrowing their external deficits.[20].

In an attempt to assess the impact of nominal exchange rate devaluation on the occurrence and the size of current account improvement, the classification of exchange rate regimes distinguish fixed regimes where the exchange rate devalued against its anchor currency by at least 2% the year before or during the reversal (and re-valuated by at least 2% in the case of deteriorations) and fixed regimes with no or negligible currency fluctuation. The probability of a current account balance to improve is lower under fixed regimes with no devaluation, while it is not significantly different from intermediate regimes in the case of fixed regimes with devaluation. While it is tempting to conclude that devaluation improves the probability of current account to improve in a sustained, this result needs to be taken with some grain of salt. As mentioned by Frieden (2015), it is difficult to interpret observed currency development as the result of a purposive currency policy by the government. An expansionary monetary policy or a restrictive fiscal policy can also lead to exchange rate devaluation as they lower interest rate and decrease foreign capital inflows. Further investigation to check the origin of the exchange rate devaluation is required.

[19] Under perfect capital mobility, a central bank of a country under fixed regime could sell domestic assets from its porfolio and attract the required foreign exchange reserves to keep the currency peg (Obstfeld, 1994). This can explain the lack of significant results regarding levels or changes in levels of reserves.

[20] Edwards (2005) finds that sudden stop of capital inflow tend to occur before or at the same time as current account improvements.

Table 1.8: Magnitude of current account improvements: Emergency and devaluation

	(1) $\geq$ 3 years	(2) $\geq$ 3 years	(3) $\geq$ 3 years	(4) $\geq$ 3 years
Selection equation (marginal effects)				
Fixed ERR	-0.068	-0.064	-0.078*	
	(0.043)	(0.041)	(0.042)	
Fixed ERR - $abs(\Delta e) > 2\%$				**0.117**
				(0.120)
Fixed ERR - other				**-0.089****
				(0.043)
Float ERR	-0.068	-0.070	-0.080	-0.067
	(0.052)	(0.050)	(0.050)	(0.052)
Initial CAB[1]	-0.028***	-0.040***	-0.035***	-0.028***
	(0.003)	(0.004)	(0.003)	(0.003)
Trade openness[2]	-0.000	-0.000	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Relative level of income (log)[2,3]	0.100***	0.119***	0.111***	0.095***
	(0.025)	(0.024)	(0.025)	(0.025)
Financial integration (FI)[2,3]	-0.049	-0.050	-0.034	-0.047
	(0.033)	(0.032)	(0.033)	(0.033)
FI $\times$ Rel. lev. income (log)[2,3,4]	0.094**	0.101**	0.090**	0.093**
	(0.035)	(0.037)	(0.035)	(0.035)
NFA[2]	0.000*	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Regional contagion[5]	0.004**	0.004**	0.004**	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
Regional GDP growth[2,6]	0.003	0.007	0.005	0.000
	(0.011)	(0.010)	(0.010)	(0.011)
Dummy high deficit		**-0.054**		
		(0.059)		
Initial CAB[1] $\times$ Dummy high deficit		**0.014****		
		(0.005)		
Dummy persistently high deficit (5 years)			**0.173**	
			(0.119)	
Initial CAB[1] $\times$ Dummy persistently high deficit			**0.015****	
			(0.006)	
Outcome equation: Magnitude of reversal				
Fixed ERR	-1.996	-1.547	-1.731	
	(1.867)	(1.427)	(1.521)	
Fixed ERR - $abs(\Delta e) > 2\%$				**2.104**
				(3.941)
Fixed ERR - other				**-2.507**
				(2.497)
Float ERR	-4.706*	-3.911**	-3.825*	-4.662*
	(2.463)	(1.908)	(1.970)	(2.497)
Initial CAB[1]	-1.208***	-0.917***	-0.981***	-1.215***
	(0.184)	(0.316)	(0.242)	(0.186)
Trade openness[2]	0.041*	0.041**	0.047**	0.042*
	(0.023)	(0.018)	(0.019)	(0.024)
Relative level of income (log)[2,3]	3.720***	2.942***	2.957***	3.689***
	(1.130)	(1.061)	(0.996)	(1.135)
Financial integration (FI)[2,3]	-2.539**	-2.268**	-2.524***	-2.498**
	(1.218)	(0.939)	(0.932)	(1.238)
FI $\times$ Rel. lev. income (log)[2,3,4]	3.102**	2.540**	2.596**	3.139**
	(1.285)	(1.099)	(1.045)	(1.307)
NFA[2]	0.022***	0.020***	0.023***	0.022***
	(0.008)	(0.006)	(0.006)	(0.009)
Dummy high deficit		**-6.570*****		
		(2.007)		
Initial CAB[1] $\times$ Dummy high deficit		**-0.314**		
		(0.247)		
Dummy persistently high deficit (5 years)			**-3.938**	
			(3.152)	
Initial CAB[1] $\times$ Dummy persistently high deficit			**-0.221**	
			(0.216)	
Inverse Mills ratio	13.791***	9.630***	10.031***	14.016***
	(4.243)	(3.594)	(3.729)	(4.270)
Observations	645	645	645	645
Selected	200	200	200	200
Pseudo-R^2	0.18	0.20	0.20	0.18
AUC	0.79	0.81	0.79	0.79
Correctly classified	73.64%	74.42%	76.12%	73.95%

Note: This table reports regressions of the magnitude of current account improvements on indicators of market pressure measured by high level of current account deficit and external support measured by nominal devaluation. Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. [1] Level before reversal; [2] Averaged over 3 years before reversal; [3] Deviation from a PPP GDP-weighted sample average; [4] Estimated using Norton *et al.* (2004)'s method; [5] Incidence of sudden stops in the region during or the year before reversal; [6] Relative to the world GDP growth.

1.6 Concluding remarks

From a policy perspective, it is important to assess whether current account improvements will be sustained and sizeable. The objective of this paper is to identify determinants of both the occurrence and magnitude of current account adjustments that last at least three years. Overall, exchange rate flexibility matters for short and small current account adjustments, which is in line with Ghosh *et al.* (2010)'s findings. Countries under fixed exchange rate regimes are not penalised by the rigidity of their exchange rate to raise their current account balance in a sustained and sizeable way. In line with the existing literature, high financial integration in the case of high-level income countries, high net foreign asset position and high trade openness are more important determinants of the occurrence and magnitude of sustained improvements. High level of current account deficits put more pressure on countries to improve their current account balance, but the adjustment may be abrupt and with more painful consequences on growth.

The analysis of most structural policies leads to interpretation at odds with the usual policy recommendations. More stringent business regulations are associated with a higher occurrence and magnitude of current account improvements. While business deregulation can lead to more competitiveness, which can improve the current account balance, it can also spur more investment, which deteriorates the current account balance. However, as underlined by Ivanova (2012), reducing current account balances is not the only objective of policy makers. Liberalising the economy can lead to higher economic growth and lower wage inequality. Less stringent policies can also better attract foreign capital, which would then contribute to lower the current account balance. As for financial reforms, they have differentiated effects on countries depending on their level of income, as it is the case with financial integration. The effects is positive for less stringent credit controls. The lack of significant or robust results for labour market and macroeconomic policies may reflect a problem of sample coverage rather than a lack of effects on sustained and sizeable current account improvements.

Data availability and comparability over a long period is the main constraint in the assessment of structural and macroeconomic policies. This does not undermine the importance of resorting to such policies to reduce current account imbalances. An event-approach like in Le Pavec (2014) could complement econometric analyses. Further investigation is needed to identify determinants of occurrence and magnitude of sustained current account deteriorations, which seem to differ from those of current account improvements. Finally, structural and macroeconomic policies may have differentiated effects on current account balance depending on the time horizon, e.g. less stringent business regulations may decrease the current balance in the short-term by stimulating investment, but increase the current balance in the long-term by improving productivity and competitiveness. However, this analysis is beyond the scope of this paper.

Appendix

1.A List of the countries

Industrial countries (long-standing OECD countries)			
Australia	France	Japan	Sweden
Austria	Germany	Netherlands	Switzerland
Belgium	Greece	New Zealand	United Kingdom
Canada	Iceland	Norway	United States
Denmark	Ireland	Portugal	
Finland	Italy	Spain	
Latin America and the Caribbean			
Antigua & Barbuda	Colombia	Guyana	Peru
Argentina	Costa Rica	Haiti	St. Kitts & Nevis
Bahamas, The	Dominica	Honduras	St. Lucia
Barbados	Dominican Rep.	Jamaica	St. Vincent & the Grenadines
Belize	Ecuador	Mexico	Suriname
Bolivia	El Salvador	Nicaragua	Trinidad & Tobago
Brazil	Grenada	Panama	Uruguay
Chile	Guatemala	Paraguay	Venezuela
Asia			
Bangladesh	Kiribati	Nepal	Singapore
China	Korea	Pakistan	Sri Lanka
Hong Kong	Lao PDR	Papua New Guinea	Thailand
India	Malaysia	Philippines	Vietnam
Indonesia	Maldives	Samoa	
Sub-Saharan Africa			
Angola	Congo, Dem. Rep.	Kenya	Sao Tome & Principe
Benin	Congo, Rep.	Lesotho	Senegal
Botswana	Cote d'Ivoire	Madagascar	South Africa
Burkina Faso	Ethiopia	Malawi	Sudan
Burundi	Gabon	Mali	Swaziland
Cameroon	Gambia, The	Mauritius	Tanzania
Central African Rep.	Ghana	Niger	Togo
Chad	Guinea	Nigeria	Uganda
Comoros	Guinea-Bissau	Rwanda	Zambia
Middle East and North Africa			
Algeria	Israel	Libya	Saudi Arabia
Egypt, Arab Rep.	Jordan	Morocco	Tunisia
Iran, Islamic Rep.	Lebanon	Qatar	United Arab Emirates
Eastern Europe and central Asia			
Albania	Cyprus	Poland	Turkey
Bulgaria	Hungary	Romania	

1.B Data sources and description

Variable	Description	Source
Current account balance	Defined in per cent of GDP	IMF WEO October 2017
Exchange rate regime	Fixed, intermediate and floating exchange rate regime (see Table 1.C.1)	Ilzetzki *et al.* (2017b)
Level of income	GDP per capita (constant USD, PPP)	IMF WEO October 2017
Trade openness	Sum of exports and imports (% GDP)	World Development Indicators
Financial integration	Sum of the stocks of external assets and liabilities (% GDP)	Lane and Milesi-Ferretti (2003, 2007)
Sudden stop	Dummy equal to one if the annual decline in the capital inflows is at least one standard deviation larger than its average and if this decline is larger than 5 % GDP, with capital inflows defined as portfolio and other liabilities	IMF BOP; Author's calculation
Regional contagion	Incidence of sudden stops in the region excluding the reference country (see Annex 1.A for the list of countries by region)	IMF BOP; Author's calculation
Regional GDP growth	GDP growth rates (constant prices, %)	IMF WEO October 2017
Ease of doing business	Country ranking (1 = most business-friendly regulations)	World Bank Doing Business
Starting a business	Country ranking (1 = smallest number of procedures with lowest time and costs and lowest paid-in minimum capital requirement)	World Bank Doing Business
Trading across borders	Country ranking Country ranking (1 = lowest time and costs to export and import)	World Bank Doing Business
Resolving insolvency	Country ranking (1 = highest recovery rate and strength of insolvency framework)	World Bank Doing Business
Credit controls	Index from 0 to 3 from fully repressed to fully liberalised, based on information on reserve requirements and credit ceilings	Abiad *et al.* (2008)
Labour market regulations	Index based on wage settings, conditions of hiring and firing and conscription; higher index means less regulations	Fraser Institute
High deficit	Dummy equal to one if the current account deficit is in the 25th percentile of the country's region in a given year	IMF WEO October 2017; Author's calculation
Persistently high deficit	Dummy equal to one if the current account deficit is defined as high for at least 5 consecutive years	IMF WEO October 2017; Author's calculation

1.C Additional information on exchange rate regimes

Table 1.C.1: Classification of exchange rate regimes

Ilzetzki *et al.* (2017b) classification	**3-way classification**
(1) No separate legal tender or currency union (2) Pre announced peg or currency board arrangement (3) Pre announced horizontal band $\leq \pm 2\%$ (4) De facto peg	Fixed
(5) Pre announced crawling peg (6) Pre announced crawling or de facto horizontal band $\leq \pm 2\%$ (7) De facto crawling peg (8) De facto crawling band $\leq \pm 2\%$ (9) Pre announced crawling band $\geq \pm 2\%$ (10) De facto crawling band $\leq \pm 5\%$ (11) Moving band $\leq \pm 2\%$	Intermediate
(12) De facto moving band $\pm 5\%$ / Managed floating (13) Freely floating	Float
(14) Freely falling (15) Dual market in which parallel market data is missing	Non classified

Note: Freely falling regimes are regimes where the twelve-month rate of inflation exceed 40%.

Countries pegged to the US dollar: Albania (1994,1995,1998), Algeria (1980-1993, 1999-2016), Angola, Antigua and Barbuda, Argentina, Australia (1980-1983), Bangladesh (1983-2016), Barbados, Belize, Bolivia, Brazil, Burundi, Canada, Chile, China, Colombia, Costa Rica, Democratic Republic of the Congo, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Ghana, Greece (1980-1984), Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, Hong Kong SAR, India, Indonesia, Islamic Republic of Iran, Israel, Italy (1980-1982), Jamaica, Jordan (1989-2016), Kenya (1994-2016), Korea, LAP P.D.R., Lebanon, Libya, Madagascar (1996-2016), Malawi (1995-1997, 2000-2016), Malaysia, Maldives, Mauritius, Mexico, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland (1993-1994), Qatar, Rwanda, Samoa, Saudi Arabia, South Africa, Spain (1980), Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Switzerland (1980-1981), Sao Tome and Principe, Tanzania, Thailand, The Bahamas, The Gambia (1987-2016), Trinidad and Tobago, Turkey (1981-1983, 2003-2016), Uganda (1987-1989, 1993-2016), United Arab Emirates, Uruguay, Venezuela, Vietnam, Zambia (2002-2016).

Countries pegged to the Euro: Albania (1999-2016), Benin (1999-2016), Bulgaria (1999-2016), Burkina Faso (1999-2016), Cameroon (1999-2016), Central African Republic (1999-2016), Chad (1999-2016), Comoros (1999-2016), Cote d'Ivoire (1999-2016), Denmark (1999-2016), Gabon (1999-2016), Guinea-Bissau (1999-2016), Hungary (1999-2016), Iceland (1999-2016), Mali (1999-2016), Morocco (1999-2016), Niger (1999-2016), Norway (1999-2016), Poland (1999-2016), Republic of Congo (1999-2016), Romania (2001-2016), Senegal (1999-2016), Sweden (1999-2016), Switzerland (1999-2016), Togo (1999-2016), Tunisia (1999-2016), Turkey (1999-2000), United Kingdom (1999-2008).

Countries pegged to the German Mark: Austria (1980-1998), Belgium (1980-1998), Bulgaria (1997-1998), Cyprus (1980-1998), Denmark (1980-1998), Finland (1980-1998), France (1980-1998), Greece (1985-1998), Hungary (1980-1998), Iceland (1984-1998), Ireland (1980-1998), Italy (1983-1998), Netherlands (1980-1998), Norway (1980-1998), Poland (1995-1998, Spain (1980-1998), Sweden (1980-1998), Switzerland (1992-1998), Turkey (1988-1998), United Kingdom (1980-1998).

Countries pegged to the French Franc: Algeria (1995-1998), Benin (1980-1998), Burkina Faso (1980-1998), Cameroon (1980-1998), Central African Republic (1980-1998), Chad (1980-1998), Comoros (1980-1998), Cote d'Ivoire (1980-1998), Gabon (1980-1998), Guinea-Bissau (1997-1998), Madagascar (1980-1993), Mali (1980-1998), Morocco (1980-1998), Niger (1980-1998), Republic of Congo (1980-1998), Senegal (1980-1998), Togo (1980-1998), Tunisia (1980-1998).

Countries pegged to Russian Ruble: Albania (1980-1991), Bulgaria (1980-1989), Poland (1980-1987), Romania (1980-1989).

Countries pegged to the South African Rand: Botswana, Lesotho, Swaziland.

Countries pegged to the Australian dollar: Kiribati, New Zealand.

Countries pegged to the Pound Sterling: Bangladesh (1980-1982), The Gambia (1980-1985)

Countries pegged to SDR: Guinea-Bissau (1980-1996), Jordan (1980-1988), Kenya (1980-1991), Malawi (1980-1993), Uganda (1980-1984), Zambia (1980-1984).

Chapter 2

Pro-competitive effects of globalisation on prices, productivity and markups: Evidence in the Euro Area

This chapter is based on a working paper co-authored with Raphaël S.-H. Lee and published by Insee in *Documents de travail de la Direction des Études et Synthèses Économiques*.

2.1 Introduction

Pro-competitive effects of trade liberalisation are well documented in the literature. As increased foreign competition puts downward pressure on markups, the least productive firms are expected to exit the industry, thus increasing the aggregated industry productivity and decreasing prices. However, there is evidence of cross-industry heterogeneous responses of prices, labour productivity and markups to increased foreign competition. Despite increased trade openness across industries, some industries do not reflect pro-competitive dynamics in their average production prices and markups.

The objective of this chapter is to investigate empirically this cross-industry heterogeneity, based on industry-level data covering nine manufacturing industries in five Euro Area countries (Austria, France, Germany, Italy and Spain) over the period 1995-2014. The analysis builds on Melitz and Ottaviano (2008) theoretical model of heterogeneous firms' response to international trade in the short- and the long-run and its empirical setup with instrumented estimates from error correction models by Chen *et al.* (2009).

The contributions of this chapter is threefold. First, it departs from Chen et al. (2009) by assess-

ing trade-induced pro-competitive effects at the industry-level to identify which industries are less responsive to foreign competition. Second, it investigates firms' dynamics that mitigates or offsets the pro-competitive effect of globalisation, like "winner-takes-most" dynamics and quality upgrading in response to competition from low-wage countries. Third, the traditional variable of gross import penetration is replaced by alternate trade indicators to account for the development of global value chains (GVC): value added import penetration and GVC participation.

The main findings confirm the pro-competitive effects of trade openness on prices, productivity and markups in most industries. When significant, in most cases, trade liberalisation is negatively correlated with price and markups and positively correlated with labour productivity, in line with the theoretical predictions of the Melitz and Ottaviano (2008) model. Results are robust with the two measures of trade openness. However, some industries do not seem to benefit from the pro-competitive effects of globalisation. For instance, in the industries of textile and of chemicals and pharmaceuticals, there is no significant effect of trade openness on prices, labour productivity and markups, regardless of the trade indicator. In the case of the textile industry, quality upgrading in response to competition from low-wage countries could explain this lack of significance. As for the industry of chemicals and pharmaceuticals, its high level of market concentration acts as a shield against foreign competition.

In the remainder of this paper, Section 2.2 provides a review of the related literature. Section 2.3 presents the main features of the theoretical framework leading to the empirical model in section 2.4. Section 2.5 introduces the data and preliminary investigation with descriptive analysis, while section 2.6 presents the empirical analysis with the baseline results and further investigations. Section 2.7 concludes.

2.2 Review of literature

The effects of trade openness on prices, markups and productivity are assessed in the theoretical model of Melitz and Ottaviano (2008) seminal paper which sets the theoretical framework of the paper. Their model predicts how prices, productivity and markups respond to trade liberalisation, through reallocation of firms within industry. Increased trade openness induces greater foreign competition which put pressure down on markups. Productivity is expected to increase, as the least productive firm exit the market. As a result, production prices decrease.

However, the lack of market contestability can mitigate the pro-competitive effects of globalisation. In protected industries or industries with low business dynamism, firms would be able to maintain high markups and production prices despite foreign competition. Recent works underline a decline in business dynamism and an increase in market power (Autor *et al.*, 2017a,b; van Reenen, 2018). For instance,

Adalet McGowan *et al.* (2017b) find evidence that financially weak and low productive firms — zombie firms — in the OECD countries are less likely to exit the market and may also create barriers to entry to young firms. This decline in business dynamism can be reflected in an increase in market concentration. Autor *et al.* (2017a) test a theoretical model which sheds lights on the emergence of "winner-takes-most" dynamics where a small share of high profitable "superstar firms" have increasing market shares and markups. This "winner-takes-most" dynamics is particularly strong in digitally-intensive sectors where marginal costs are low, like ICT manufacturing, machinery and transport equipment (Calligaris *et al.*, 2018)

Higher competition can encourage firms to invest in research and development to improve the product quality, as a "defensive innovation" strategy (Acemoglu, 2003), especially when they are facing competition with low-wage countries (Auer *et al.*, 2013; Martin and Mejean, 2014). This would allow them to increase their markup despite an increased competition. Dinopoulos and Unel (2013) develop a theoretical framework close to that of Melitz and Ottaviano (2008) to show that markups and quality are endogeneous. Using French manufacturing firm-level data, Bellone *et al.* (2014) provide evidence that quality-enhancing effects of globalisation are more relevant than its price-loring effect. In addition, Aghion *et al.* (2005) and Aghion *et al.* (2006) highlight that firms can adopt two strategies when facing a higher competition: the "escape-competition" strategy for products close to the frontier, based on quality-upgrading, to compete with potential new entrants, and the "appropriability" strategy for products too distant from the frontier that firms are discouraged to invest in quality.

Chen *et al.* (2004, 2009) propose an estimable version of Melitz and Ottaviano (2008) theoretical model and they introduce gross import penetration in final demand as a proxy for trade costs. Recent papers discuss the relevance of this indicator to assess the effect of trade on prices, markups and productivity. Auer *et al.* (2017) find evidence that global supply chain integration has a higher power in explaining domestic inflation. Jonson and Noguera (2012) and Andrews *et al.* (2018b) also argue that indicators of global value chains (GVC) better capture this integration and use participation in GVC to assess the effects of trade on prices and markups. As GVC developed over the last decades, firms can choose how to allocate their resources and to specialise in specific tasks and participate to a specific stage of the production process. For instance, they can move upstream to provide intermediate products or downstream to assemble intermediate products. They can also choose to import intermediate products to assemble and produce domestically or import final products to address domestic demand. Kasahara and Lapham (2013) and Kasahara and Rodrigue (2008) highlight the effect on productivity of intermediate imports specialisation. As a country specialises in the most productive stage of the production process, it can enhance its productivity.

2.3 Theoretical framework

The baseline empirical specification is motivated by the theoretical model developed by Melitz and Ottaviano (2008) and extended by Chen *et al.* (2004, 2009). The model describes a monopolistically competitive model of trade linking industry prices, productivity and markups to market size and trade costs. It also distinguishes short- from long-run dynamics. The main features and predictions of the model are presented here to lay ground for the steps leading to the empirical setup. The focus is put on the relation of the three variables of interest (prices, productivity, markups) to the number of firms supplying the market and trade costs. For a full description of this model, the interested reader can refer to the original Melitz and Ottaviano (2008). The model presents two economies (domestic and foreign). Foreign variables are marked with an asterisk (*).

2.3.1 Main features

Consumer preferences are assumed to be identical across all countries. For a representative consumer, indexed by i, the utility from consumption is derived from a quasi-linear preferences over a numeraire good and a continuum of varieties indexed by ω. Demand for each variety is linear in prices, but unlike the classic monopolistically competitive setup introduced in Dixit and Stiglitz (1977), the price elasticity of demand increasingly depends on the number of firms in the sector (N), which is a feature introduced in Ottaviano *et al.* (2002).

Labour is the only factor of production factor with a unit cost c –– defined as the ratio of wages to labour productivity. It is perfectly mobile across firms, but not across countries. International wage differences are therefore possible. As a result, the variation in unit production costs across firms in a sector stems from technological reasons, i.e. differences in labour productivity across firms. In contrast, unit production costs vary across countries due to differences in both wages and technology. Each firm produces at marginal cost c (equal to the firm's unit labour cost).

Firms bear fixed entry costs f_E that are sunk. After entering a market, firms that can cover their marginal cost and produce, while the others exit the market. Surviving firms maximise their profits for price $p(c)$ and produced quantity $q(c)$, given a number N of active competing firms on the domestic market and trade costs. Due to trade costs, they will have to choose between selling to the domestic market and exporting. If they choose to export, they bear *ad valorem* cost $\tau^* > 1$ (also called "iceberg costs"), reflecting transportation costs or tariffs determined in the foreign economy. Trade costs for foreign goods imported by the domestic economy are symmetrically denoted by τ. Since this chapter covers only Euro Area countries that mainly trade with each other and are submitted to the same trade regulations, trade costs are assumed to be symmetric, i.e. $\tau = \tau^*$.

The cut-off cost c_D expresses the threshold such that domestic firms with $0 \leq c < c_D$ produce to supply to the domestic market whereas domestic firms with $c > c_D$ stop producing and leave the domestic market. At the equilibrium, $c_D = p_{\max}$ and $p(c_D) = c_D$. Likewise the cut-off cost for domestic firms exporting in the foreign economy is $c_X = \frac{c_D^*}{\tau} = \frac{p_{\max}^*}{\tau}$. Trade barriers make it more difficult for exporters to break even relative to domestic producers and to verify zero-profit conditions compared to domestic producers. Due to trade costs, firms have to choose how much to produce for domestic markets and how much for export.

To obtain closed form expressions for the key variables, the inverse of costs, $1/c$, in domestic (resp. foreign) economy is assumed to follow a Pareto distribution with cumulative distribution function $G(c) = \left(\frac{c}{c_M}\right)^k$ (resp. $G^*(c) = \left(\frac{c}{c_M^*}\right)^k$), with k a parameter measuring the dispersion of cost draws and $c \in [0, c_M]$ (resp. $c \in [0, c_M^*]$). In this setup, $1/c_M$ represents the lower bound of productivity in the domestic economy. To allow cross-country productivity differences, extend the model so that the upper bound for costs differs across countries, i.e. $c_M \neq c_M^*$. By comparing c_M and c_M^*, the domestic economy displays either relatively low cost (high productivity) or high cost (low productivity), compared to the foreign economy.

Assuming N_E (resp. N_E^*) firms located in the domestic (resp. foreign) economy, the Pareto assumption simplifies the expressions for the average cost $\bar{c}$ for all firms producing in the domestic economy and the resulting aggregate price index $\overline{p}$, given by:

$$\bar{c} = \frac{1}{N_E G(c_D) + N_E^* G^*(\frac{c_D}{\tau})} \left(N_E \int_0^{c_D} c dG(c) + N_E^* \int_0^{\frac{c_D}{\tau}} c dG^*(c) \right) = \frac{k}{k+1} c_D \tag{2.3.1}$$

$$\overline{p} = \frac{1}{N_E G(c_D) + N_E^* G^*(\frac{c_D}{\tau})} \left(N_E \int_0^{c_D} p(c) dG(c) + N_E^* \int_0^{\frac{c_D}{\tau}} p(c) dG^*(c) \right) = \frac{2k+1}{2(k+1)} c_D \tag{2.3.2}$$

Moreover, unit costs only depend on wages and on labour productivity and average labour productivity is thus given by:

$$\bar{z} = \frac{w}{\bar{c}} = \frac{k+1}{k} \frac{w}{c_D} \tag{2.3.3}$$

where w denotes the nominal wage in the domestic economy.

With markups for domestic sales equal to $\mu_\omega = p_\omega - c_\omega$, average markups in the domestic economy are:

$$\overline{\mu} = \overline{p} - \bar{c} = \frac{1}{2(k+1)} c_D \tag{2.3.4}$$

From (2.3.2), (2.3.3) and (2.3.4), price, markup and labour productivity are related to the marginal cost c_D:

$$\begin{cases} \overline{p} = \frac{2k+1}{2(k+1)} c_D \\ \overline{z} = \frac{k+1}{k} \frac{w}{c_D} \\ \overline{\mu} = \frac{1}{2(k+1)} c_D \end{cases}$$

Based on the consumer behaviour, $p_{\max} = \frac{1}{\gamma+\eta N} (\alpha\gamma + \eta N \overline{p})$ and using the equation $p_{\max} = c_D$:

$$N = \frac{2\gamma(k+1)}{\eta} \left(\frac{\alpha}{c_D} - 1 \right) \tag{2.3.5}$$

where α, η and γ represent demand parameters that are all positive. α and η measure the substitution pattern between the differentiated varieties and the numeraire good, while γ measures the degree of product differentiation between the varieties ω.

The previous equation shows a decreasing relationship between N and c_D. An increase in c_D implies an increase in $p_{\max}$, which is related to lower aggregated demand and lower number of varieties. This characterises the demand side of the economy.

2.3.2 Short run implications

In the short run, firms are assumed to have a fixed location. There is no entry of new firms. The incumbent firms choose whether to produce or not and which markets to supply. This means that the number of firms located in the domestic economy (N_{SR}) and in the foreign economy (N^*_{SR}) are assumed to be fixed. The number of active firms in the domestic market include domestic producers and foreign exporters:

$$N = \underbrace{\overline{N}_{SR} G(c_D)}_{\substack{\text{Domestic firms supplying} \\ \text{the domestic market}}} + \underbrace{\overline{N}^*_{SR} G^* \left(\frac{c_D}{\tau} \right)}_{\substack{\text{Foreign firms supplying} \\ \text{the domestic market}}}$$

Using Pareto distribution, the previous equation gives:

$$N = \left(\frac{\overline{N}_{SR}}{c_M^k} + \frac{1}{\tau^k} \frac{\overline{N}^*_{SR}}{(c^*_M)^k} \right) c_D^k \tag{2.3.6}$$

The previous equation, derived from the firm decision, shows an increasing relationship between N and c_D. The larger the level of cut-off costs c_D, the higher the number of producing firms in the domestic economy.

Equations (2.3.6) and (2.3.5) show that in the short run, the number of firms producing in the domestic economy N and the cut-off cost c_D depend on the trade costs τ, the productivity upper bounds c_M and c^*_M and the number of firm located in both countries N_{SR} and N^*_{SR}. More precisely, a decrease in trade costs τ affect firms' production decisions by reducing the cut-off cost c_D and thus increasing the number of firms exporting in domestic economy. It results in lower average price $\overline{p}$, markups $\overline{\mu}$ and higher productivity $\bar{z}$, implying pro-competitive effects of globalisation.

2.3.3 Long run implications

In the long run, firms can choose to change their location and incur the fixed costs f_E or f^*_E. The number of firms located in the domestic and the foreign economies is determined by free entry and zero expected profit condition prior to entry. Under the Pareto distribution assumption, the zero expected profit condition in both countries and recalling that the cut-off cost for domestic firms exporting in the foreign economy is $c_X = \frac{c^*_D}{\tau}$ (and $c^*_X = \frac{c_D}{\tau}$ for foreign firms exporting in the domestic economy), it is possible to determine c_D as an expression of τ, c_M, c^*_M and L:

$$c_D^{k+2} = \frac{\phi}{L(1-\rho\rho^*)} \left[1 - \rho\lambda\right] \tag{2.3.7}$$

where $\phi = 2\gamma(k+1)(k+2)c_M^k f_E$, $\rho = 1/\tau^k$ and $\lambda = (c_M/c^*_M)^k$ (resp. $\lambda^* = c^*_M/c_M$). In the long run, c_D and c^*_D does not depend on N but on structural characteristics of domestic and foreign economies, that is the distribution of costs (c_M) and (c^*_M), the level of fixed costs f_E , the market size (L) and trade costs (τ).

Equation (2.3.5) derived from the consumer side is still valid to characterise the demand side of the economy. From equations (2.3.5) and (2.3.7), the number of firms producing in each economy in the long run is only determined by the characteristics of domestic and foreign eocnomy, namely the market sizes (L and L^*) and trade costs (τ).

Given that f_E does not depend on trade costs and that trade costs are the same between regions ($\tau = \tau^*$), a fall in trade costs implies that for a firm located in the domestic economy, it is less costly to relocate in the foreign economy and supply the domestic market from there since falls in trade costs lower the *ad valorem* cost. The cut-off cost c_D increases, while the number of firms located in the domestic economy falls. In other words, in the long run trade liberalisation has anti-competitive effects on prices, productivity and markups.

Note that the endogenous long run equilibrium number of firms located in each country (N_{LR} and N^*_{LR}) can be determined by the following relations:

$$N = N_{LR}G(c_D) + N^*_{LR}G^*\left(\frac{c_D}{\tau}\right)$$

Using Pareto distribution, the previous equation gives N_{LR} and N^*_{LR} depending on N, N^*, c_D and c^*_D, that is on structural characteristics of both countries.

2.4 Empirical framework

The empirical model relies on Chen *et al.* (2004, 2009) setting to empirically assess Melitz and Ottaviano (2008) theoretical model, with a tractable version of trade costs.

2.4.1 Tractable trade costs

As highlighted in Chen *et al.* (2004, 2009), trade costs τ are the key variable characterising trade liberalisation. However reliable estimates of trade costs are difficult to measure and like Chen *et al.* (2009), import penetration is used as a measure of openness and ca be expressed in terms of trade costs. Import penetration is defined as the weight of imports in total domestic demand:

$$\theta = \frac{\int_0^{c^*_X} p^*_X(c)q^*_X(c)dG^*(c)}{\int_0^{c_D} p_D(c)q_D(c)dG(c) + \int_0^{c^*_X} p^*_X(c)q^*_X(c)dG^*(c)}$$

Since $p_D(c)q_D(c) = \frac{L}{4\gamma}(c_D^2 - c^2)$, $p^*_X(c)q^*_X(c) = \frac{L}{4\gamma}(c_D^2 - \tau^2 c^2)$ and $c^*_X = \frac{c_D}{\tau}$, under the Pareto distribution, it implies:

$$\tau^k = \frac{1-\theta}{\theta}\left(\frac{c_M}{c^*_M}\right)^k \tag{2.4.1}$$

Assuming $\frac{c_M}{c^*_M}$ does not change over time, import penetration can be used as a proxy for trade costs and increases as trade costs decrease.

2.4.2 Empirical model

Following the theoretical framework and Chen *et al.* (2004, 2009)'s empirical setup, equations of production prices, labour productivity and markups are estimated as an error correction model separately, which distinguishes short- from long-run competitive effects of trade liberalisation. The estimation is implemented over a pooled sample of manufacturing industries (weighted and non weighted), as well as at the industry level. In order to support this estimation strategy, the variables of interest must be non-stationary in a unit root sense. Dickey-Fuller test is used to confirm that prices, productivity and markups contain unit root. The non-stationarity supports the use of the error correction model.[1]

Changes in production prices can reflect the effect of pure monetary inflation. To control for that effect, Chen *et al.* (2009) used the monetary base. However, since the sample of countries is restricted to Euro Area countries, monetary base data is not available at the country-level. As an alternative, the industry-level price is deflated by the overall manufacturing price. By doing so, the analysis is carried out for the deviation from the overall trend.

Long run relations are derived from a log-differentiation form of equations (2.3.5), from the long run relation between c_D and the structural characteristics of the economy and from the previous relation between trade costs and domestic openness. Long run relations thus include domestic market size (measured by domestic gross domestic product), domestic openness and in the case of the productivity equation, real wages. Moreover, since $\frac{c_M}{c_M^*}$ represents relative upper bounds for unit production costs between countries, its evolution may capture technological progress from the domestic country relative to the foreign country. Since the country coverage of this chapter includes main Euro area countries, $\frac{c_M}{c_M^*}$ can be assumed constant.[2]

Short run relations are also derived from a log-differentiation form of equations (2.3.5), given the short run equilibrium between c_D and N. They include the number of firms in the domestic industry and the domestic openness.

The effect of trade openness on prices, markups and labour productivity is assessed as follows:

$$\Delta \ln Y_{ijt} = \alpha_0 + \alpha_1 \Delta \ln \theta_{ijt} + \alpha_2 \Delta \ln D_{ijt} + \beta \left[\ln Y_{ijt-1} + \gamma_0 + \gamma_1 \ln \ln \theta_{ijt-1} + \gamma_2 \ln X_{ijt-1} \right] + \varepsilon_{ijt} \quad (2.4.2)$$

Where i, j and t denote respectively country, industry and year, Y_ijt denotes prices, markups or

[1] See Annex 2.D.2 for the results of the test.

[2] Based on CompNet data, the evolution for the last decile of productivity can be computed and the evolution is rather stable over time.

labour productivity, θ_{ijt} denotes import penetration, D_{ijt} denotes the number of active firms in the country i and industry j and X_{ijt-1} includes additional explanatory variables such as the size of the market and the real remuneration level in the labour productivity equation. Country and industry fixed effects are also included, as well as a dummy for the crisis period to account for the Great Recession.[3] The terms in brackets represent the long run equation and $\beta < 0$. In the case of labour productivity, the long run equation also includes the real remuneration level.

2.4.3 Instrumenting openness

As trade costs are approximated by import penetration, this introduces an endogeneity bias, since trade openness also depends on the variables of interest. For instance, foreign countries can base their decision to export on domestic prices of their trade partners. If the latter experience increasing inflation, consumers can be more attracted to imported products. Likewise, the relation between productivity and openness can also be ambiguous. Openness can increase productivity, while the most productive firms can choose to trade with foreign partners. To address the endogeneity issue, a set of instruments is chosen to reflect trade liberalisation, as well as trade costs (i.e. transport and transaction costs), based on tariff and non-tariff barrier variables and competitiveness variables.

Two variables are used to measure tariff barriers: bulkiness and apparent tariff rate. Bulkiness is defined as the ratio of exports in value to exports in volume (weight in kg) for each industry. In order to avoid potential endogeneity bias, it is computed based on the exports to the US which are defined as the sum of the exports to the US from the five countries in the sample excluding those from the reference country i:

$$\text{Bulkiness}_{ijt} = \frac{valX_{\text{US},jt} - valX_{\text{US},ijt}}{volX_{\text{US},jt} - volX_{\text{US},ijt}}$$

where i, j and t denote, respectively, countries, industries and year; $valX_{\text{US},jt}$ and $volX_{\text{US}}, jt$ denote, respectively the exports in value and in volume. Bulkiness relates to the weight of imported goods, the underlying assumption being that the heavier they are, the more expensive their transport costs are (Hummels, 2001). Heavier goods thus reduce incentives to import.

Since the database contains Euro area countries, same tariff rates apply for all the imports. The other variable is an effective tariff rate defined as an import-weighted tariff rate like Ahn *et al.* (2016):

$$\tilde{\tau}_{ijt} = \frac{\sum_{k \in K_j} \tau_{ijkt} m_{ijkt}}{\sum_{k \in K_j} m_{ijkt}}$$

[3] The chosen period for the dummy is 2008-2009. This choice is robust to adding one or two years around this period.

where $T_{EU,jt}$denotes the European Union tariff rate applied to products from industry j and m_{ijt} denotes imports (in current value) from non EU partners of country i in industry j and year t. The effective tariff rate can be seen as a proxy for the degree of protection of the domestic suppliers. It is thus expected to be negatively correlated to import penetration.

Two variables are used to measure non-tariff barriers: gravity and freight transports. The gravity model of international trade provides an explanation for the empirically observed regularity of the trade flows. From seminal contribution of Krugman (1980) to the theoretical and empirical explanation given by Chaney (2013), trade flows between two countries are proportional to the economic size and inversely proportional to the distance separating these two countries. Following Chen *et al.* (2009), gravity is defined as follows:

$$G_{ijt} = \sum_{k \neq i} \frac{Y_{kjt}/Y_{kt}}{d_{ik}}$$

where d_{ik} denotes the distance between country i and country k, Y_{kjt} denotes the gross value added of industry j in country k and Y_{kt} the total gross value added of country k. Since countries are expected to import goods from nearby trade partners with the larger share of industry j, the variable G_{ijt} is expected to be positively correlated to import penetration. Likewise, freight transports are expected to be positively correlated to import penetration. As they measure the total movement of goods through inland transport, high values reflect the ability to exchange goods easily and quickly.

Finally, competitiveness variables are included in the instrumental variables, since increased competitiveness can also increase import penetration. The real effective exchange rate (REER) is defined as a weighted average of bilateral exchange rates. Hence it reflects the value of a currency, as well as the trade structure of the country. It covers 67 countries (Darvas, 2012). Since imports become cheaper with increases in REER, import penetration is expected to be positively correlated to REER.[4]

Following Martin and Mejean (2014), the Balassa index is included. It measures revealed comparative advantage of industry j in country i, by comparing the country i's export share for this industry to a reference area's export share for the same industry (here the Euro Area):

$$\text{Balassa}_{ij} = \frac{x_{ij}/X_i}{x_{aj}/X_a}$$

where x_{ij} (resp. x_{aj}) are the exports of industry j in country i (resp. Euro Area) and X_i (resp. X_a) are

[4]In this paper, the the correlation turns out to be significant and negative, even when REER is included with lags. Gantman and Dabós (2018) find evidence of a negative relation between REER and trade openness and also underlines potential endogeneity between these two variables. They find that an increase in trade openness leads to a depreciation of REER. The potential endogeneity between trade openness and REER should exclude REER from the set of instrumental variables. Unfortunately, excluding REER jeopardises all the instrumented estimations. It is hence kept in the set of instrumental variables, knowing that further investigation would be required to replace this variable and verify that the main conclusions remain the same.

total exports from country i (resp. Euro Area). The expected effect of the Balassa index on import penetration is ambiguous. On one side, countries with a comparative advantage in an industry are expected to export more and import less products from this industry. On the other side, with the development of global value chains, production is more fragmented and firms can choose to import intermediate inputs to produce goods. Since the dataset includes a high-aggregation level of industries, these intermediate inputs could be part of the same industry and contribute to increase import penetration in this industry. For instance, a country can have comparative advantage to produce cars but choose to import equipment like generators, brakes, wheels or car seats. Both cars and the equipment are included in the industry of transport equipment.

To test whether these instruments are valid, two tests are implemented. Cragg and Donald (1993) test verifies the existence of weak instruments and the Sargan (1958) test verifies that instruments are not correlated with the error terms of the initial regression.[5] For the pooled estimations, the tests reject the null hypothesis of weak instruments and accepts the null hypothesis of no correlation between the instruments and the error terms. At the industry-level, the estimates pass at least one of these tests in most cases. Based on these tests, the set of instrumental variables is chosen for the three dependent variables. For prices, the instrumental variables include bulkiness, freight transports, REER and the Balassa index. For productivity and markup, they include gravity, effective tariff rate, REER and the Balassa index.

2.5 Data and descriptive statistics

2.5.1 Data

The sample covers five Euro Area countries (Austria, France, Germany, Italy and Spain) and nine manufacturing sectors[6] over the period 1995-2014 for which dependent and explanatory variables can be defined[7]. Those five selected countries represent around 85% of the GDP of the Euro area. Details on the sources and definition of all data are given in Appendix 2.A.2.

Domestic data Industry-level relative prices are defined as the ratio of sector-industry producer price indices (PPI) to the PPI for the total manufacturing sector. PPI reflect pure price changes (i.e. quality-adjusted[8]) of products sold on the domestic market from the producer's perspective. Hence, they ex-

[5] See Appendix 2.D.1 for the results of the tests.
[6] See Annex 2.A.1
[7] At the country-level, the main constraint is the country coverage of firm data (BACH, Eurostat-SBS). At the sector-level, the main constraint is the availability of producer prices for high level of disaggregated for manufacturing sectors. Sector data are all expressed in NACE Rev.2 (See Appendix 2.A.1 and Appendix 2.A.3 for further details).
[8] See Eurostat (2012) for further details.

clude taxes, transport and trade margins paid by the purchaser, and include subsidies on products received by the producer. Labour productivity is measured as the ratio of value added in volume to total employment (employees and self-employed). Markups are usually measured with Lerner index, defined as the difference between price and marginal costs divided by price. However, since marginal costs prices are difficult to observe, markups are defined using information on total variable costs only (i.e. cost of goods sold, materials and consumables plus staff costs), using BACH database[9]:

$$\mu_{ijt} = \left[\frac{\text{unit price}}{\text{unit variable costs}}\right]_{ijt} = \left[\frac{\text{turnover}}{\text{total variable costs}}\right]_{ijt}$$

where i, j and t denote respectively country, industry and year. Turnover and total variable costs are weighted averages of the firm-level data in BACH.

The number of active firms selling in the domestic firms is unavailable and is approximated by the number of active firms located in the domestic market provided by Eurostat Structural Business Survey (SBS). The market size is measured by real GDP.

Trade data Value added import penetration is computed as the content of foreign value added in the domestic final demand, based on Stehrer (2012) method.[10] Measurements in value added terms avoid double-counting intermediates in gross trade flows and overstating the size of trade openness, especially when the production process is fragmented in international supply chains. For instance, if a country re-exports most of its imports, indicator in gross terms will overestimate the size of import penetration. In addition, value added trade flows account for the inter-dependencies between the production in one country and its consumption in another country. They account where income is generated and where it is spent (Flaig *et al.*, 2018). For all these reasons, using import penetration in terms of value added seems to be a more relevant to measure import penetration in domestic final demand. Value added import penetration is further decomposed based on the income level of trade partners.

Participation in GVC is computed by Wang *et al.* (2016, 2017), using respectively the 2013 and 2016 editions of WIOD Input-Output Tables. It indicates how much a country is integrated in the international trade, or more precisely, in the global value chains. It is defined as the sum of domestic value added embodied in foreign exports (forward linkage in % value added) and foreign value added embodied in domestic exports (backward linkage in % output). Forward linkage measures the extent to

[9]The Bank for the Accounts of Companies Harmonized (BACH) database gathers harmonized economic and financial information of non-financial enterprises by size class and business sector. The selected companies in the BACH database represent neither a complete survey nor a statistically representative sample. Some countries have administrative databases that cover the entire population of non-financial corporations. Nonetheless for most countries, subsets of the total population are available and large companies are generally over represented.

[10]See Appendix 2.B for more details.

which exports have become more vertically specialised and backward linkage measures the extent to which intermediate inputs to produce exports have been offshored. Wang *et al.* (2016, 2017) further distinguish complex GVC from simple GVC. The first cover trade flows that crossed at least two borders, while the latter cover trade flows that crossed only one border.

Market concentration The normalised Herfindahl-Hirschman index (HHI) from EU-KLEMS is used to measure market concentration. It is averaged over the period 1997-2007, in each of the five countries[11]. For each industry j in country i, it is defined as follows[12]: $HHI_{ij} = \sum_k = (S_k)^2$, where S is the share of firm k in the industry sales (measured by the turnover). It is included between 0 and 1. The closer HHI_{ij} is to 1, the more concentrated is the industry j. O'Mahony *et al.* (2008) then normalise this index to correct reporting bias in case the number of firms in a given industry of a country and reporting the information is low. The normalised HHI_{ij} is defined as follows: $HHI_{ij^*} = \frac{HHI_{ij} - 1/N}{1-1/N}$; where N is the number of companies in the industry. For industries with numerous firms, HHI and HHI^* are approximately equal.

Quality upgrading Change in the quality of domestically produced goods is defined as the difference between change in the unit value index of domestic output (measured by the output deflator) and change in PPI: Quality upgrading$_{ijf} = \Delta ln(\text{output deflator}_{ijt} - \Delta ln(PPI_{ijt})$; where subscripts i, j and t denote, respectively, countries, industries an years. This definition relies on the fact that PPI is adjusted for quality changes and output deflator is affected by both quality change and pure price change. The difference should then reflect change in quality, i.e. quality upgrading.

2.5.2 Descriptive analysis

Cross-industry heterogeneity in the three indicators of industry performance is observed in Figure 2.5.1. Production prices have a marked downward trend in most industries, except in the food, chemicals and the metals industries (Panel a). Labour productivity had an upward trend in all industries, but the size of productivity gains differs across industries (Panel b). As for markups, only four industries display downward trends: wood, chemicals, rubber and metals (Panel c).

Trade openness increased over the period in all industries (Panel d). This increase had pro-competitive effect in some industries, like the wood, chemicals and rubber industries. However, its dynamics is at odds with prices and markups in some industries. The industry of metals stands out as the only industry where production prices increased, despite increasing trade openness. Markups increased across countries over the whole period in the industries of textile, machinery and food, while it increased

[11] See O'Mahony *et al.* (2008) for further details. The index is on average stable over the period 1997-2007.

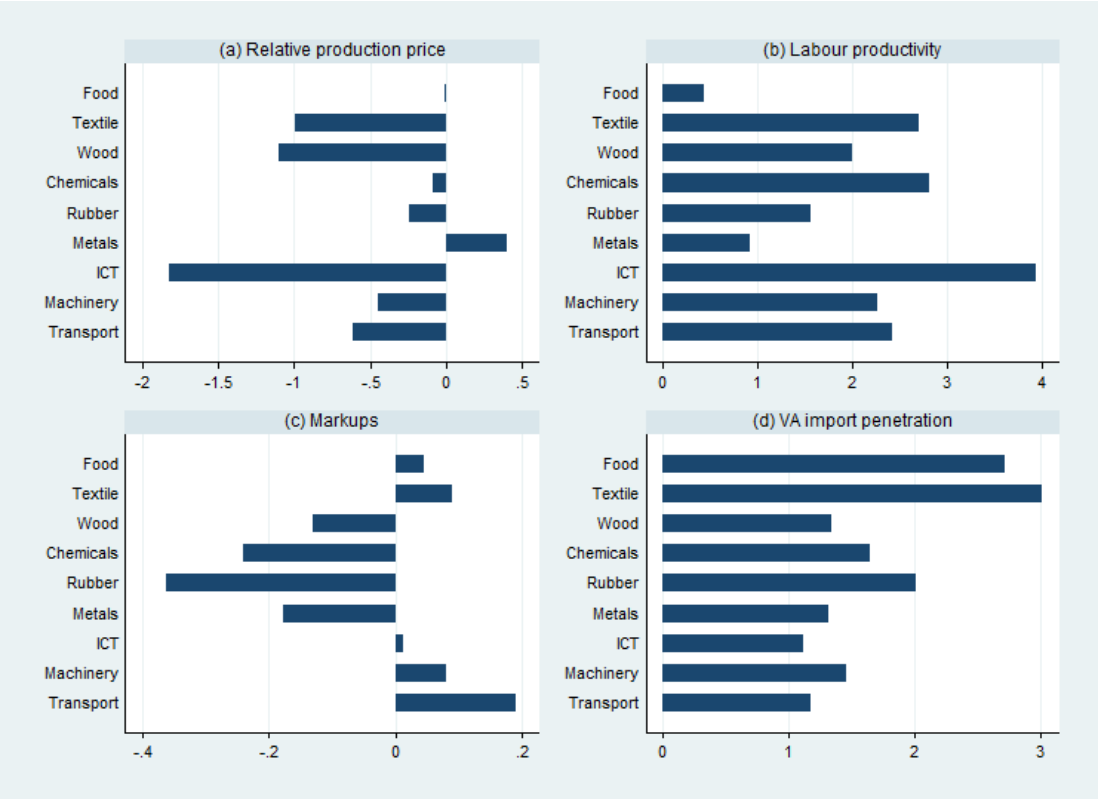
[12] Since HHI^* is computed for more detailed sectors (2-digit level), it is aggregated into the 9 indusries using weighted average, where the weight is the share of firms in the sub-sector is in the aggregated sector S of country i: $HHI_{iS} = \sum_{s \in S}(HHI^*_{is} \times \frac{N_{is}}{N_{iS}})$.

during the past decade in the industries of transport and ICT. Markup increases are rather unexpected in the case of textile and ICT, since these industries are more exposed to competition with low-and middle-income countries which are used as proxy for low-wage countries (Figure 2.5.2, panel a).

Quality upgrading in domestically produced goods is observed in four industries: textile, wood, metals and machinery (Figuree 2.5.2, panel b). In the case of the textile and machinery industries, this quality upgrading is in line with the lack of pro-competitive effects of trade on markups. This may suggest that firms in these industries responded to increased competition from low-wage countries by moving their products to the high end products. Panel c in Figure 2.5.2 provides further insight on industries like textile, chemicals, ICT, and transport equipment, where pro-competitive effects of trade seem non-existent or weak. Interestingly, those industries also display high level of market concentration as measured by the Herfindahl-Hirschman index. With the exception of the textile industry, the other industries are classified as digitally-intensive industries by Calligaris *et al.* (2018). They find evidence that such industries exhibit higher markups.

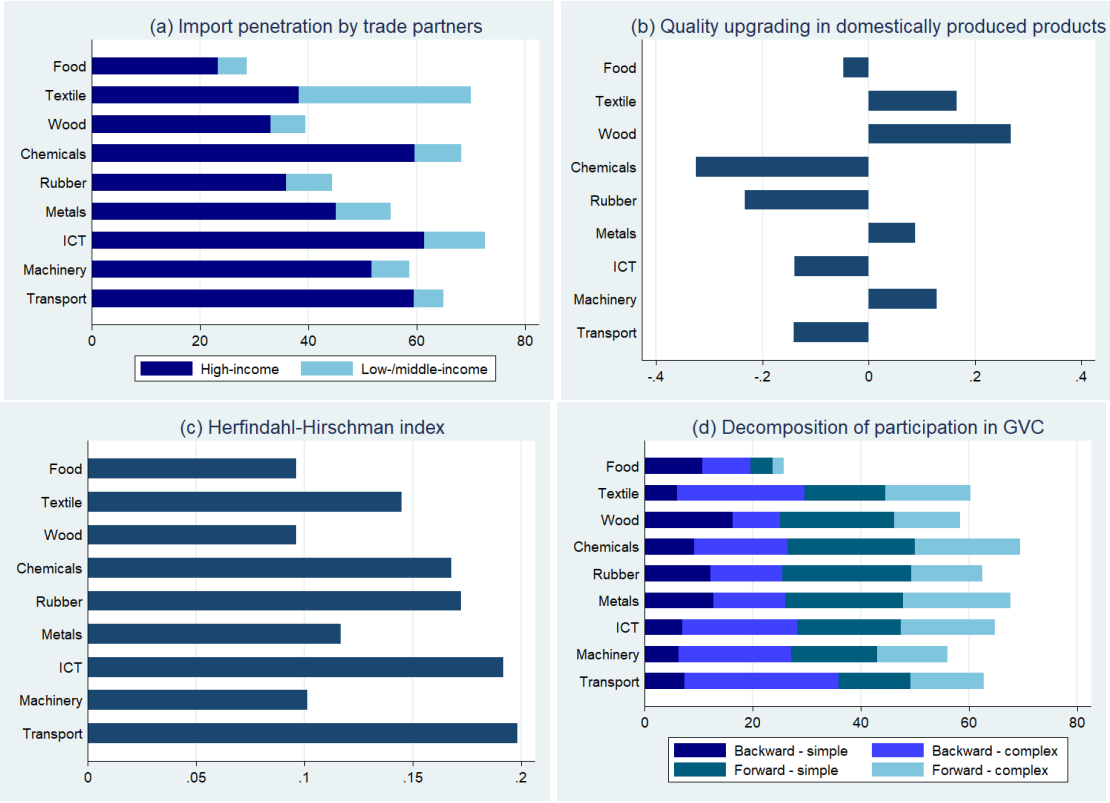
Panel d in Figure 2.5.2 gives information on integration in value chains and fragmentation of the production. The food industry is the least integrated in GVC and mainly trades final goods. Industries like transport equipment, machinery, ICT and textile have more fragmented production where imported products cross several borders before being exported again. This highlights the relevance of using value added import penetration rather that gross import penetration, to avoid double-counting intermediates in gross trade flows.

Figure 2.5.1: Trends of price, productivity, markups and trade



Note: Figures show year trend from regressions that also include country fixed effects.
Source: See Table 2.A.2.

Figure 2.5.2: Competition from low-wage countries, market concentration and development in GVC



Note: Panels a, b and d represent average data over 1995-2014. Panel c represents average data over 1997-2007. Import penetration and participation in GVC are expressed in percentage of value added. In panel d, simple means that products crossed borders once, while complex means that products crossed borders at least twice.
Source: See Annex 2.A.2.

2.6 Empirical results

The estimations are first run over the pooled sample and then by industry to investigate cross-industries heterogeneity. Estimations over the pooled sample are also weighted to better account for the cross-industry heterogeneity, using the share of the industry value added over the total as a weight. Only instrumented estimates are presented in this section. OLS estimates for the baseline specification are in Tab 2.C.1.

2.6.1 Baseline results

According to the theoretical and empirical framework, increases in trade openness reduce relative production prices and markups and increase labour productivity in the short run and have reversed effects in the long run. Increases in the number of active firms in the domestic market and in the size of the

market have negative on prices and markups and positive effects on labour productivity. In the short run, increases in import penetration have pro-competitive effects on prices, productivity and markups (Table 2.6.1, Columns 1 and 2).

In the long run, import penetration has no significant effects on labour productivity. When significant, it has pro-competitive effects on relative production prices and markups, conversely to predictions of Melitz and Ottaviano (2008) model. As highlighted in Baghli *et al.* (1998), "economic long run" can differ from "econometric long run". Given the short estimation period, the long-run relation derived from the theoretical economic model does not meet the estimated "econometric long run". In the framework, the lack of reversal between long- and short-run effects of trade openness suggests that "long-run economic" implications of trade liberalisation need more time to be assessed econometrically. Another explanation can be found in Chen *et al.* (2008) and lies in the nature of the fixed entry costs f_E. Melitz and Ottaviano (2008) assume they are exogenous. However, Chen *et al.* (2008) consider an alternate scenario where they would be endogenous to trade costs τ, which lead to ambiguous long run effects of trade openness.

Conversely to the theoretical model, change in the number of enterprises has no significant effects on prices, productivity and markups. This may be explained by the fact that the number of active firms selling on the domestic market is not well observed and is proxied by the number of firms located in the domestic market. The size of the market (real GDP) has pro-competitive effects on prices and labour productivity.

The cross-industry heterogeneity underlined in Section 2.5 is also observed in the baseline specifications (Table 2.6.1). Overall, the industries of food, wood, rubber, ICT, machinery display pro-competitive effects of trade openness on most of their industry performance indicators. Even when these effects are not significant, they still have the expected signs. However, in two industries there is no evidence of pro-competitive effects of trade openness on prices, labour productivity or markups: textile and chemicals. These industries will be further analysed in the following sections.

The case the metals industry is striking. While import penetration has short-run pro-competitive effects on labour productivity and markups, it has a positive effect on relative production prices. Two factors can explain this inconsistency (ECORYS, 2011; Commission, 2013). First, the metals industry heavily relies on energy prices which have developed over the period. Second, it is capital intensive, which means that labour productivity might not be a relevant proxy for production costs. Similar incon-

[12]The baseline estimations using gross import penetration is displayed in Table 2.C.2. Both trade indicators lead to similar results for most industries, except for the industries of transport equipment in the case of prices, machinery in the case of labour productivity and rubber in the case of markups. The effect of trade is slightly stronger when import penetration is measure in value added terms.

sistencies are observed in the industries of wood and transport, although to a lesser degree (Table 2.6.1, columns 5 and 11). In the industry of wood, there is no significant effect of import penetration on prices, whereas there are significant effects on productivity and markups. It is the opposite in the industry of transport.

Table 2.6.1: Baseline regressions using instrumented VA import penetration

	(1) Total	(2) Total	(3) Food	(4) Textile	(5) Wood	(6) Chemicals	(7) Rubber	(8) Metals	(9) ICT	(10) Machine	(11) Transport
Dependent variable: change in relative production price (PPI)											
Change in import penetration	-0.18***	-0.19***	-0.26***	-0.24	-0.09	0.20	-0.17**	0.22**	-0.41***	-0.34***	-0.31**
	(0.05)	(0.05)	(0.07)	(0.17)	(0.11)	(0.46)	(0.08)	(0.09)	(0.15)	(0.12)	(0.15)
Change in nb enterprises	0.00	-0.00	-0.02	0.00	-0.02	-0.04	0.01	0.05	0.03	0.04	0.00
	(0.01)	(0.01)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Level of relative PPI$_{-1}$	-0.13***	-0.12***	-0.28***	-0.31***	-0.27***	-0.12	-0.20***	-0.17**	-0.11***	-0.34***	-0.23***
	(0.02)	(0.02)	(0.07)	(0.08)	(0.09)	(0.15)	(0.05)	(0.07)	(0.04)	(0.08)	(0.07)
Level of import penetration$_{-1}$	-0.01	-0.01	0.02	-0.02	-0.09	0.01	-0.02	0.02	-0.25***	-0.02	-0.14**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.07)	(0.08)	(0.02)	(0.05)	(0.09)	(0.03)	(0.05)
Level of real GDP$_{-1}$	-0.05***	-0.04***	-0.05*	-0.17***	-0.08*	-0.01	-0.02	0.03	-0.03	-0.12***	-0.07*
	(0.01)	(0.01)	(0.03)	(0.05)	(0.04)	(0.04)	(0.02)	(0.03)	(0.05)	(0.04)	(0.04)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in labour productivity											
Change in import penetration	0.39***	0.42***	0.19	0.56	0.38***	-0.48	0.24	0.55***	0.96**	0.82**	-0.08
	(0.11)	(0.14)	(0.16)	(0.36)	(0.14)	(0.61)	(0.21)	(0.18)	(0.38)	(0.37)	(0.55)
Change in nb enterprises	0.02	0.04	0.08	-0.09	0.04	-0.01	-0.01	0.03	-0.05	0.05	0.09
	(0.03)	(0.05)	(0.06)	(0.08)	(0.06)	(0.11)	(0.10)	(0.11)	(0.11)	(0.11)	(0.12)
Level of labour productivity$_{-1}$	-0.17***	-0.16***	-0.39***	-0.53***	-0.21***	-0.20**	-0.17***	-0.31***	-0.17***	-0.29***	-0.25***
	(0.02)	(0.02)	(0.08)	(0.10)	(0.07)	(0.08)	(0.06)	(0.08)	(0.06)	(0.08)	(0.09)
Level of import penetration$_{-1}$	0.02	0.03	-0.03	-0.02	0.17*	0.11	0.08	0.28**	0.36	0.01	-0.11
	(0.03)	(0.03)	(0.04)	(0.04)	(0.10)	(0.13)	(0.08)	(0.12)	(0.23)	(0.09)	(0.18)
Level of real GDP$_{-1}$	0.24***	0.22***	0.21**	0.44***	0.19**	0.10	0.06	0.06	0.30**	0.45***	0.51***
	(0.04)	(0.04)	(0.09)	(0.12)	(0.09)	(0.16)	(0.09)	(0.12)	(0.14)	(0.17)	(0.19)
Level of real remuneration$_{-1}$	-0.05**	-0.06**	0.17*	-0.31***	-0.08	0.10	-0.02	-0.18**	-0.06	-0.03	0.08
	(0.02)	(0.03)	(0.10)	(0.08)	(0.06)	(0.16)	(0.08)	(0.08)	(0.07)	(0.11)	(0.12)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in markup											
Change in import penetration	-0.11***	-0.13***	-0.21**	-0.07	-0.15***	0.40	-0.15**	-0.21***	-0.14	-0.12	0.12
	(0.04)	(0.04)	(0.09)	(0.09)	(0.06)	(0.26)	(0.07)	(0.05)	(0.09)	(0.11)	(0.18)
Change in nb enterprises	-0.01	-0.00	-0.02	0.02	-0.02	-0.07	-0.00	0.01	-0.02	0.05	-0.01
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Level of markup$_{-1}$	-0.28***	-0.28***	-0.18***	-0.60***	-0.75***	-0.40***	-0.39***	-0.32***	-0.27***	-0.32***	-0.40***
	(0.02)	(0.04)	(0.07)	(0.12)	(0.10)	(0.13)	(0.10)	(0.08)	(0.08)	(0.08)	(0.09)
Level of import penetration$_{-1}$	-0.02***	-0.02***	-0.04*	-0.01	-0.09***	0.02	-0.04	-0.06	-0.02	-0.03	0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.03)	(0.05)	(0.03)	(0.04)	(0.05)	(0.03)	(0.05)
Level of real GDP$_{-1}$	0.00	0.00	0.01	0.04	0.02	-0.04	-0.06***	0.00	0.00	0.03	0.06*
	(0.01)	(0.01)	(0.04)	(0.03)	(0.02)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Observations	810	810	90	90	90	90	90	90	90	90	90

Note: Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy. Columns (1) and (2) include country × industry fixed effects. The other columns include country fixed effects. Column (2) displays coefficients from a weighted regression, with the share of industry-level value added in total value added as weights.

2.6.2 Effects of market concentration

Results from the baseline specification suggest that the lack of significant effects of trade in the industries of textile, chemicals, ICT and transport equipment may reflect a lack of market contestability, as these industries display high level of market concentration (Figure 2.5.2. This can be reflected by an increase in market concentration, i.e. a lower number of enterprises N and a higher cut-off cost c_D ac-

cording to equation 2.3.5, which leads to higher prices and markups and low productivity.

To assess whether high level of market concentration dampen the pro-competitive effects of trade openness, the baseline specificatio is augmented with an interacted terms: $HH_{ij} \times \Delta ln\theta_{ijt}$ to assess the short-run effect and $HH_{ij} \times ln\theta_{ijt-1}$ to assess the long-run effect. High level of industry concentration has significant anti-competitive effects on prices and productivity in the short run, and no effect in the long run (Table 2.6.2). However, the overall mitigating effect of high industry concentration is small compared to the effect of trade openness.

Table 2.6.2: Effects of firm concentration

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Relative production price		Labour productivity		Markups	
Change in import penetration	-0.26***	-0.27***	0.60***	0.54*	-0.14*	-0.18**
	(0.09)	(0.10)	(0.22)	(0.31)	(0.08)	(0.08)
HHI × Change in import penetration	0.01**	0.01**	-0.02**	-0.02	0.00	0.01
	(0.00)	(0.00)	(0.01)	(0.02)	(0.00)	(0.00)
Change in nb enterprises	0.00	-0.00	0.02	0.04	-0.01	-0.00
	(0.01)	(0.01)	(0.03)	(0.04)	(0.01)	(0.01)
Level of the dependent variable$_{-1}$	-0.13***	-0.12***	-0.18***	-0.17***	-0.28***	-0.27***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)
Level of import penetration$_{-1}$	-0.01	-0.01	0.04	0.04	-0.02*	-0.03**
	(0.02)	(0.01)	(0.04)	(0.03)	(0.01)	(0.01)
HHI × Level of import penetration$_{-1}$	0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Level of real GDP$_{-1}$	-0.05***	-0.04***	0.26***	0.24***	0.00	0.00
	(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)
Level of real remuneration$_{-1}$			-0.07***	-0.07***		
			(0.02)	(0.03)		
Observations	769	769	769	769	810	810
Weighted regression	NO	YES	NO	YES	NO	YES

Note: Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy and country × industry fixed effects. HHI is the Herfindahl-Hirshman index and is included as the average over the period at the country-industry level. Since it is collinear to the fixed effects, it is only included in the interacted terms. Weighted regression use the share of industry-level value added in total value added as weights.

2.6.3 Effects of competition in low-wage countries

Foreign competition can have different effects depending on the origin of the imports. There is evidence that imports from low-wage countries have pronounced effects on prices (Auer and Fischer, 2010; Auer *et al.*, 2013; Carluccio *et al.*, 2018) and productivity (Auer *et al.*, 2013). In response to increased competition from low-wage countries, industries may choose to increase the quality of their products (Auer *et al.*, 2013; Martin and Mejean, 2014). In the theoretical framework, this would have lower the degree of substitution between all varieties α, resulting in a lower N and a higher c_D, and hence higher price and markup and lower productivity.

Since the production price index (PPI) is quality-adjusted (Eurostat, 2012), quality upgrading should

be reflected in higher markups in the corresponding industries. Trade partners are classified into two groups of countries, base on their income level, using the World Bank classification: high-income countries and low- and middle-income countries (used as a proxy for low-wage countries).[13]

Increased imports from high-income countries have no significant effect, except on labour productivity at the cross-industry level (Table 2.6.3 , column 1). In several industries, there is evidence that pro-competitive effects of increase trade openness reflect increased competition from low-wage countries. These pro-competitive effects are still observed in the industries of rubber and transport for prices, in the industries of wood and ICT for labour productivity and in the industries of wood and rubber for markups. Conversely to the baseline results (Tables 2.6.1), import penetration with low- and middle-income countries have pro-competitive effect on prices in the textile industry and on productivity in the chemicals industry.

In the industries of textile, metals and machinery, import penetration with low- and middle-income countries have no significant effect on markups. These industries experienced quality upgrading in domestically produced goods (Figure 2.5.2). This may suggest that firms in these industries responded to increased competition from low-wage countries by moving their products to the high end products.

2.6.4 Effects of development in global value chains

Participation to the global value chains (GVCs) differs from the previous indicators of trade openness defined as import penetration in final demand by Chen *et al.* (2009) to fit Melitz and Ottaviano (2008) theoretical framework. However, recent works find evidence of a higher effects of GVC to measure trade openness (Auer *et al.*, 2017; Jonson and Noguera, 2012; Andrews *et al.*, 2018a). In addition, Melitz and Ottaviano (2008) underline the importance of a well-integrated market through trade to increase productivity and lower markups. In this section, GVC participation is used to measure higher degree of trade integration and as a robustness check of the previous results based on import penetration.

Compared to estimates based on gross or value-added import penetration, estimates based on GVC indicator yield to similar results, and have a significant effect in most industries. However, unlike the previous estimates, there is a pro-competitive effect of increased participation to GVC on prices in the textile industry. This suggests that import penetration may not be the relevant proxy for trade costs for this industry. Further, prices in the chemicals industry increase with higher participation to GVC, like prices in the metals industry. When participation GVC is distinguished between its complex and its simple components, only the complex components has significant pro-competitive effects.

[13] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Table 2.6.3: Effects of the level of income of trade partners

	(1) Total	(2) Total	(3) Food	(4) Textile	(5) Wood	(6) Chemicals	(7) Rubber	(8) Metals	(9) ICT	(10) Machine	(11) Transport
Dependent variable: change in relative production price (PPI)											
Change in import penetration^{HIC}	0.07	0.01	-0.14	0.38	0.36	-0.40	0.80	-0.24	-0.96	-0.20	-0.08
	(0.11)	(0.13)	(0.17)	(0.24)	(0.32)	(0.46)	(0.72)	(0.21)	(1.16)	(0.16)	(0.19)
Change in import penetration^{LMY}	-0.11***	-0.09**	-0.10	-0.15**	-0.19	0.09	-0.24*	0.21***	0.02	-0.09	-0.11**
	(0.03)	(0.04)	(0.10)	(0.08)	(0.13)	(0.10)	(0.14)	(0.06)	(0.18)	(0.07)	(0.05)
Change in nb enterprises	0.02	0.01	0.01	0.03	0.00	-0.04	0.13	-0.03	0.05	0.07	-0.01
	(0.01)	(0.01)	(0.03)	(0.04)	(0.05)	(0.06)	(0.11)	(0.05)	(0.08)	(0.05)	(0.05)
Level of relative PPI$_{-1}$	-0.16***	-0.14***	-0.37***	-0.22*	-0.26**	-0.27*	-0.22**	-0.10	-0.04	-0.48***	-0.20**
	(0.02)	(0.02)	(0.08)	(0.12)	(0.13)	(0.15)	(0.10)	(0.08)	(0.09)	(0.10)	(0.08)
Level of import penetration$^{HIC}_{-1}$	0.04*	0.04	-0.05	0.04	0.22	-0.17	0.38	-0.06	-0.45	0.07	-0.06
	(0.02)	(0.03)	(0.09)	(0.04)	(0.19)	(0.13)	(0.35)	(0.11)	(0.52)	(0.07)	(0.06)
Level of import penetration$^{LMY}_{-1}$	-0.02***	-0.02**	0.05	-0.01	-0.06***	0.03	-0.06	0.02	-0.06	-0.04	-0.02
	(0.01)	(0.01)	(0.06)	(0.02)	(0.02)	(0.03)	(0.05)	(0.02)	(0.04)	(0.03)	(0.01)
Level of real GDP$_{-1}$	0.02	0.02	-0.11	-0.05	0.10	-0.06	0.17	-0.06	0.00	0.05	-0.03
	(0.03)	(0.03)	(0.09)	(0.07)	(0.11)	(0.07)	(0.16)	(0.08)	(0.10)	(0.13)	(0.06)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in labour productivity											
Change in import penetration^{HIC}	0.44**	0.64**	0.69*	2.56	-0.12	-0.39	-0.11	0.33	-0.18	0.65	-0.19
	(0.19)	(0.27)	(0.42)	(4.89)	(0.32)	(0.60)	(0.41)	(0.60)	(0.72)	(0.42)	(0.56)
Change in import penetration^{LMY}	0.01	-0.08	-0.28	0.25	0.25*	0.18	0.08	0.18	0.32***	0.19	0.00
	(0.07)	(0.12)	(0.21)	(0.41)	(0.13)	(0.18)	(0.08)	(0.19)	(0.10)	(0.12)	(0.15)
Change in nb enterprises	0.03	0.06	0.08	-0.01	-0.00	0.02	-0.03	-0.03	-0.05	-0.02	0.09
	(0.03)	(0.05)	(0.08)	(0.24)	(0.06)	(0.11)	(0.10)	(0.13)	(0.11)	(0.12)	(0.12)
Level of labour productivity$_{-1}$	-0.18***	-0.17***	-0.43***	-0.77	-0.19**	-0.35***	-0.20***	-0.33***	-0.16**	-0.33***	-0.30***
	(0.02)	(0.03)	(0.09)	(0.61)	(0.08)	(0.10)	(0.07)	(0.08)	(0.07)	(0.09)	(0.10)
Level of import penetration$^{HIC}_{-1}$	0.03	0.08	0.43**	0.46	-0.08	-0.11	-0.14	0.32	-0.21	-0.12	-0.22
	(0.05)	(0.07)	(0.22)	(0.79)	(0.21)	(0.14)	(0.23)	(0.30)	(0.35)	(0.16)	(0.17)
Level of import penetration$^{LMY}_{-1}$	0.01	0.00	-0.28**	-0.10	0.08*	0.16***	0.05	0.04	0.02	0.07	0.02
	(0.01)	(0.03)	(0.13)	(0.18)	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)	(0.05)	(0.03)
Level of real GDP$_{-1}$	0.23***	0.26***	0.64***	0.93	-0.04	-0.06	-0.02	0.11	0.16	0.22	0.43*
	(0.06)	(0.09)	(0.22)	(1.12)	(0.21)	(0.18)	(0.12)	(0.27)	(0.15)	(0.25)	(0.26)
Level of real remuneration$_{-1}$	-0.06***	-0.06**	0.20*	-0.69	-0.03	0.12	-0.02	-0.25***	-0.01	-0.10	0.15
	(0.02)	(0.03)	(0.12)	(0.76)	(0.08)	(0.18)	(0.08)	(0.08)	(0.07)	(0.12)	(0.13)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in markup											
Change in import penetration^{HIC}	-0.03	-0.07	-0.16	-0.42	0.07	0.34	0.12	-0.08	-0.13	-0.13	0.05
	(0.06)	(0.07)	(0.22)	(0.86)	(0.14)	(0.24)	(0.12)	(0.21)	(0.14)	(0.13)	(0.18)
Change in import penetration^{LMY}	-0.06***	-0.05*	-0.06	-0.02	-0.10*	0.00	-0.08***	-0.06	-0.02	-0.02	0.02
	(0.02)	(0.03)	(0.11)	(0.08)	(0.06)	(0.07)	(0.03)	(0.06)	(0.03)	(0.04)	(0.05)
Change in nb enterprises	0.00	0.00	-0.01	-0.02	0.00	-0.07	0.03	0.02	-0.02	0.05	-0.01
	(0.01)	(0.01)	(0.04)	(0.07)	(0.02)	(0.05)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)
Level of markup$_{-1}$	-0.26***	-0.26***	-0.19**	-0.54**	-0.59***	-0.36***	-0.33***	-0.31***	-0.27***	-0.32***	-0.41***
	(0.03)	(0.04)	(0.07)	(0.24)	(0.15)	(0.13)	(0.09)	(0.08)	(0.09)	(0.08)	(0.10)
Level of import penetration$^{HIC}_{-1}$	-0.01	-0.01	-0.00	-0.07	0.05	0.04	0.08	0.04	-0.03	-0.03	-0.00
	(0.01)	(0.02)	(0.09)	(0.09)	(0.09)	(0.06)	(0.06)	(0.09)	(0.06)	(0.05)	(0.05)
Level of import penetration$^{LMY}_{-1}$	-0.01**	-0.01	-0.02	-0.00	-0.03***	-0.00	-0.02**	-0.02	-0.00	-0.01	0.01
	(0.00)	(0.01)	(0.06)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Level of real GDP$_{-1}$	0.03	0.02	0.04	-0.03	0.10**	-0.02	-0.01	0.06	0.01	0.04	0.03
	(0.02)	(0.02)	(0.11)	(0.15)	(0.05)	(0.05)	(0.03)	(0.08)	(0.04)	(0.08)	(0.05)
Observations	810	810	90	90	90	90	90	90	90	90	90

Note: HIC stands for high-income countries and LMY for low- and middle-income countries. Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy. Columns (1) and (2) include country × industry fixed effects. The other columns include country fixed effects. Column (2) displays coefficients from a weighted regression, with the share of industry-level value added in total value added as weights.

Table 2.6.4: Regressions using instrumented participation in GVC

	(1) Total	(2) Total	(3) Food	(4) Textile	(5) Wood	(6) Chemicals	(7) Rubber	(8) Metals	(9) ICT	(10) Machine	(11) Transport
Dependent variable: change in relative production price (PPI)											
Change in GVC participation	-0.14***	-0.15***	-0.25***	-0.20**	-0.07	0.19***	-0.18***	0.17*	-0.21**	-0.32***	-0.45***
	(0.03)	(0.03)	(0.05)	(0.10)	(0.10)	(0.07)	(0.07)	(0.09)	(0.08)	(0.10)	(0.17)
Change in nb enterprises	0.00	-0.00	0.01	0.01	-0.03	-0.04	0.02	0.05	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.05)
Level of relative PPI_{-1}	-0.13***	-0.12***	-0.34***	-0.37***	-0.27***	-0.10*	-0.17***	-0.14**	-0.13***	-0.32***	-0.29***
	(0.02)	(0.02)	(0.06)	(0.09)	(0.08)	(0.06)	(0.04)	(0.07)	(0.04)	(0.07)	(0.09)
Level of GVCP $participation_{-1}$	-0.01	-0.01	0.05***	-0.07*	-0.07	0.01	-0.00	-0.02	-0.09**	-0.03	-0.15**
	(0.01)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.07)
Level of real GDP_{-1}	-0.04***	-0.03**	-0.05**	-0.15***	-0.07*	-0.03	-0.03	0.04	-0.05	-0.10***	-0.04
	(0.01)	(0.01)	(0.02)	(0.04)	(0.04)	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.05)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in labour productivity											
Change in GVC participation	0.28***	0.31***	0.13	0.38	0.38***	0.11	0.24	0.52***	0.50***	0.41	0.11
	(0.08)	(0.10)	(0.11)	(0.28)	(0.12)	(0.19)	(0.19)	(0.16)	(0.19)	(0.32)	(0.48)
Change in nb enterprises	0.02	0.04	0.06	-0.10	0.07	-0.00	-0.02	0.08	0.02	0.10	0.08
	(0.03)	(0.04)	(0.06)	(0.09)	(0.06)	(0.11)	(0.09)	(0.12)	(0.10)	(0.10)	(0.12)
Level of labour $productivity_{-1}$	-0.17***	-0.16***	-0.43***	-0.47***	-0.16***	-0.24***	-0.16***	-0.28***	-0.19***	-0.27***	-0.23***
	(0.02)	(0.03)	(0.08)	(0.11)	(0.06)	(0.07)	(0.06)	(0.09)	(0.06)	(0.08)	(0.08)
Level of GVCP $participation_{-1}$	0.02	0.03	-0.09**	-0.00	0.02	0.12*	0.06	0.20**	0.09	0.05	-0.02
	(0.02)	(0.03)	(0.04)	(0.11)	(0.07)	(0.07)	(0.09)	(0.09)	(0.09)	(0.08)	(0.17)
Level of real GDP_{-1}	0.22***	0.20***	0.30***	0.36***	0.24**	0.15	0.05	0.01	0.35***	0.36**	0.43**
	(0.04)	(0.04)	(0.09)	(0.11)	(0.11)	(0.14)	(0.10)	(0.14)	(0.12)	(0.15)	(0.20)
Level of real $remuneration_{-1}$	-0.05**	-0.06**	0.14	-0.25*	-0.12*	0.06	-0.02	-0.14	-0.05	-0.02	0.10
	(0.02)	(0.02)	(0.10)	(0.13)	(0.07)	(0.15)	(0.10)	(0.09)	(0.06)	(0.10)	(0.15)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in markup											
Change in GVC participation	-0.08***	-0.09***	-0.19***	-0.08	-0.15***	0.01	-0.17***	-0.16***	-0.07	-0.08	0.10
	(0.03)	(0.03)	(0.07)	(0.06)	(0.05)	(0.06)	(0.06)	(0.04)	(0.05)	(0.09)	(0.14)
Change in nb enterprises	-0.01	-0.00	0.00	0.03	-0.03	-0.07*	0.00	0.00	-0.03	0.03	-0.01
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Level of $markup_{-1}$	-0.29***	-0.28***	-0.19***	-0.63***	-0.71***	-0.47***	-0.37***	-0.32***	-0.29***	-0.31***	-0.39***
	(0.02)	(0.03)	(0.07)	(0.11)	(0.10)	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)
Level of GVCP $participation_{-1}$	-0.02**	-0.02***	-0.04*	-0.02	-0.06***	-0.01	-0.03	-0.03	-0.00	-0.03	0.03
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)
Level of real GDP_{-1}	0.01	0.01	0.04	0.04*	0.03	-0.05	-0.06***	-0.01	0.01	0.04	0.05
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Observations	810	810	90	90	90	90	90	90	90	90	90

Note: HIC stands for high-income countries and LMY for low- and middle-income countries. Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy. Columns (1) and (2) include country × industry fixed effects. The other columns include country fixed effects. Column (2) displays coefficients from a weighted regression, with the share of industry-level value added in total value added as weights.

2.7 Conclusion

To investigate cross-industry heterogeneity dynamics in prices, productivity and markups, this paper builds on (Melitz and Ottaviano, 2008)'s theoretical framework and its empirical setup by Chen *et al.* (2009). The data cover nine manufacturing industries in five Euro Area countries (Austria, France, Germany, Italy and Spain) over the period 1995-2014. Short-run pro-competitive effects of globalisation are observed in most industries on all three indicators of industry performance (prices, productivity, markups), regardless of the trade indicator. However, once the specifications are estimated industry-by-industry, there is evidence of cross-industry heterogeneity. The lack of pro-competitive effects of trade openness in the industries of textile and chemicals may reflect high level of market concentration, as well as quality upgrading of domestically produced goods in the European textile industry.

In terms of policy implications, the results of this chapter suggest that competition-friendly product market policies would enhance pro-competitive effects of trade openness on prices, productivity and markups. For instance, lowering tariff and non-tariff barriers or administrative burden to set up new firms would encourage firms – both domestic and foreign – to enter the market. Nevertheless, competition policies should also need to be designed to find the right balance between preventing anti-competitive behaviour of incumbent firms and encouraging firms to keep innovating to upgrade the quality of their products and reap the benefits of their innovations.

The approach chosen in this chapter could be subject to further investigation. First, it could put more emphasis on the developments of global value chains, since it measures the level of integration of markets through trade. For instance, the position in GVC (upstream or downstream) also influences trade costs Koopman *et al.* (2010), and hence on prices, markups and productivity. Second, the analysis underlines the limits in assuming labour as the only production factor. For capital-intensive industries such as the metals industry, labour productivity is not relevant as a measure of production costs. The intensity of investment in both tangibles and intangibles could be introduced as a proxy for capital. Third, instrumental variables for trade openness could be more specifically chosen depending on the industry or trade partners, instead of resorting to a one-size-fits-all set of instrumental variables.

Appendix

2.A Additional information on data

2.A.1 Manufacturing industry aggregation

Label	**Code (from NACE Rev. 2)**	**Description**
Food	D10T12	Food products, beverages and tobacco products
Textile	D13T15	Textile, apparel,leather and related products
Wood	D16T18	Wood and paper products, and printing
Chemicals	D20T21	Chemicals and chemical products; Pharmaceuticals, medicinal chemical and botanical products
Rubber	D22T23	Rubber and plastic products, and other non-metallic mineral products
Metals	D24T25	Basic metals and fabricated metal products
ICT	D26T27	Computer, electronic and optical products; Electrical equipment
Machine	D28	Machinery and equipment
Transport	D29T30	Transport equipment

Note: In the case of variables from BACH database, "Food" does not include tobacco (D12).

2.A.2 Data sources and description

Variable	Description	Source
Producer price	Producer price index (2010 = 100) in manufacturing industry for domestic market. Sector producer prices are expressed relative to the producer price of the total manufacturing.	Eurostat (Short-term statistics)
Labour productivity	Ratio of value added in volume to total employment (employees and self-employed)	Eurostat (National accounts)
Markup	Ratio of turnover to total variable costs	BACH
Value added penetration	Foreign value added embodied in the final domestic demand; see Appendix 2.B for further details	WIOD (2013 and 2016)
GVC participation	Sum of foreign value added embodied in domestic exports (backward linkage) and domestic value added embodied in foreign exports (forward linkage) over value added	Wang et al. (2016, 2017)
Number of enterprises	Number of enterprises active during at least a part of the reference period	Eurostat (Structural Business Survey)
Size of the country	GDP in volume	Eurostat (National accounts)
Real remuneration	Compensation of employees deflated by producer price index	Eurostat (National accounts, Short-term statistics)
Bulkiness	Ratio of exports in value to exports in volume (weight in kg)	Eurostat (COMEXT)
Apparent tariff rate	Import-weighted tariff rates of the European Union at the sector-level	WTO-TRAINS, Eurostat (COMEXT)
Gravity	weighted average of industry value added share over total value added, where the weight is defined as the distance between two countries	Eurostat and CEPII
Freight transport	Total inland freight transport (Tonnes-kilometres)	OECD Transport Database
Real effective exchange rate	weighted average of HCPI-based nominal effective exchange rates	Updated data from Darvas (2012)
Balassa index	Ratio of a country's export share in an industry to the Euro area's average export shares	Eurostat (COMEXT)
HHI	Herfindahl-Hirschmann Index	EU-KLEMS
Domestic quality upgrading	Difference between changes in the gross output deflator and the producer price index	Eurostat (Short-term statistics) and OECD STAN Database

2.A.3 Classification harmonization

Matching trade and firms data to national account data is a difficult task, as different classifications (good-, product- and activity-based) and vintages coexist. Most of the data are classified according to the NACE Rev.2 economic activity-level classification and need to match data classified at good- or

product-level. For this exercise, theoretical transition matrices are used, based on *ad hoc* correspondence tables provided by Eurostat and the United Nations.

The main difficulty is that correspondence tables do not provide unique associations between codes. More specifically, a single code α of the initial classification can correspond to $n \geq 2$ codes of the final classification (A_1, A_2,..., A_n). To disaggregate α into A_1, A_2,..., A_n, the observation classified in α are divided by n, i.e. $1/n$ of α goes to each A_i with $i \in [1, n]$.

Trade data. The bulkiness index and tariff rates are estimated with data classified in HS (Harmonized Commodity Description and Coding System, managed by the World Customs Organisation).

The following figures illustrate the steps to convert goods-level data for trade into NACE Rev.2 classification:

$$N^{goods}_{HS2012} \Rightarrow N^{goods}_{HS2007} \Rightarrow N^{products}_{CPA2008} \Rightarrow N^{activity}_{NACErev2}$$

Value added import penetration is computed with WIOD editions of 2013 and 2016. Data of the 2013 edition cover the period 1995-2011 and are in NACE Rev.1, while data of the 2016 edition cover the period 2000-2014 in NACE Rev. 2. Computing long series over the period 1995-2014 require two steps. First, data of the 2013 edition are converted into NACE Rev.2 using an approximated correspondence table[14]. Second, data of the 2016 edition are backward-extrapolated over the period 1995-1999 using changes in the data from the first step.

Firms data: In the case of the number of enterprises and the markup, firms data are used (Eurostat SBS for the first and BACH for the second). These data are broken into two vintage: one in NACE Rev.1 (before 2005 for SBS and 2000 for BACH) and one in NACE Rev.2. To work with long series, the correspondences between NACE Rev.1 and NACE Rev.2 provided Eurostat is used. Unlike the two previous conversions, a "linguistic" correspondence is used instead of a theoretical correspondence, like Auer *et al.* (2013). When a single code α corresponds to $n \geq 2$ codes of the final classification (A_1, A_2,..., A_n), the class that best matched the label of α is chosen. For instance, the class 29.13 (Manufacture of taps and valves) in NACE Rev.1 corresponds to both classes 28.14 (Manufacture of other taps and valves) and 33.12 (Repair of machinery). As 28.14 corresponds better to 29.13, 28.14 is used as the exact reference of 29.13 in NACE Rev.2.

[14] http://www.oecd.org/sti/ind/TiVA 2015 Guide to Country Notes.pdf

2.B Value added import penetration

Value added import penetration is defined as the foreign value added embodied in the final demand, based on Stehrer (2012) and TiVA's approach. More precisely, this indicator measure how much value added of all trade partners is contained in the final demand of a country. Based on the Input-Output approach:

$$x = ic + f = A.x + f = L.f \tag{2.B.1}$$

with x, ic and f $NK \times 1$ vectors of respectively gross output, intermediate consumption and final demand (with N being the number of countries and K the number of products). Note that x includes both domestic production and imports. A is a $NK \times NK$ matrix of technical input-output coefficients, with element a_{ij} denoting the ratio of input used from an industry j in product i per unit of j gross output. $L = (I - A)^{-1}$ is called the Leontief inverse.

The value added is related to gross output through the following relation $va = V.x$ where va denotes a $NK \times 1$ vector of value added and $V = diag((I - {}^tA)\mathbf{1})$ is a diagonalized $NK \times NK$ matrix of value added share of gross output (with $\mathbf{1}$ a vector of ones and of lenght NK).

Stehrer (2012) illustrates his calculations with an example of trade between three countries r, s and t.

$$\begin{bmatrix} va^r \\ va^s \\ va^t \end{bmatrix} = \begin{bmatrix} v^r & 0 & 0 \\ 0 & v^s & 0 \\ 0 & 0 & v^t \end{bmatrix} \begin{bmatrix} L^{rr} & L^{rs} & L^{rt} \\ L^{sr} & L^{ss} & L^{st} \\ L^{tr} & L^{ts} & L^{tt} \end{bmatrix} \begin{pmatrix} f^{rr} + f^{rs} + f^{rt} \\ f^{sr} + f^{ss} + f^{st} \\ f^{tr} + f^{ts} + f^{tt} \end{pmatrix} \tag{2.B.2}$$

where f^{cc} $(c = r, s, t)$ is a $N \times 1$ vector of country c final demand for domestic products, and $f^{cc'}$ $(c \neq c')$ is a $N \times 1$ vector of country c' final demand for country c products.

now consider trade between countries r and s. From the previous relation, country s value added can be written as a sum of three terms:

$$va^s = v^s(L^{ss}f^{ss} + L^{sr}f^{rs} + L^{st}f^{ts}) + v^s(L^{sr}f^{rr} + L^{ss}f^{sr} + L^{st}f^{tr}) + v^s(L^{sr}f^{rt} + L^{ss}f^{st} + L^{st}f^{tt})$$

where each term respectively represents the country s value added included in (domestic and imported) final demand of country s, r and t. More precisely, the "value added import of r from s" is the second

term of the sum, that is the value added from s included in r final demand:

$$t_M^{rs} = v^s(L^{sr}f^{rr} + L^{ss}f^{sr} + L^{st}f^{tr})$$

The first term in the second line accounts for the value added created in country s to satisfy country r's domestic demand, the second term denotes value added created in country s to satisfy country r's demand for final products imported from country s and the third term denotes the value added created in country s to satisfy country r's demand for final products imported from country t.

The value added import of country r is then:

$$t_M^r = t_M^{rs} + t_M^{rt}$$

And the value added import penetration of country r is the ratio of the value added import of r to its final demand:

$$\theta_{VA}^r = \frac{t_M^r}{f^{rr} + f^{sr} + f^{tr}}$$

2.C Additional regressions

Table 2.C.1: Baseline regressions using non instrumented VA import penetration

	(1) Total	(2) Total	(3) Food	(4) Textile	(5) Wood	(6) Chemicals	(7) Rubber	(8) Metals	(9) ICT	(10) Machine	(11) Transport
Dependent variable: change in relative production price											
Change in import penetration	-0.05***	-0.04*	-0.11***	-0.11	-0.04	-0.02	-0.15***	0.24***	-0.25***	-0.14**	-0.15**
	(0.02)	(0.02)	(0.04)	(0.07)	(0.07)	(0.06)	(0.04)	(0.05)	(0.08)	(0.06)	(0.06)
Change in nb enterprises	0.01	0.00	-0.01	0.01	-0.01	-0.04	0.01	0.05	0.02	0.03	0.01
	(0.01)	(0.01)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Level of relative PPI$_{-1}$	-0.13***	-0.12***	-0.27***	-0.28***	-0.24***	-0.18***	-0.19***	-0.18**	-0.10***	-0.33***	-0.22***
	(0.02)	(0.02)	(0.07)	(0.08)	(0.08)	(0.07)	(0.05)	(0.07)	(0.04)	(0.08)	(0.07)
Level of import penetration$_{-1}$	0.00	0.00	0.03**	-0.01	-0.07	-0.03	-0.02	0.02	-0.17**	-0.00	-0.10**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)	(0.03)	(0.02)	(0.04)	(0.07)	(0.03)	(0.04)
Level of real GDP$_{-1}$	-0.05***	-0.04***	-0.05**	-0.15***	-0.07*	0.00	-0.02	0.02	-0.04	-0.12***	-0.08**
	(0.01)	(0.01)	(0.03)	(0.05)	(0.04)	(0.03)	(0.02)	(0.03)	(0.05)	(0.04)	(0.04)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in labour productivity											
Change in import penetration	0.17***	0.19***	-0.09	0.30**	0.16*	0.07	0.22*	0.53***	0.16	0.39**	-0.17
	(0.05)	(0.06)	(0.09)	(0.15)	(0.10)	(0.17)	(0.11)	(0.15)	(0.20)	(0.17)	(0.18)
Change in nb enterprises	0.01	0.04	0.07	-0.11	0.03	0.00	-0.01	0.03	-0.02	0.08	0.08
	(0.03)	(0.04)	(0.06)	(0.08)	(0.06)	(0.11)	(0.10)	(0.12)	(0.11)	(0.10)	(0.12)
Level of labour productivity$_{-1}$	-0.18***	-0.17***	-0.41***	-0.55***	-0.19***	-0.25***	-0.17***	-0.31***	-0.17***	-0.29***	-0.25***
	(0.02)	(0.03)	(0.08)	(0.10)	(0.07)	(0.07)	(0.06)	(0.09)	(0.05)	(0.09)	(0.09)
Level of import penetration$_{-1}$	0.00	0.01	-0.04	-0.03	0.10	0.18*	0.07	0.27**	-0.04	-0.03	-0.13
	(0.02)	(0.02)	(0.04)	(0.04)	(0.09)	(0.10)	(0.08)	(0.13)	(0.17)	(0.09)	(0.14)
Level of real GDP$_{-1}$	0.25***	0.24***	0.19**	0.43***	0.20**	0.18	0.07	0.06	0.37***	0.42**	0.51**
	(0.04)	(0.04)	(0.09)	(0.12)	(0.10)	(0.14)	(0.08)	(0.13)	(0.13)	(0.17)	(0.20)
Level of real remuneration$_{-1}$	-0.06***	-0.07***	0.23**	-0.33***	-0.08	0.02	-0.02	-0.18**	-0.04	-0.01	0.07
	(0.02)	(0.03)	(0.10)	(0.08)	(0.06)	(0.14)	(0.07)	(0.08)	(0.07)	(0.11)	(0.12)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in markup											
Change in import penetration	-0.10***	-0.10***	-0.14**	-0.05	-0.10***	-0.03	-0.19***	-0.20***	-0.08	-0.01	-0.04
	(0.02)	(0.02)	(0.05)	(0.05)	(0.03)	(0.06)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)
Change in nb enterprises	-0.01	0.00	-0.01	0.02	-0.01	-0.07*	-0.00	0.01	-0.02	0.04	-0.02
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
Level of markup$_{-1}$	-0.28***	-0.27***	-0.19***	-0.61***	-0.76***	-0.48***	-0.42***	-0.32***	-0.28***	-0.29***	-0.37***
	(0.02)	(0.04)	(0.07)	(0.11)	(0.11)	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)	(0.09)
Level of import penetration$_{-1}$	-0.02***	-0.02**	-0.03	-0.01	-0.08***	-0.03	-0.05**	-0.06	0.00	-0.02	-0.01
	(0.01)	(0.01)	(0.02)	(0.01)	(0.03)	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.04)
Level of real GDP$_{-1}$	0.00	0.00	0.01	0.04	0.02	-0.04	-0.05***	0.00	-0.00	0.02	0.06*
	(0.01)	(0.01)	(0.04)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Observations	810	810	90	90	90	90	90	90	90	90	90

Note: Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy. Columns (1) and (2) include country × industry fixed effects. The other columns include country fixed effects. Column (2) displays coefficients from a weighted regression, with the share of industry-level value added in total value added as weights.

Table 2.C.2: Baseline regressions using instrumented gross import penetration

	(1) Total	(2) Total	(3) Food	(4) Textile	(5) Wood	(6) Chemicals	(7) Rubber	(8) Metals	(9) ICT	(10) Machine	(11) Transport
Dependent variable: change in relative production price											
Change in import penetration	-0.13***	-0.15***	-0.40***	-0.17	-0.15	0.48	-0.14**	0.19***	-0.23**	-0.23**	-0.09
	(0.04)	(0.04)	(0.10)	(0.14)	(0.11)	(0.32)	(0.07)	(0.06)	(0.10)	(0.09)	(0.09)
Change in nb enterprises	-0.00	-0.01	-0.07**	0.01	-0.01	0.00	0.01	0.07*	0.02	0.01	0.00
	(0.01)	(0.02)	(0.03)	(0.04)	(0.04)	(0.07)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
Level of relative PPI$_{-1}$	-0.14***	-0.13***	-0.16*	-0.33***	-0.36***	-0.11	-0.22***	-0.17**	-0.17***	-0.32***	-0.17**
	(0.02)	(0.02)	(0.08)	(0.09)	(0.11)	(0.11)	(0.06)	(0.07)	(0.05)	(0.09)	(0.07)
Level of import penetration$_{-1}$	-0.02***	-0.03***	0.02	-0.03	-0.15**	0.03	-0.01	-0.01	-0.17**	-0.03	-0.03
	(0.01)	(0.01)	(0.02)	(0.03)	(0.07)	(0.05)	(0.02)	(0.03)	(0.07)	(0.03)	(0.05)
Level of real GDP$_{-1}$	-0.04***	-0.03**	-0.06*	-0.12**	-0.10**	0.02	-0.03	0.04	-0.03	-0.12***	-0.10**
	(0.01)	(0.01)	(0.03)	(0.06)	(0.05)	(0.05)	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in labour productivity											
Change in import penetration	0.29***	0.34***	0.21	0.41	0.33***	-0.21	0.04	0.35***	0.57**	0.45	-0.07
	(0.08)	(0.10)	(0.23)	(0.28)	(0.13)	(0.29)	(0.17)	(0.12)	(0.26)	(0.28)	(0.25)
Change in nb enterprises	0.04	0.07	0.10	-0.09	0.04	-0.05	-0.03	0.03	-0.03	0.12	0.10
	(0.03)	(0.05)	(0.07)	(0.08)	(0.06)	(0.12)	(0.10)	(0.12)	(0.11)	(0.11)	(0.12)
Level of labour productivity$_{-1}$	-0.18***	-0.17***	-0.35***	-0.56***	-0.24***	-0.19**	-0.20***	-0.30***	-0.25***	-0.27***	-0.23***
	(0.02)	(0.03)	(0.09)	(0.10)	(0.07)	(0.09)	(0.06)	(0.08)	(0.07)	(0.09)	(0.08)
Level of import penetration$_{-1}$	0.03	0.04	-0.00	-0.01	0.18**	0.03	0.07	0.03	0.28	0.03	-0.09
	(0.02)	(0.03)	(0.05)	(0.06)	(0.09)	(0.08)	(0.05)	(0.08)	(0.18)	(0.09)	(0.14)
Level of real GDP$_{-1}$	0.23***	0.22***	0.15	0.42***	0.23***	0.19	0.07	0.24**	0.32***	0.45**	0.47***
	(0.04)	(0.04)	(0.09)	(0.14)	(0.09)	(0.14)	(0.07)	(0.11)	(0.12)	(0.18)	(0.18)
Level of real remuneration$_{-1}$	-0.04	-0.05*	0.21**	-0.34***	-0.08	-0.00	-0.01	-0.26***	-0.08	-0.05	0.08
	(0.02)	(0.03)	(0.10)	(0.09)	(0.06)	(0.14)	(0.07)	(0.07)	(0.07)	(0.12)	(0.12)
Observations	769	769	89	88	85	89	89	81	81	78	89
Dependent variable: change in markup											
Change in import penetration	-0.07***	-0.09***	-0.23*	-0.05	-0.13***	0.07	-0.02	-0.14***	-0.06	-0.06	0.06
	(0.03)	(0.03)	(0.13)	(0.09)	(0.05)	(0.10)	(0.07)	(0.04)	(0.07)	(0.08)	(0.08)
Change in nb enterprises	-0.01	-0.01	-0.04	0.03	-0.01	-0.06	0.01	0.01	-0.03	0.04	-0.02
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
Level of markup$_{-1}$	-0.29***	-0.28***	-0.21***	-0.63***	-0.81***	-0.45***	-0.32***	-0.29***	-0.27***	-0.36***	-0.41***
	(0.02)	(0.04)	(0.07)	(0.10)	(0.11)	(0.10)	(0.10)	(0.08)	(0.09)	(0.08)	(0.09)
Level of import penetration$_{-1}$	-0.01	-0.01*	-0.03	-0.01	-0.08***	0.00	-0.02	-0.02	0.02	-0.05**	0.05
	(0.01)	(0.01)	(0.03)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.04)
Level of real GDP$_{-1}$	-0.00	-0.00	-0.01	0.04	0.01	-0.05*	-0.06***	-0.01	-0.01	0.03	0.04
	(0.01)	(0.01)	(0.04)	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)
Observations	810	810	90	90	90	90	90	90	90	90	90

Note: Standard errors in parentheses. *, ** and *** denote statistical significance at the 10%, 5%. All columns include a crisis dummy. Columns (1) and (2) include country × industry fixed effects. The other columns include country fixed effects. Column (2) displays coefficients from a weighted regression, with the share of industry-level value added in total value added as weights.

2.D Tests

2.D.1 Tests for instrumental variables

Reported tests are those for the pooled regressions. For prices, the instrumental variables include bulkiness, freight transports, REER and the Balassa index. For productivity and markup, they include gravity, effective tariff rate, REER and the Balassa index. When there is only one endogenous variable to instrument, the reported statistic to test weakness of instruments is the Cragg and Donald (1993) statistic for which Stock and Yogo (2005) have tabulated critical values. When there are multiple endogenous variables (e.g. import penetration from high-income countries and from low-/middle-income countries), the reported statistic is the Gantman and Dabós (2016) multivariate F test of excluded instruments.

Table 2.D.1: Testing the efficiency of instrumental variables in the baseline equation with value added import penetration

	Test of weak instruments[1]			Test of Sargan[2] (χ^2 p-value)		
	Price	Productivity	Markup	Price	Productivity	Markup
Total	41.26 (5%)	40.28 (5%)	40.00 (5%)	7.57 (0.06)	2.25 (0.52)	4.33 (0.23)
Total (weighted)	43.09 (5%)	43.35 (5%)	41.76 (5%)	2.49 (0.48)	2.53 (0.47)	2.76 (0.43)
Food	9.89 (20%)	8.69 (20%)	9.73 (20%)	6.00 (0.11)	2.23 (0.53)	2.15 (0.54)
Textile	4.00 (> 30%)	3.31 (> 30%)	6.02 (30%)	10.16 (0.02)	6.51 (0.09)	1.84 (0.61)
Wood	10.87 (10%)	14.41 (10%)	10.85 (10%)	8.23 (0.04)	1.97 (0.58)	2.50 (0.47)
Chemicals	0.36 (> 30%)	1.56 (> 30%)	1.48 (> 30%)	8.00 (0.05)	3.39 (0.34)	1.00 (0.80)
Rubber	6.00 (> 30%)	7.00 (20%)	6.16 (30%)	8.59 (0.03)	1.26 (0.74)	10.86 (0.01)
Metals	8.00 (20%)	33.94 (5%)	31.10 (5%)	12.6 (0.01)	4.89 (0.18)	12.72 (0.01)
ICT	7.00 (20%)	7.57 (30%)	8.38 (20%)	7.83 (0.05)	9.01 (0.03)	2.01 (0.57)
Machine	5.80 (30%)	4.46 (> 30%)	5.19 (> 30%)	1.26 (0.74)	8.03 (0.05)	5.92 (0.12)
Transport	3.93 (> 30%)	2.05 (> 30%)	2.00 (> 30%)	4.87 (0.18)	0.17 (0.98)	0.77 (0.86)

Note: The table displays the tests for Table 2.6.1. [1] The Stock-Yogo critical value is in parentheses. [2] Test of Hansen for the weighted regression.

Table 2.D.2: Testing the efficiency of instrumental variables in the equation with market concentration

	Test of weak instruments[1]			Test of Sargan[2] (χ^2 p-value)		
	Price	Productivity	Markup	Price	Productivity	Markup
Total	32.15 (5%)	35.31 (5%)	31.26 (5%)	10.76 (0.01)	2.98 (0.40)	4.42 (0.22)
Total (weighted)	37.24 (5%)	41.84 (5%)	38.76 (5%)	6.24 (0.10)	3.00 (0.39)	2.68 (0.44)

Note: The table displays the tests for Table 2.6.2. [1] The Stock-Yogo critical value is in parentheses. [2] Test of Hansen for the weighted regression.

Table 2.D.3: Testing the efficiency of instrumental variables in the equation with low-wage countries

	Test of weak instruments[1]			Test of Sargan[2] (χ^2 p-value)		
	Price	Productivity	Markup	Price	Productivity	Markup
Total	8.80 (20%) 10.75 (10%)	15.97 (10%) 16.74 (10%)	16.16 (10%) 16.42 (10%)	0.48 (0.79)	1.04 (0.60)	0.40 (0.82)
Total (weighted)	7.31 (20%) 8.67 (20%)	12.49 (10%) 10.93 (10%)	12.16 (10%) 11.36 (10%)	0.05 (0.97)	1.00 (0.61)	0.96 (0.62)
Food	1.05 (> 30%) 0.99 (> 30%)	1.62 (> 30%) 1.62 (> 30%)	1.47 (> 30%) 1.47 (> 30%)	7.25 (0.03)	0.87 (0.65)	2.07 (0.36)
Textile	2.12 (> 30%) 8.61 (20%)	0.10 (> 30%) 1.99 (> 30%)	0.13 (> 30%) 0.37 (> 30%)	4.73 (0.09)	0.78 (0.68)	1.46 (0.48)
Wood	1.43 (> 30%) 1.50 (> 30%)	3.79 (> 30%) 4.12 (> 30%)	2.83 (> 30%) 3.37 (> 30%)	6.22 (0.04)	0.71 (0.71)	0.22 (0.90)
Chemicals	0.59 (> 30%) 2.78 (> 30%)	1.43 (> 30%) 2.06 (> 30%)	1.63 (> 30%) 2.74 (> 30%)	3.60 (0.17)	2.47 (0.29)	0.22 (0.90)
Rubber	0.47 (> 30%) 0.56 (> 30%)	3.72 (> 30%) 20.57 (5%)	4.18 (> 30%) 23.87 (5%)	0.31 (0.85)	1.00 (0.61)	3.31 (0.19)
Metals	3.34 (> 30%) 3.60 (> 30%)	2.08 (> 30%) 2.13 (> 30%)	1.89 (> 30%) 1.93 (> 30%)	1.01 (0.60)	3.93 (0.14)	12.64 (0.00)
ICT	0.23 (> 30%) 0.25 (> 30%)	1.65 (> 30%) 4.11 (> 30%)	3.45 (> 30%) 5.17 (> 30%)	2.40 (0.30)	7.05 (0.03)	2.01 (0.37)
Machine	2.25 (> 30%) 1.29 (> 30%)	5.15 (> 30%) 4.69 (> 30%)	5.50 (30%) 4.50 (> 30%)	1.36 (0.51)	9.19 (0.01)	5.94 (0.05)
Transport	3.77 (> 30%) 6.22 (30%)	2.65 (> 30%) 5.56 (30%)	2.64 (> 30%) 5.58 (30%)	1.90 (0.38)	0.45 (0.81)	0.86 (0.65)

Note: The table displays the tests for Table 2.6.3. For the test of weak instruments, the first set number corresponds to the test of weak instruments for value import penetration in high-income countries and the second to the test for low-/middle-income countries. [1] The Stock-Yogo critical value is in parentheses. [2] Test of Hansen for the weighted regression.

Table 2.D.4: Testing the efficiency of instrumental variables in the equation with GVC participation

	Test of weak instruments[1]			Test of Sargan[2] (χ^2 p-value)		
	Price	Productivity	Markup	Price	Productivity	Markup
Total	71.84 (5%)	63.19 (5%)	65.44 (5%)	6.40 (0.09)	3.59 (0.31)	4.29 (0.23)
Total (weighted)	70.91 (5%)	63.20 (5%)	65.83 (5%)	2.05 (0.56)	3.55 (0.31)	4.85 (0.18)
Food	12.92 (10%)	19.54 (5%)	21.38 (5%)	3.32 (0.34)	2.45 (0.48)	1.24 (0.74)
Textile	6.68 (30%)	4.93 (> 30%)	7.76 (20%)	9.95 (0.02)	5.42 (0.14)	1.13 (0.77)
Wood	13.01 (10%)	18.47 (5%)	17.00 (5%)	7.20 (0.07)	0.64 (0.89)	1.75 (0.63)
Chemicals	12.54 (10%)	14.64 (10%)	15.16 (10%)	2.21 (0.53)	4.35 (0.23)	5.80 (0.12)
Rubber	8.16 (20%)	9.32 (20%)	9.19 (20%)	9.01 (0.03)	1.01 (0.80)	8.56 (0.04)
Metals	5.01 (30%)	22.23 (5%)	26.01 (5%)	14.82 (0.00)	3.87 (0.28)	15.07 (0.00)
ICT	11.04 (10%)	18.12 (5%)	18.37 (5%)	11.13 (0.01)	12.71 (0.01)	3.30 (0.35)
Machine	6.60 (30%)	6.54 (30%)	8.44 (20%)	3.33 (0.34)	11.59 (0.01)	6.45 (0.09)
Transport	3.19 (> 30%)	2.60 (> 30%)	2.97 (> 30%)	2.02 (0.57)	0.05 (0.99)	0.83 (0.84)

Note: The table displays the tests for Table 2.6.4. [1] The Stock-Yogo critical value is in parentheses. [2] Test of Hansen for the weighted regression.

Table 2.D.5: Testing the efficiency of instrumental variables in the baseline equation with gross import penetration

	Test of weak instruments[1]			Test of Sargan[2] (χ^2 p-value)		
	Price	Productivity	Markup	Price	Productivity	Markup
Total	51.06 (5%)	53.19 (5%)	56.29 (5%)	8.47 (0.04)	1.54 (0.67)	5.35 (0.15)
Total (weighted)	50.33 (5%)	54.61 (5%)	57.22 (5%)	2.33 (0.51)	1.67 (0.64)	3.62 (0.31)
Food	8.50 (20%)	7.35 (20%)	8.70 (20%)	2.44 (0.49)	3.19 (0.36)	3.33 (0.34)
Textile	6.05 (30%)	7.84 (20%)	7.36 (20%)	9.90 (0.02)	6.15 (0.10)	2.22 (0.53)
Wood	9.42 (20%)	12.70 (10%)	12.80 (10%)	8.34 (0.04)	3.53 (0.32)	4.53 (0.21)
Chemicals	0.86 (> 30%)	3.20 (> 30%)	3.26 (> 30%)	0.71 (0.87)	3.79 (0.28)	4.35 (0.23)
Rubber	8.67 (20%)	8.81 (20%)	8.39 (20%)	6.79 (0.08)	2.39 (0.50)	12.55 (0.01)
Metals	6.55 (30%)	26.21 (5)	31.66 (5%)	10.64 (0.01)	4.00 (0.27)	9.69 (0.02)
ICT	7.43 (20%)	5.78 (30%)	6.90 (20%)	8.80 (0.03)	13.54 (0.00)	2.78 (0.43)
Machine	7.60 (20%)	5.75 (30%)	6.86 (20%)	2.00 (0.57)	8.55 (0.04)	7.94 (0.05)
Transport	11.69 (10%)	10.35 (10%)	8.66 (20%)	8.84 (0.03)	0.15 (0.98)	1.07 (0.78)

Note: The table displays the tests for Table 2.C.2. [1] The Stock-Yogo critical value is in parentheses. [2] Test of Hansen for the weighted regression.

2.D.2 Stationarity tests

Panel-data Dickey-Fuller test is carried out with one lag and without trend. The null hypothesis is that all the series do have a unit root and the alternative hypothesis is that at least one series does not have a unit root.

Table 2.D.6: Dickey-Fuller test - Production price

		Statistics	p-value
Inverse chi-squared(100)	P	83.4424	0.8839
Inverse normal	Z	4.5041	1.0000
Inverse logit t(254)	$L*$	4.2534	1.0000
Modified inv. chi-squared	P_m	-1.1708	0.8792

p-statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels..

Table 2.D.7: Dickey-Fuller test - Labour productiviy

		Statistics	p-value
Inverse chi-squared(100)	P	8509963	0.8396
Inverse normal	Z	1.031	0.8485
Inverse logit t(254)	$L*$	1.0707	0.8573
Modified inv. chi-squared	P_m	-0.9902	0.8390

p-statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels..

Table 2.D.8: Dickey-Fuller test - Markup

		Statistics	p-value
Inverse chi-squared(100)	P	105.2287	0.3407
Inverse normal	Z	0.4250	0.6646
Inverse logit t(254)	$L*$	0.1323	0.5526
Modified inv. chi-squared	P_m	0.3697	0.3558

p-statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels..

Chapter 3

Accounting for technology, trade and final consumption in employment: An Input-Output decomposition

This chapter is based on a working paper co-authored with Aurélien Poissonnier and published by Insee in *Documents de travail de la Direction des Études et Synthèses Économiques*.

3.1 Introduction

The increasing share of high-skill employment is a widespread phenomenon across advanced economies. While France displays skill-biased changes in employment, there is evidence for labour market polarisation in other countries, i.e. increase in both high-skilled and low-skilled employment at the expense of middle-skilled one[1]. In a context of marked technological change and increasing globalisation, there are ongoing debates over the relative influence of trade and technology on employment in advanced economies, and more specifically their contributions to the structure of employment. More recent studies also underline the importance of consumer preferences to explain either skill-biased changes or labour market polarisation.

The objective of this paper is to understand the nature of employment changes in France over the period 1982-2010. More specifically, we try to establish whether France experienced only skill-biased changes in employment or if there is evidence of polarisation effects that are offset by other effects. Based on Input-Output analysis, we provide a breakdown of changes in employment by skill and pro-

[1] See Harrison *et al.* (2010) for a detailed review of literature on the subject

duction between the contributions of final consumption, trade and technology (defined here as the use of production factors).

Our main findings are that on a yearly basis, technology shows marked skill-bias, whereas trade and final consumption have limited skill-bias effects. We find no evidence of polarisation effects of technology, trade or final consumption. The development of high-technology manufacturing and R&D over the last thirty years mainly contributes to this skill-biased change in employment. Final consumption has an important contribution regardless of the skill level and explained by the development of services at the expense of agriculture and low-technology manufacturing products. Finally, unlike other papers based on Input-Output analysis, we find a positive contribution of trade to employment at every skill level, as the positive contribution of higher exports thanks to globalisation offsets the negative contribution of offshore outsourcing.

Our analysis builds on textbook methodologies of structural decomposition (Miller and Blair, 2009, Chapter 13)[2] but innovative data: time series of Input-Output tables from 1980 to 2010, based on the new European System of Account (ESA2010) and both in current and previous year prices. The price effects in the data we built are specific to each use (consumption, investment, exports...) and account for the price differential between domestic and imported supplies.

Within the limitations of the structural decomposition methodology, our evaluation allows for a comparison of the three contributions to employment (of technology, trade and consumption). As such it can be used as a benchmark for econometric approaches trying to capture also the long-term effect of these factors on employment.

In the remainder of this paper, Section 3.2 reviews the stylized facts and literature behind the present debate, Section 3.3 analyses the labour content of final demand (the framework on which our decomposition is built), Section 3.4 exposes the method we use to decompose changes in employment and Section 3.5 provides an analysis of our results. The construction of the datasets, both Input-Output tables and employment are documented in Appendix 3.A and 3.B.

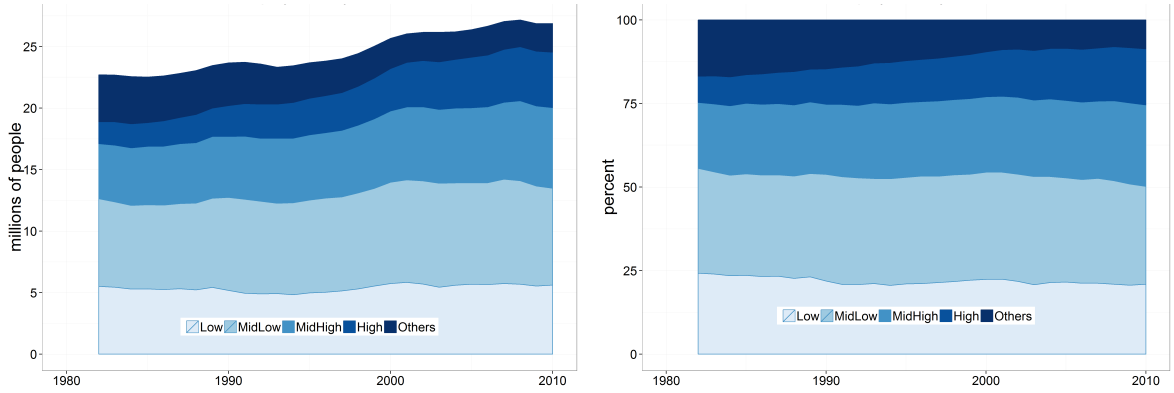
3.2 Driving forces of employment changes

We identify five skill levels for employment: high skill, middle-high skill, middle-low skill, low skill and others (including in particular farmers and self-employed). Over 1982-2010, the share of higher-skilled

[2]See Rose and Casler (1998); Dietzenbacher and Los (1998) for a general overview of the literature

jobs[3] steadily increased, especially for the highest-skilled group: its share markedly increased from 8% to 17% (Figure 3.2.1). The share of low-skilled jobs slightly decreased over the same period from 24% to 21%. As for the skill group *others*, their share in the total employment dramatically dropped from 17% to 9%, in line with the decline of the agricultural industry.

Figure 3.2.1: Employment by skill level

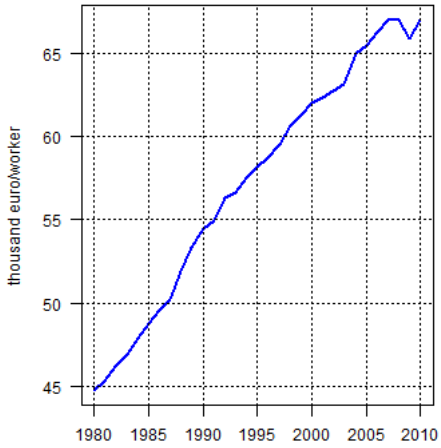


Source: Insee, LFS and national accounts; authors' calculations.

Like in many advanced economies, this skill-bias in French employment occurs in a context of steady labour productivity gains (+52% in real terms between 1980 and 2010, Figure 3.2.2), increasing openness (+5 points since 1980, Figure 3.2.3) and preferences of consumers for services (Figure 3.2.4). Hence technology, trade and final consumption are traditionally examined to explain employment changes and particularly changes by skill levels.

[3]See Appendix 3.B for details about how we define skill levels.

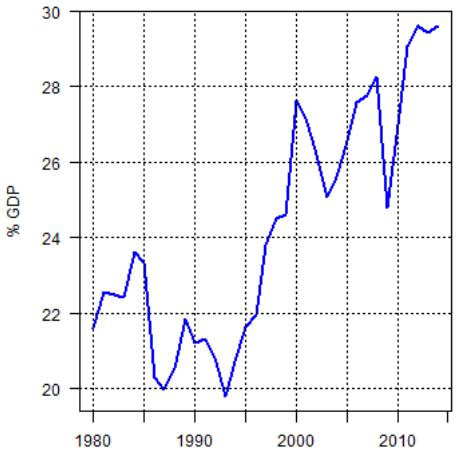
Figure 3.2.2: Labour productivity in France



Source: Insee, national accounts.

Note: Labour productivity is defined as the ratio of real value added on total domestic employment (in number of persons).

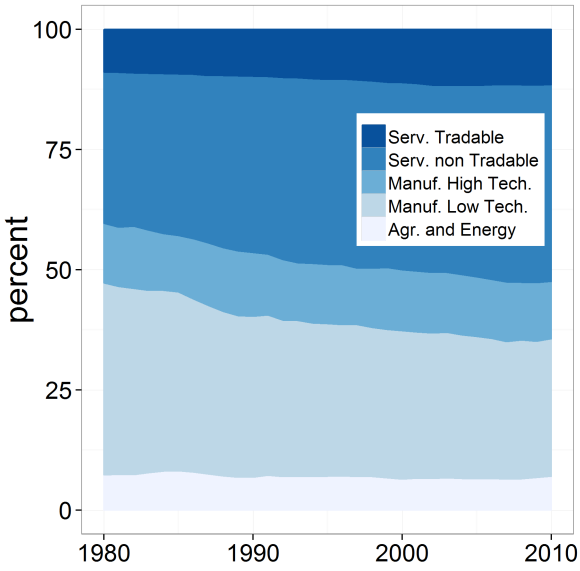
Figure 3.2.3: Trade openness ratio in France



Source: Insee, national accounts.

Note: Trade openness is defined as the sum of total exports and imports on GDP times two.

Figure 3.2.4: Consumption structure



Source: Insee, national accounts; authors' calculations

3.2.1 Technology development

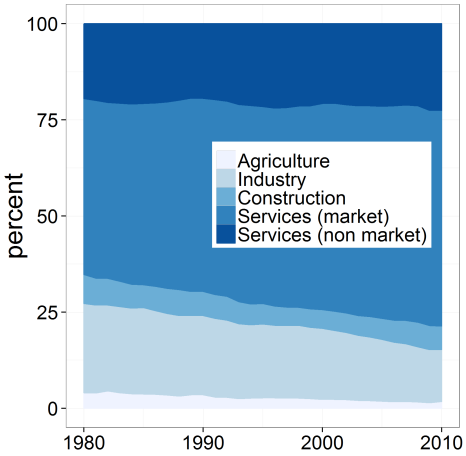
The theoretical impact of technology on aggregate employment is ambiguous. A labour saving innovation can be either used to address higher demand – and hence increase employment – or reduce payroll. Using micro-data on American firms in the concrete industry, Morin (2015) analyses the effects of electricity, a labour saving technology, during the Great Depression and finds that firms have taken advantage of the development of electrical power to reduce employment and payroll.

Technological change can also influence job composition and can lead to important reallocation of labour along with sector development, for instance development of services at the expense of the manufacturing sector (Figure 3.2.5). In this sense, changes in technology have the same effects as consumer preferences (Autor and Dorn, 2013). There is evidence of technological skill-biased effects on employment, i.e. it can be associated with an increasing demand for high- relative to low-skilled jobs (Autor *et al.*, 1998, 2003; Maurin and Thesmar, 2004; Los *et al.*, 2014; Charnoz and Orand, 2017). This skill-bias relies on the *routinization hypothesis* of Autor *et al.* (2003): new technologies such as computers are substitute for routine tasks – accomplished by following explicit rules or step-by-step procedures – and complementary to non-routine cognitive ones[4].

[4]Maurin and Thesmar (2004) rely on a similar hypothesis to explain skill-biased technological change in France: new technologies increase the demand for jobs that require constant adaptation to change, while decreasing the demand for jobs that can be programmed in advance.

One particular aspect of skill-biased technological change is labour market polarisation, i.e. a decline in middle skill labour relative both to skilled and unskilled one. Goos and Manning (2007) argue that routinization as described by Autor *et al.* (2003) is the main factor of job polarisation, as routine jobs tend to be concentrated in the middle of the skill distribution, and non-routine cognitive and manual ones in respectively the higher and lower part. On both theoretical and empirical grounds, this labour market polarisation is mainly highlighted in the US (Autor and Dorn, 2013; Autor *et al.*, 2013; Morin, 2014), but also in the UK (Goos and Manning, 2007) and Western European countries (Goos *et al.*, 2009, 2011, 2014; Michaels *et al.*, 2014).

Figure 3.2.5: Value added by industry in France



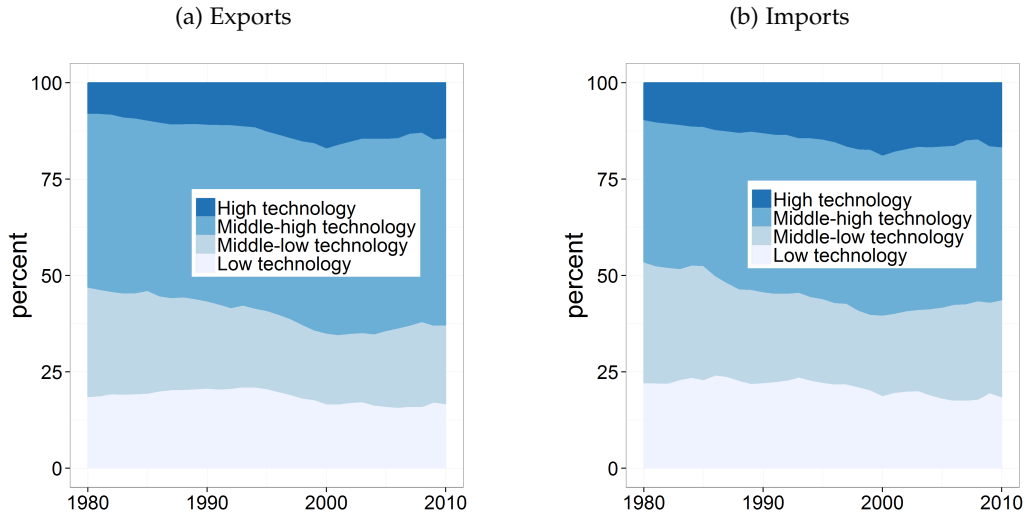
Source: Insee, national accounts.

Note: Non market services comprise public administration, education, human health and social work activities. Market services comprise the remaining services.

3.2.2 Trade openness and offshoring

Like technology, trade has opposite effects on aggregate employment. On the one hand, foreign demand can foster domestic employment through exports. On the other hand foreign economies can reduce domestic market shares – and hence employment – by supplying final and intermediate demand. The latter case has raised particular interest. As information and communication technology develop, and transportation costs and trade barriers are reduced, firms have more opportunities to subcontract to foreign lower-cost firms. This phenomenon is known as offshoring (production and jobs of a given firm are moved abroad (Blinder, 2009)) or offshore outsourcing (moved to a different firm abroad).

Figure 3.2.6: Level of technology in manufactured exports and imports in France. 1980-2010



Source: Insee, national accounts; authors' calculations

Note: High technology comprises pharmaceutical, computer, electronic and optical, air and spacecraft. Middle-high technology comprises cheminals, electrical equipment and machinery, motor vehicles. Middle-low technology comprises rubber, plastic, coke and refined petroleum products,ships and boats. Low technology comprises food, beverage, textile, furniture.

Trade can also foster reallocation of workers and production to other industries through relative competitiveness. Being more exposed to international competition, a more open economy can specialise in less exposed sectors (e.g. personal services) or where it has a comparative advantage (for instance in terms of production inputs as predicted by the Heckscher-Ohlin theorem). Trade can thus reallocate labour to sectors using skills in different proportions. For instance, the structure of trade in France – especially manufactured exports – has gradually incorporated more technological content (Figure 3.2.6). The share of exports in high-technology manufactured goods raised from 7.9% to 14.3% between 1980 and 2010, the share of imports in such goods from 9.5% to 16.6%. As high-technology requires more skilled jobs, this upgrade in manufactured exports could lead to skill-biased changes in employment.

Trade effects on skill demand is usually considered as small (Feenstra and Hanson, 1999; Gregory *et al.*, 2001; Goos and Manning, 2007), or not significant (Blinder, 2009; Goos *et al.*, 2009, 2014; Michaels *et al.*, 2014). However some empirical analyses assess a significant negative impact of trade on employment changes in developed economies (Autor *et al.*, 2013) and even a job polarisation effects of trade (Zeddies, 2013) and offshoring (Goos *et al.*, 2011; Foster *et al.*, 2012), since routine jobs – and hence middle-skilled jobs – tend to be more offshorable.

3.2.3 Final consumption

Conversely to the two previous channels, final consumption is expected to have a positive contribution to employment change. Gregory *et al.* (2001) and Los *et al.* (2014) even show that changes in final consumption are the main determinant of changes in employment.

In addition, structural effects may have an effect. The rationale for this structural effect is twofold. First, there can be changes in relative prices to which demand reacts. Second, consumers can have different preferences as explained by *Engel curves*: as incomes grow, relative demand tends to shift to superior goods and services whose labour content may differ. This mechanism is used to explain labour market polarisation in Autor and Dorn (2013) and Goos and Manning (2007). For instance, as displayed in figure 3.2.4, the share of services in the household consumption has dramatically increased between 1980 and 2010 (from 31 to 41% for non-tradable services and from 9 to 11% for tradable ones), at the expense of low-technology manufactured products (from 40 to 29%).

3.2.4 Our approach

The aforementioned papers mainly focus on either one or two out of these three channels to explain employment changes, based on theoretical or econometric models. However, Input-Output analysis can take into account and disentangle these three effects altogether. It is also a comprehensive framework that covers all sectors of the economy and captures the increasing complexity of the value chain due to outsourcing. A classic example of this phenomenon is Apple's iPod (Linden *et al.*, 2007). China exports iPods to the US for $150. However, its national value added for assembling the electronic inputs represents a few dollars at most, as most expensive electronic inputs are provided by Japan. Hence the overall contribution of exporting iPods to Chinese employment is rather small.

Our analysis belongs to this strand of the literature. It builds on textbook methodologies of structural decomposition (Miller and Blair, 2009, Chapter 13) but innovative data. Conversely to previous papers relying on Input-Output analysis to analyse employment changes (Gregory *et al.*, 2001; Los *et al.*, 2014), we work with time series of Input-Output tables from 1980 to 2010, based on the new European System of Account (ESA2010) and both in current and previous year prices. The price effect in the data we built are specific to each use (consumption, investment, exports...) and account for the price differential between domestic and imported supplies[5].

However there are some limitation. First, the Input-Output analysis cannot reveal the underlying causal links between employment and its determinants in the long run (Martin and Evans, 1981). In-

[5]See Appendix 3.A for further details

deed, this approach captures what we may call first round, short-term or partial equilibrium effects. It does not take into account long-term equilibrium effects. Trade openness can introduce new varieties of goods in the consumption basket, a structural change we identify in the final consumption effect. It can also induce opportunities to adopt new technologies as a "defensive innovation" strategy (Acemoglu, 2003) or increase the productivity of factors – both offshored and not offshored ones – (Grossman and Rossi-Hansberg, 2008) for instance through imported technology. Foreign competition can also enhance productivity by leading less productive companies to exit the market. Like trade, final consumption cannot be considered exogenous to technology. By enhancing apparent productivity, technology can also increase wages and hence households' purchasing power, which in turn raises final consumption and employment.

Second, we do not isolate the effect of relative prices either. This accounting approach cannot disentangle changes in the relative use of production inputs stemming from changes in relative prices and from changes in the underlying function of production. Likewise our approach cannot disentangle the relative demands for different products or for imported/domestic products caused by changes in relative prices and from changes in preferences. In other terms, we do not differentiate changes along the demand curves from change of the demand curves.

Third, skills are defined based on occupations, which implies that skills are defined in relative terms at each period in time. Occupations classification does not reflect the change across time of the qualification associated with each occupation but their relative qualification.

Within the limitations of our Input-Output decomposition and skills data, our evaluation allows for a comparison of the three channels – technology, trade and consumption – on employment. As such it can be used as a benchmark for econometric approaches also trying to capture the long-term effect of technology, trade and final consumption on employment. Our methodology complements these econometric approaches by providing a benchmark evaluation for the aforementioned effects altogether. In addition, in the case of technology, we can solve in part the long-term issue by identifying the contribution of purchasing power gains to employment changes (See equation 3.4.10 in section 3.4). Finally, overlooking long-term closure effects in our analysis does not stand as an issue, since our analysis is restricted to short-term effects of technology, trade and final consumption. Even if long-term effects offset negative effects on employment at time t, employment destruction did occur and should be accounted for at time t (Barlet *et al.*, 2009).

3.3 A preliminary investigation: the labour content of final demand

As underlined in the previous section, the skill structure of employment has changed over the last 30 years. In this preliminary investigation, we introduce the first Input-Output elements to analyse employment changes by skill level [6].

3.3.1 Defining the labour content of final demand

From the Input-Output framework, we have for every year[7] the following equilibrium and division between domestic ($IC^d + FD^d$) and imported shares ($IC^m + FD^m$):

$$P + M = IC + FD \quad \Rightarrow \quad \begin{cases} P = IC^d + FD^d \\ M = IC^m + FD^m \end{cases} \tag{3.3.1}$$

with P, M, IC, FD respectively the vectors of production, imports, intermediate consumption, and final demand (vectors of length p, with p the number of products).

We denote $\mathbf{A}$ the matrix of technical coefficients, such that $IC = \mathbf{A}P$ (hence $\mathbf{A}$ is the matrix of intermediate consumption of each product (in lines) for the production of all products (in columns) divided in columns by the production of these products).

The (diagonal) matrix of domestic shares for each demand is denoted $\mathbf{S}^z$ with z the corresponding demand, such that $FD^d = \mathbf{S}^{FD}FD$ is the final demand[8] supplied by domestic production (and $I - \mathbf{S}^z$ is the imported share).[9]

Since $P = IC^d + FD^d = \mathbf{S}^{IC}\mathbf{A}P + \mathbf{S}^{FD}FD$, we can then write:

$$P = (I - \mathbf{S}^{IC}\mathbf{A})^{-1}\mathbf{S}^{FD}FD = \mathbf{R}\mathbf{S}^{FD}FD \tag{3.3.2}$$

Let N denote a vector of domestic employment corresponding to the domestic employment required for domestic production detailed by product and employment's skill level. Hence N is a vector of length $q \times p$, with p the number of products and q the number of skill groups. We define a matrix T such that:

$$N = \mathbf{T}.VA \tag{3.3.3}$$

[6] Employment changes are expressed in terms of headcounts (see Appendix 3.B).
[7] The time index is omitted for simplification.
[8] Final demand is the sum of final consumption, gross fixed capital formation (GFCF) and exports.
[9] Due to aggregation effects, these shares differ across operations at the A38 level we work with. They are however based on homogenous assumptions at the underlying level used for retropolation of Input-Output tables (F48).

with VA the vector of value added for each product. $\mathbf{T}$ is a matrix of skill-use coefficients. More precisely, it is a concatenation of diagonal matrices for each skill where the diagonal elements are the level of employment of the corresponding skill used for each production divided by the corresponding value added.

For each product k, the value added of k is equal to the production of k minus the intermediate consumption used to produce it.

$$VA_k = P_k - \sum_{i=1}^{p} a_{i,k} P_k \tag{3.3.4}$$

with $a_{i,k}$ the intermediate consumption of a product i required for the production of k, divided by the production of k, i.e. the coefficients of matrix ${}^t\mathbf{A}$.

So VA is related to P through the following relation:

$$VA = diag((I - {}^t\mathbf{A})\mathbf{1})P = \mathbf{M}P \tag{3.3.5}$$

with $\mathbf{1}$ a vector of ones and of length p. $\mathbf{M}$ is a diagonal matrix of size $p \times p$ which allows us to subtract the share of intermediate consumption required to produce each product[10].

Equations (3.3.2), (3.3.3) and (3.3.5) combined provide an initial framework to measure the domestic labour content of final demand by skill and product.

$$N = \mathbf{TMRS}^{FD} FD \tag{3.3.6}$$

Under this form, we can identify the product of matrices $\mathbf{TMRS}^{FD}$ as the domestic employment content of final demand. It is a $pq \times p$ matrix. For each product in column, it corresponds to the number of jobs of each skill level and for each product (lines) required to provide 1 euro of this product (in column) to the final consumers.

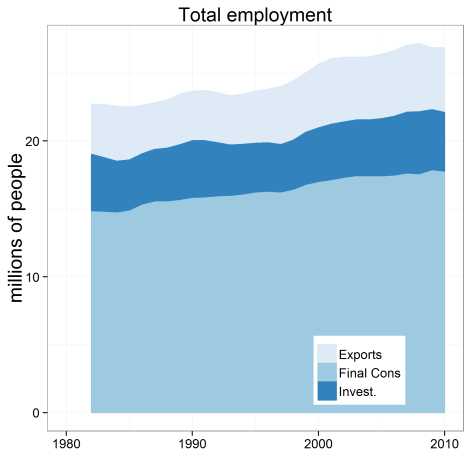
[10]Intermediate consumption defined in Equation 3.3.2 is different to the one defined in Equation 3.3.5. In the first case, it represents the use of a product p as an intermediate consumption in the production of all products. In the second case, it represents all intermediate consumptions used to produce p. Hence we cannot write $VA = (I - A)P$.

3.3.2 How many jobs are required to address final domestic demand and exports?

Noting that $\mathbf{S}^{FD}FD$ is the sum of several uses, we can further decompose total employment and employment by skill level into the shares used to address final consumption (including changes in inventories), investment and exports (Figures 3.3.1 and 3.3.2).

Final consumption requires the largest share of employment: on average two thirds of employment serve it. From 1982 to 2010 the labour force required to address final demand has been steadily increasing (Figure 3.3.1). This increase (+0.7% per year on average) is however less than the increase in the three components of final demand (+3.3% per year on average, in volume). This differential is a consequence of the labour productivity gains. The labour content of final demand measured in employment per euro (corrected for inflation) has thus decreased.

Figure 3.3.1: Labour content of final domestic demand and exports



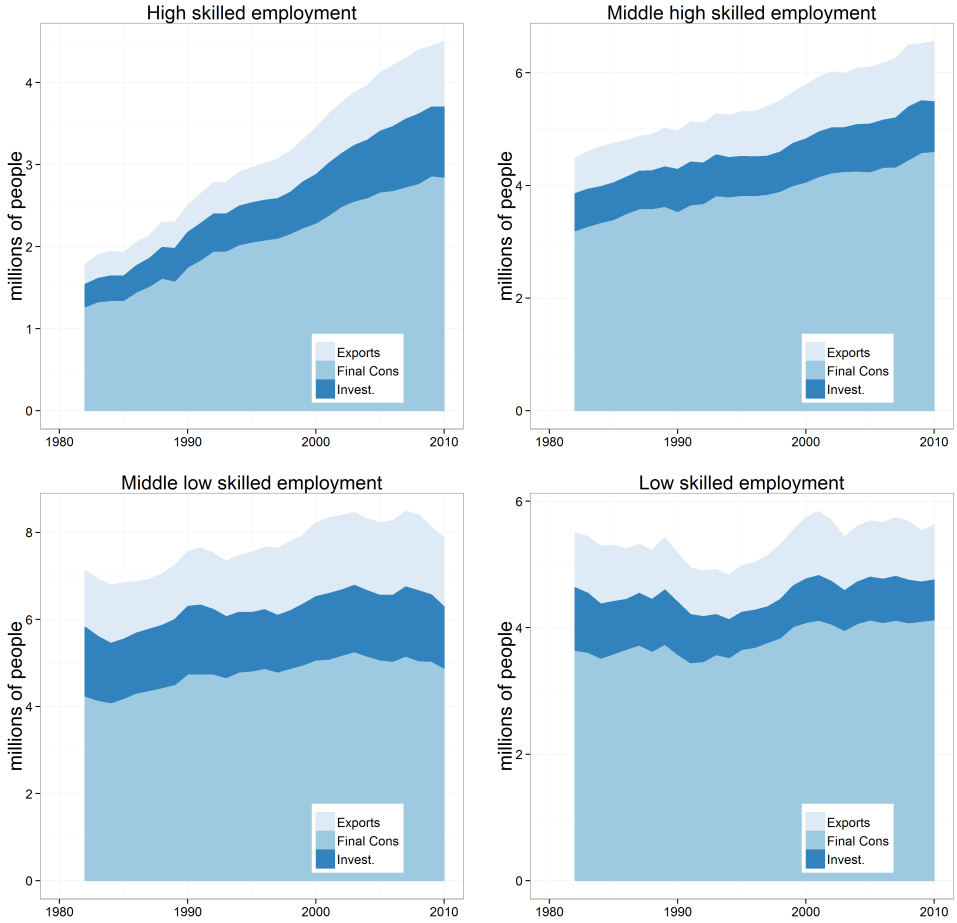
Source: Insee, national accounts; authors' calculations.

Note: In 2010, 18, 4 and 5 millions of people are required to address respectively final consumption, investment and exports.

While the increase in employment is more sizeable for higher-skilled jobs (+5.4% and +1.7% per year for high- and middle high-skill), it is virtually null for low-skilled jobs (Figure 3.3.2). More precisely buoyancy in high-skilled employment reflects the increasing need of investment and exports for high-skilled labour content, as R&D develops and manufactured exports are more specialised in high-technology. The share of high-skilled employment dedicated to investment increased from 17% in 1982 to 23% in 2010, while it increased from 17% to 20% in the case of exports. Conversely, the share of

low-skilled jobs dedicated to investment dropped over the same period (from 18% to 11%), while the share dedicated to consumption dramatically increased (from 66% to 77%).

Figure 3.3.2: Labour content of final domestic demand and exports, by skill level



Source: Insee, LFS and national accounts; authors' calculations.

Note: In 2010, 3, 0.9 and 0.8 millions of high-skilled jobs are required to address respectively final consumption, investment and exports.

3.3.3 Skilled and unskilled, direct and indirect labour content

Table 3.3.1 provides a comparison of the labour content of final domestic demand by product between 1982 and 2010.[11] This analysis confirms the overall decrease in the labour content: fewer jobs are re-

[11] A table for 17 products and complementary figures are available in Pak and Poissonnier (2016).

quired to produce each good and service, in line with productivity gains. In 1982, 17.8 jobs are required to produce 1 million euros of 2010 of final domestic demand products. They are 12.7 in 2010. This decrease in the labour content of final domestic demand is effective for all products but more sizeable for goods than services. For instance, 1 million euro of high-technology manufactured goods requires 24.6 jobs in 1982 and only 7.3 in 2010, while labour content in non-tradable services decreases only from 17 to 13.7 jobs per million euro. This sizeable decrease in the labour content of manufactured products is consistent with the routinization hypothesis of Autor *et al.* (2003): new technologies replace human labour in routine tasks in industrial sectors while low-skilled jobs in services, engaged in more interactive and social tasks (sales, catering, house care...) are less impacted.

In thirty years, the share of higher-skilled labour content increased for all products, conversely to the other skill levels. This increase is particularly important in tradable services and more specifically in information and communication and in business services where R&D is accounted.[12] As for high-technology manufactured products, high-skilled jobs represent 7.3% of the labour content in 1982, against 19.9% in 2010. As underlined by Autor *et al.* (1998), computer-intensive industries in developed economies – and by extension new technology-intensive industries – require higher-skilled jobs. The skill level *Others* includes farmers together with other self-employed workers; the content of agriculture (grouped with energy) but also low technology manufactured goods (incl. food products) in this kind of employment has dramatically decreased, reflecting the decline of employment in the agricultural sector.

The direct labour content of a product is defined as the labour involved in the production of final demand within the corresponding sector, whereas the indirect labour content is the labour content of intermediate consumption used to address final demand [13]. For instance, to produce cars, jobs on a car assembly line – direct labour content – will be required, as well as indirect labour content such as jobs in a tire factory, advertising, power plants. Vertical specialisation would entail an increasing share of indirect labour content both or either domestic or imported. Looking only at the domestic labour content, this is the case only for high-technology manufactured goods and more specifically transport equipment.

[12] A table for 17 products is available in Pak and Poissonnier (2016).

[13] More simply, the direct labour content is the one reported in the LFS in proportion of the final use in each production. More technically, the direct labour content of a product is estimated through **TM** and the indirect labour content through **TMR-TM**.

Table 3.3.1: Labour content of final domestic demand by product (in employment per million euro of 2010)

	Product	Skill level					Total	Direct	Indirect
		High	Mid-high	Mid-low	Low	Others			
1982	Manuf. High Tech.	1.8	5.1	9.4	6.5	1.8	24.6	10.3	14.2
		7.3	20.7	38.1	26.4	7.5	100	42	58
	Manuf. Low Tech.	0.9	2.4	5.5	5.9	6.6	21.2	8.4	12.8
		4.2	11.2	25.9	27.6	31.2	100	39.5	60.5
	Serv. non Tradable	1.4	3.8	5.2	4.2	2.3	17	12.7	4.3
		8.4	22.4	30.4	25	13.8	100	74.7	25.3
	Serv. Tradable	2.4	4	7.4	3.2	1.5	18.5	10.9	7.6
		13	21.6	40	17.3	8.1	100	59	41
	Agr. Energy	0.6	1.8	2.4	2.4	8.9	16	9.8	6.2
		3.5	11	15.2	14.9	55.4	100	61.4	38.6
	Total	1.4	3.6	5.4	4.3	3	17.8	11.8	6
		8.1	20.3	30.6	24.4	16.6	100	66.4	33.6
2010	Manuf HighTech	1.5	1.9	2.4	1.1	0.4	7.3	2.5	4.8
		19.9	26.4	32.4	15.4	5.8	100	34.8	65.2
	Manuf LowTech	1.3	2.2	3.3	2.5	2	11.2	4.8	6.4
		11.4	19.3	29.4	22	17.8	100	42.6	57.4
	Serv. non Tradable	2	3.5	3.9	3.2	1	13.7	10.5	3.2
		14.7	25.7	28.7	23.3	7.6	100	76.6	23.4
	Serv. Tradable	3.4	2.4	2.9	1.2	0.6	10.5	5.9	4.6
		31.9	23.1	27.8	11.8	5.4	100	56.4	43.6
	Agr. Energy	1.2	1.9	1.9	1.8	2.5	9.3	4.6	4.7
		12.9	20.5	20.8	19.3	26.6	100	49.7	50.3
	Total	2.1	3.2	3.6	2.7	1.1	12.7	9	3.7
		16.8	24.8	28.5	21.5	8.4	100	70.7	29.3

Source: Insee, LFS and national accounts; authors' calculations.

Note: In 1982, for the total economy, the labour content of final domestic demand (defined by $\mathbf{TMRS}^{FD}$) is 17.8 jobs per million euros of 2010, including 5.4 middle low-skilled wokers who represent 30.6% of the total labour content. This content is down to 12.7 in 2010. In 1982 for high technology manufactured goods, 58% of the labour content is indirect, i.e. due to intermediate consumption while in 2010 it is 65%, reflecting vertical specialisation in this sector.

3.4 Decomposition methodology of employment changes

3.4.1 From changes in production to changes in employment

Changes in production Between two periods t and τ, changes in production can be related to changes in final demand (domestic or foreign), changes in openness ($\mathbf{S}^z$) and changes in technology ($\mathbf{A}$). From the previous structural decomposition, we built on (Miller and Blair, 2009, Chapter 13) and (Gregory *et al.*, 2001) to identify the contribution of each effect to changes in production. We apply the following methodology to changes in Input-Output data in prices of the previous year at time t and in current prices at time $t-1$, following in that sense the concept of chain linked volumes applied in national accounts. The retropolation of Input-Output is detailed in Appendix 3.A. Note however, that deflation of each operation is based on its specific price index (consumption, investment...) and that the relative prices of domestic and imported shares of a specific operation reflects the relative prices of production and imports.

$$\Delta P_{t,\tau} = P_t - P_\tau = \mathbf{R}_t(\Delta \mathbf{S}^{FD} FD_t + \mathbf{S}^{FD}_\tau \Delta FD) + \Delta \mathbf{R}(\mathbf{S}^{FD}_\tau FD_\tau) \tag{3.4.1}$$

We can rearrange the terms

$$\begin{aligned} \Delta \mathbf{R}(\mathbf{S}^{FD}_\tau FD_\tau) &= \mathbf{R}_t(\mathbf{S}^{FD}_\tau FD_\tau) - \mathbf{R}_\tau(\mathbf{S}^{FD}_\tau FD_\tau) = (\mathbf{R}_t \mathbf{R}_\tau^{-1} - I)P_\tau & (3.4.2)\\ &= \mathbf{R}_t(\mathbf{R}_\tau^{-1} - \mathbf{R}_t^{-1})P_\tau = \mathbf{R}_t(\mathbf{S}^{IC}_t \mathbf{A}_t - \mathbf{S}^{IC}_\tau \mathbf{A}_\tau)P_\tau & (3.4.3) \end{aligned}$$

and

$$\mathbf{S}^{IC}_t \mathbf{A}_t - \mathbf{S}^{IC}_\tau \mathbf{A}_\tau = \Delta \mathbf{S}^{IC} \mathbf{A}_t + \mathbf{S}^{IC}_\tau \Delta \mathbf{A} \tag{3.4.4}$$

It follows that changes in production can be decomposed as:

$$\Delta P_{t,\tau} = \mathbf{R}_t(\Delta \mathbf{S}^{FD} FD_t + \mathbf{S}^{FD}_\tau \Delta FD) + \mathbf{R}_t(\Delta \mathbf{S}^{IC} \mathbf{A}_t + \mathbf{S}^{IC}_\tau \Delta \mathbf{A})P_\tau \tag{3.4.5}$$

with $FD = FDD + X$ (FDD is the final domestic demand and X are the exports).

Eventually, we can decompose changes in production in three terms:

$$\Delta P_{t,\tau} = \underbrace{\mathbf{R}_t \mathbf{S}^{FDD}_\tau \Delta FDD}_{\text{Changes in final domestic demand}} + \underbrace{\mathbf{R}_t(\Delta \mathbf{S}^{FDD} FDD_t + \Delta(\mathbf{S}^X X)) + \mathbf{R}_t \Delta \mathbf{S}^{IC} \mathbf{A}_t P_\tau}_{\text{Changes in exports and imports}} + \underbrace{\mathbf{R}_t \mathbf{S}^{IC}_\tau \Delta \mathbf{A} P_\tau}_{\text{Changes in technology}} \tag{3.4.6}$$

Is GFCF demand or technology? In the former decomposition in section 3.3, we take a standard accounting approach and consider gross fixed capital formation (GFCF) as final domestic demand along with final consumption. However, changes in GFCF can also be related to capital and hence future changes in production factors, i.e. technology. In addition, the labour content of capital stock at time t is only due to new investments. Hence in this paper, we consider GFCF changes as technological changes.

We then write in a slightly different fashion:

$$\begin{aligned}\Delta P_{t,\tau} = & \underbrace{\mathbf{R}_t \mathbf{S}_\tau^{FC} \Delta FC}_{\text{Changes in final consumption}} \\ & + \underbrace{\mathbf{R}_t(\Delta \mathbf{S}^{FC} FC_t + \Delta \mathbf{S}^{GFCF} GFCF_t + \Delta(\mathbf{S}^X X)) + \mathbf{R}_t \Delta \mathbf{S}^{IC} \mathbf{A}_t P_\tau}_{\text{Changes in exports and imports}} \\ & + \underbrace{\mathbf{R}_t \mathbf{S}_\tau^{IC} \Delta \mathbf{A} P_\tau + \mathbf{R}_t \mathbf{S}_\tau^{GFCF} \Delta GFCF}_{\text{Changes in technology}}\end{aligned} \tag{3.4.7}$$

Changes in employment Changes in production can be related to changes in employment through equations (3.3.3) and (3.3.5). Employment changes can then be decomposed between a production, an intermediate consumption and a skill-use effect:

$$\Delta N_{t,\tau} = \mathbf{T}_t \mathbf{M}_t \Delta P + \mathbf{T}_t \Delta \mathbf{M} P_\tau + \Delta \mathbf{T} \mathbf{M}_\tau P_\tau \tag{3.4.8}$$

Replacing changes in production by its expression (3.4.7) we can relate the changes in employment by skill level to changes in final domestic consumption, changes in foreign trade and changes in technology:[14]

$$\begin{aligned}\Delta N_{t,\tau} = & \underbrace{\mathbf{T}_t \mathbf{M}_t \mathbf{R}_t \mathbf{S}_\tau^{FC} \Delta FC}_{\text{Changes in final consumption}} \\ & + \underbrace{\mathbf{T}_t \mathbf{M}_t \mathbf{R}_t(\Delta \mathbf{S}^{FC} FC_t + \Delta \mathbf{S}^{GFCF} GFCF_t + \Delta(\mathbf{S}^X X)) + \mathbf{T}_t \mathbf{M}_t \mathbf{R}_t \Delta \mathbf{S}^{IC} \mathbf{A}_t P_\tau}_{\text{Changes in exports and imports}} \\ & + \underbrace{\mathbf{T}_t \mathbf{M}_t \mathbf{R}_t \mathbf{S}_\tau^{IC} \Delta \mathbf{A} P_\tau + \mathbf{T}_t \mathbf{M}_t \mathbf{R}_t \mathbf{S}_\tau^{GFCF} \Delta GFCF + \mathbf{T}_t \Delta \mathbf{M} P_\tau + \Delta \mathbf{T} \mathbf{M}_\tau P_\tau}_{\text{Changes in technology}}\end{aligned} \tag{3.4.9}$$

3.4.2 Interpreting the decomposition

Final consumption The first term measures the contribution of changes in final consumption to employment, given the skill-use coefficients **T**, the technology (**R**, **M**) and domestic shares **S**. To provide

[14] By multiplying this decomposition by a diagonal matrix of the inverse of the elements of N, decomposition (3.4.9) becomes a decomposition of the growth rate of each level of employment per production and skill.

further insights on the effect of changes in consumption we further decompose ΔFC into household consumption and other final consumptions (including changes in inventories). Households' consumption is then decomposed into a composition effect (weight of each product in the consumption basket), population size (measured in consumption units), the purchasing power of gross domestic income (GDI[15]) per consumption unit[16] and the consumption to GDI ratio:

$$FC_{val} = P^{tot} \frac{FC_{val}}{FC_{val}^{tot}} cu \; PP^{GDI/cu} \frac{FC_{val}^{tot}}{GDI} \tag{3.4.10}$$

with P^{tot}, cu, $PP^{GDI/cu}$ respectively the price index for aggregate households consumption, the number of consumption units and the purchasing power of GDI per consumption unit. FC_{val}^{tot} is the aggregate households' consumption as opposed to the vector of households' consumptions FC_{val}.

With this decomposition, it is possible to directly relate the increase in purchasing power with the increase in labour productivity, two factors which are related in the long run but dissociated in our decomposition. The sociodemographic effect cu can be seen as a pure demand effect. The composition effect $\frac{FC_{val}}{FC_{val}^{tot}}$ is ambiguous, as we do not disentangle changes in the consumption basket composition linked to changes in relative prices from those linked to households' preferences. As for the contribution of changes in $\frac{FC^{tot}}{GDI}$, it can be directly interpreted in terms of savings ratio. Apart from the development of financial savings in the late eighties early nineties, the savings ratio has been stable in France. Its contribution to changes in employment should be only transitory (akin to the long-term imbalances correction in an error correction model for consumption) and null on average in our analysis.

Trade The second term combines the effect of foreign demand addressed to France ($\Delta(\mathbf{S}^X X)$) and changes in openness (ΔS).][17] In this term, the part related to changes in the domestic share of intermediate consumption ($\Delta \mathbf{S}^{IC} \mathbf{A}$) can be interpreted as the effect of *offshore outsourcing* (also referred to as international vertical specialisation) in the *broad sense* (Strauss-Kahn, 2004; Foster *et al.*, 2012). Isolating the diagonal elements (imports of the same product) provides a measure of the offshore-outsourcing effect in the *narrow sense* (Feenstra and Hanson, 1999; Strauss-Kahn, 2004; Foster *et al.*, 2012). According to Feenstra and Hanson (1999), the narrow measure best captures the essence of fragmentation which

[15] The GDI has been modified to be valued at basic prices like the rest of the Input-Output Table, instead of being valued at purchasing price.

[16] Purchasing power per consumption unit takes into account not only population growth, but also changes in household size and composition. An increase in consumption units reflects population growth or social changes such as divorces or youngsters leaving with their parents. According to the OECD-modified scale, the household head is assigned 1 CU, then each additional person older than 14 and each child younger than 14 respectively represents 0.5 and 0.3 CU. Compared to the mere purchasing power, this indicator is more relevant to assess changes in the average standard living of households.

[17] Considering the imported share rather than the imported level in this decomposition avoids the issue of dependency exposed by Dietzenbacher and Los (2000).

occurs within the industry. We focus on offshore outsourcing in the broad sense, so that all contributions sum to employment changes, but nonetheless assess the effect of narrow offshore outsourcing.

In this decomposition, the contribution of trade is related to domestic employment only, i.e. we do not report the global labour content of the trade balance.[18] If imported consumption increases in the same proportion as domestically produced consumption, there is no negative contribution of trade but a positive contribution of consumption. However, if imports increase faster than domestically produced consumption, the decrease in the share of domestic production generates a negative contribution of trade. Overall, the trade effect combines the positive contribution on employment of increasing exports and the negative contribution on domestic employment of imports increasing faster than domestic production.

Technology The third term gathers changes in technology, not only through changes in skill-use coefficients (ΔT, labour-saving effect) and in future capital ($\Delta GFCF$), but also through changes in the production process like outsourcing (captured by ΔA and ΔM)[19]. Here we define technology as the observed use of production factors, i.e. effective technology rather than potential technology (as postulated by a CES, Cobb-Douglas or translog cost function for instance). As a consequence, we also capture under technology effects the reallocation of production factors following changes in their relatives prices.

Due to the overall increase in labour productivity, the contribution of changes in matrix **T** will be largely labour saving. This effect, as we have mentioned, can be interpreted in parallel with the increase in income per capita, which also reflects the increase in productivity but with a positive effect on employment through consumption. We may also expect changes in the indirect labour content of output (GFCF and intermediate consumption) to have positive effect on labour. For intermediate consumption this contribution would reflect vertical specialisation (although our preliminary analysis suggest it is very limited). For GFCF it would reflect an upgrade in the technology of production.

3.4.3 $n!$ decompositions

When decomposing the variation of the product of n terms into the contribution of each term's changes, there are $n!$ equally valid decompositions. The choice of a particular decomposition corresponds to the choice of reference years to weight each term's variation, i.e. t or τ in the previous equations can switch

[18] See Bohn *et al.* (2016) for such an analysis

[19] These two contributions both depend on matrix A. This could raise the issue of full dependency of determinants raised by Dietzenbacher and Los (2000). However, since we aggregate these two contributions into one ("IC effects"), we are not confronted to this full dependency issue.

places. This can be compared, in the context of prices and volumes, to a choice between Paasche and Laspeyre indices.

In our case, there are up to 9! ways to compile each element of Equation (3.4.9), once the decomposition of households consumption is accounted for. More precisely, we apply the principle of nested or hierarchical decompositions (Dietzenbacher and Los, 1998): we first restrict our analysis to the 4! decompositions of $\mathbf{TMR}FD^d$[20] and then we breakdown the components of final consumption (Equation 3.4.10) into 5! more ways. Hence we end up with up to 2 880 (= 5! $\times$ 4!) potential decompositions.

We compute and average all these decompositions to measure each effect on the changes in employment by skill[21]. To address criticisms associated with these numerous decompositions (Martin and Evans, 1981; Dietzenbacher and Los, 1998), we show that the choice of a particular decomposition would have a relatively small impact on our analysis in Pak and Poissonnier (2016): the methodological uncertainty associated with these decompositions is small relative to the differences between two contributions.

3.5 What are the main channels of employment changes?

Results from the decomposition (3.4.9) are displayed both graphically and in tables and are expressed in terms of average annual changes in the following tables and figures. Table 3.5.1 displays the general decomposition by skill level, while Tables 3.5.2, 3.5.3 and 3.5.4 focus on final consumption, trade and technology effects respectively. Table 3.5.5 (and 3.D.1, 3.D.2 and 3.D.4 in Appendix 3.D) extend the decompositions of these tables by distinguishing the contributions for five main products (a more detailed decomposition for 17 products is available in Pak and Poissonnier (2016)). Figures 3.5.1 to 3.E.4 in Appendix 3.E display these decompositions over the whole period.

As displayed in Table 3.5.1, between 1982 and 2010, the overall employment increases on average by 0.6 % each year (i.e. approximately 150 000 jobs per year). The main driver of this increase is final consumption (average contribution of +1.2 percentage point per year to employment growth) along with trade growth (+0.3 pp), while technology has a labour-saving effect (-0.9 pp). More precisely, on a short-term basis, technology has a direct labour saving effect through changes in skill-use coefficients (-1.2 pp, Table 3.5.4). However in the long run, these gains entail real wage increase and hence contribute to the increase in households' purchasing power (+0.4 pp, Table 3.5.2). They also enhance competitiveness gains which contribute to foster exports.

[20] The product $S^{FD}FD$ is equal to FD^d and is hence considered as one single aggregate.
[21] Also see Dietzenbacher and Los (1998) for a discussion on alternate solutions to decompose a product of n terms.

Compared to final consumption and technology, trade has a more limited impact on employment, in line with other works based on Input-Output analysis (Gregory *et al.*, 2001; Los *et al.*, 2014). However, unlike these works it has a positive short-term impact: foreign demand has an employment-enhancing effect (+0.7) that offsets the negative effect of offshoring and lost market shares (-0.4, i.e. 99 000 jobs on average per year). This result seems at odds with the fact that France trade balance is in deficit over the covered period, except during the 1990's. The explanations lies behind our counterfactual calculation of jobs destroyed by imports. First, if goods are imported to satisfy final consumption and not at the expense of domestic production the effects on employment cannot be as high as suggested by the total amount of import, because such goods would not have been produced domestically. Second, the counterfactual consists in calculating the number of jobs in France that would have been required to produced these imported goods, using French technology. Overall, this implies that with French technology, producing domestically instead of importing would have created less jobs compared to jobs created by exports.[22]

By comparison, Barlet *et al.* (2009) find that imports eliminated 340 000 jobs on average each year over the period 2000-2005, compensated by 281 000 creations attribued to additionnal exports. In our decomposition the contribution of imports over the same period is only -129 000. One explanation for the gap is the way they cleared their decomposition from price effects, using unit value indexes for manufactured products (dollar per kilogram) and computing contributions directly in value for service sectors where unit value indexes are not available[23].

3.5.1 Sources of skill-bias in employment changes

As previously mentioned, higher-skilled employment dramatically increased over the last decades, conversely to lower-skilled one. In this section we examine the short-term implications of final consumption, trade and technology on this skill-biased change in employment. We also investigate whether one of these three channels implies jobs polarisation. As displayed in Table 3.5.1, on average employment of higher-skilled jobs increases substantially over the period 1982-2010 (respectively +3.4 % for high- and +1.4 % for middle high-skilled jobs on average per year). In comparison the increase in lower-skilled categories is rather small. Employment destructions are mainly focused on farmers, craft jobs and chief executives (-1.7 % per year), in line with the decline of agriculture.

The overall effect of final consumption displays neither a polarisation effect on employment nor a

[22] Stehrer and Stöllinger (2013) use a similar counterfactual calculation and also find job gain from international trade in France.

[23] Besides this methodological point, the purpose of their study was also somewhat different from ours, their idea being to approximate a notion of "effective" gross destructions. They did so by netting-out positive and negative factors at the within-branch level. For instance, while the decomposition implies that a branch "loses" Y jobs because of increasing imports but "gains" X other ones because of increasing global demand or other offsetting factors, their assumption has been to consider only max(0, $Y - X$) effective losses. Under this assumption their final evaluation of yearly destructions was reduced to 36 000 only instead of 340 000, for branches losing jobs, compensated by 41 000 export-driven creations in other branches.

skill-biased one. It is driven by household purchasing power gains and the growth in public consumption (Table 3.5.2). However changes in the consumption structure is slightly skill-biased. These changes benefit to high-skilled jobs (+0.1 percentage point per year), while they are detrimental to other skill groups (-0.2 for the low-skilled group). The negative effect is even stronger for other skills (including farmers), a result in line with the prediction of Engel curves theory for food products.

Like final consumption, the skill-bias of trade is also limited[24] (Table 3.5.3). However offshore outsourcing has been slightly more detrimental to lower skills (including in the narrow sense, see Table 3.D.3). This bias remains quantitatively very low compared to technology. Furthermore, on a short-term basis, the impact of vertical specialisation on lower-skilled jobs is stronger: narrow offshore outsourcing represents 48% of total offshore outsourcing for low-skilled jobs, while it represents 41% for high-skilled ones. Our results relate to other works: Goos *et al.* (2009, 2014); Michaels *et al.* (2014) find no significant effect of offshoring on job polarisation in Europe. Likewise, Blinder (2009) finds a weak correlation between educational attainment and offshorability (+0.08). However other works show evidence of a skill-bias, as trade's negative impact on employment is stronger for lower-skilled jobs (Gregory *et al.* (2001) for UK and Autor *et al.* (2013) for the US). Goos *et al.* (2011); Foster *et al.* (2012); Zeddies (2013) even find a polarisation effect of offshoring.

The most skill-biased determinant is technology. While technological change is largely labour saving on a short-term basis, this shows mainly on the lowest-skilled jobs (Table 3.5.4). Only high-skilled jobs benefit from changes in technology (+1.4 percentage point on average per year). According to Autor *et al.* (2003), this skill-biased technological change rose as the price of computer capital dramatically declined over the last decades. The main driver of this skill-bias is the direct labour saving effect. However, there is also a small skill-bias from GFCF, in line with the development of ICT and R&D. Conversely to the US (Autor and Dorn, 2013; Michaels *et al.*, 2014) and to some European countries (Goos and Manning, 2007; Goos *et al.*, 2011, 2014), there is no evidence of employment polarisation because of technological change. The skill-bias seems monotonous in France and favours high-skilled jobs the most as in (Maurin and Thesmar, 2004). Only by using a more detailed occupational level does Ast (2015) find a slight job polarisation in some services, as employment of low-skilled jobs (caregivers, home help, caretakers, nanny, salesclerk, employees in the accommodation and food industry...) has been particularly dynamic.

[24]The skill-bias of trade is by construction only driven by a composition effect. There is no information of the specific labour content of exported products compared to domestically consumed products, least about its change with time.

Table 3.5.1: Broad contributions to employment change by skill level. 1983-2010

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Jobs creation	0.6	3.4	1.4	0.4	0.1	-1.7
Final consumption	1.2	1.3	1.3	1.2	1.3	0.9
Trade	0.3	0.3	0.3	0.4	0.3	0.4
Technology	-0.9	1.7	-0.3	-1.2	-1.5	-3.0

Source: Insee, LFS and national accounts; authors' calculations.

Note: The first row of the table represents the average annual growth rate of total employment and employment by skill level. The remaining rows represent the average annual contributions that sum to the employment growth rate.

Table 3.5.2: Breakdown of final consumption contributions to employment change by skill level. 1983-2010

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Final consumption effects	1.2	1.3	1.3	1.2	1.3	0.9
Consumption structure	-0.1	0.1	0	-0.1	-0.2	-0.3
Purchasing power	0.4	0.4	0.4	0.4	0.5	0.6
Sociodemographic effects	0.3	0.2	0.2	0.3	0.3	0.4
Household saving	0.0	0.0	0.0	0.0	0.0	0.1
Gov. and NPISH consumption	0.5	0.6	0.7	0.5	0.6	0.2

Source: Insee, LFS and national accounts; authors' calculations.

Note: The first row represents the average annual contribution of final consumption to employment growth also displayed in Table 3.5.1. It is equal to the sum of the remaining rows.

Table 3.5.3: Breakdown of trade contributions to employment change by skill level. 1983-2010

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Trade effects	0.3	0.3	0.3	0.4	0.3	0.4
Exports	0.7	0.7	0.7	0.8	0.7	0.8
Offshore outsourcing	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3
Home share in FC	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Home share in GFCF	0.0	0.0	0.0	0.0	0.0	0.0

Note: See Table 3.5.2.

Table 3.5.4: Breakdown of technology contributions to employment change by skill level. 1983-2010

Average contribution (in % per year)	**Total**	**Skill level**				
		High	Middle higher	Middle lower	Low	Other
Technology effects	-0.9	1.7	-0.3	-1.2	-1.5	-3.0
Direct labour saving	-1.2	1.4	-0.4	-1.5	-1.5	-3.2
IC effects	-0.1	-0.1	-0.1	0.0	-0.2	0.0
GFCF effects	0.3	0.5	0.3	0.3	0.2	0.2

Note: See Table 3.5.2.

3.5.2 Are skill-biased changes a consequence of sector developments?

Autor *et al.* (1998) underline the correlation between the skill-bias and computer-intensive industries. In France, services flourished over the last decades at the expense of industrial and agricultural sectors, and high-skilled jobs are mainly gathered in services (more than 80% in 2010). The previously underlined skill-biased changes could in fact reflect sector-biased developments.

In order to assess the effect of sector development on skill-biased change, we focus on five broad groups of products:

(1) High technology manufacturing: chemicals, pharmaceutical, computer, electronic and optical products, electrical and machinery equipment (air and spacecraft, ships, boats...);

(2) Low technology manufacturing: other industrial products such as rubber, plastic, food, beverage, textile, etc.;

(3) Non-tradable services[25]: construction, accommodation and food services, finance and insurance, real estate, public and personal services;

(4) Tradable services: trade, transportation, information and communication, business services;

(5) Other: agriculture, energy and utilities.

Table 3.5.5 and tables 3.D.1, 3.D.2 and 3.D.4 break down the previous decompositions according to these five groups of products[26].

[25]These sectors are defined as non-tradable on the basis of an insignificant contribution of trade to the total changes in the jobs required to produce the final output. See Table 3.C in Appendix 3.C for more details

[26]These tables are also available for 17 products in Pak and Poissonnier (2016).

Regardless of the skill level, development of services accounts for a substantial part of employment change[27] (+0.5 percentage point per year on average in both non-tradable and tradable services), while changes are negative in the other industries. The growth in the total labour content of services is mainly driven by consumption, especially purchasing power and population growth. As expected in the case of non-tradable services, public spending like public services is a more important determinant of the increase in total labour content (Table 3.D.1).

The skill-bias effect of changes in consumption structure reflects the shift in the consumption of services at the expense of agriculture and low-technology manufactured products. As the latter two require more low-skilled labour content (see Table 3.3.1), low-skilled jobs suffer more from changes in consumption structure. However this negative contribution to the growth of low-skill is offset by income and population effects. More specifically, the income effect is stronger in the lowest-skilled content of non-tradable services. This implies that low-skilled jobs benefit greater demand from richer workers for services replacing their household production, e.g. child care, domestic work, food service (Michaels *et al.*, 2014).

On the trade side, the more favourable contribution of foreign demand to lower-skilled jobs is driven by low-technology manufactured products and tradable services (mainly trade, transportation and business services). Nevertheless, offshore outsourcing (broad and narrow) weighs the most on lower-skilled content of these goods and services. Focusing on manufacturing, importing finished goods (for final consumption and GFCF) is more detrimental to low-skilled jobs in low-technology manufacturing (average annual contribution of -0.07 point against -0.02 in high-technology manufacturing).

Finally, the skill-bias effect of technological change is observed in all industries, manufacturing or services, although we note a small polarisation effect from technology on tradable services. More precisely, the direct labour saving effect weighs more on lower-skilled workers in low-technology manufacturing and tradable services (trade and transportation). In the framework of the labour-technology literature, these jobs are more substitutable with capital. The skill-bias effect of GFCF can also be explained as a consequence of sector development, as it is more sizeable for tradable services, and more precisely for R&D, included in the business services, and for information and communication.

[27] Sector employment is measured in terms of jobs required to produce its final output, and does not represent the employment within the sector.

Table 3.5.5: Broad contributions to employment change by skill and product. 1983-2010

Average contribution (in % per year)	**Total**	**Products in:**				
		Manufacturing		Services		Agr. and
		high-tech	low-tech	non-tradable	tradable	energy
				Total		
Jobs creation	0.61	-0.08	-0.20	0.52	0.48	-0.12
Final consumption	1.21	0.02	0.05	0.70	0.40	0.04
Trade	0.34	0.05	0.01	0.03	0.23	0.03
Technology	-0.95	-0.15	-0.25	-0.21	-0.15	-0.19
				High skill		
Jobs creation	3.37	0.12	0.08	1.47	1.63	0.07
Final consumption	1.32	0.04	0.02	0.81	0.42	0.02
Trade	0.32	0.06	0.01	0.05	0.2	0.01
Technology	1.73	0.02	0.05	0.61	1.00	0.04
				Middle skill (higher)		
Jobs creation	1.38	-0.05	0.01	0.75	0.62	0.04
Final consumption	1.34	0.03	0.03	0.86	0.38	0.03
Trade	0.32	0.06	0.01	0.04	0.20	0.01
Technology	-0.28	-0.14	-0.03	-0.15	0.04	0.00
				Middle skill (lower)		
Jobs creation	0.38	-0.13	-0.17	0.38	0.28	0.01
Final consumption	1.18	0.02	0.05	0.63	0.45	0.02
Trade	0.37	0.06	0.01	0.03	0.26	0.01
Technology	-1.17	-0.21	-0.23	-0.28	-0.43	-0.02
				Low skill		
Jobs creation	0.11	-0.18	-0.54	0.49	0.34	0.00
Final consumption	1.27	0.02	0.06	0.8	0.37	0.03
Trade	0.30	0.04	-0.01	0.02	0.23	0.01
Technology	-1.46	-0.23	-0.60	-0.33	-0.26	-0.05
				Other skill		
Jobs creation	-1.70	-0.02	-0.31	-0.24	-0.07	-1.06
Final consumption	0.94	0.00	0.07	0.36	0.35	0.16
Trade	0.38	0.01	0.01	0.03	0.21	0.12
Technology	-3.02	-0.04	-0.39	-0.62	-0.63	-1.35

Source: Insee, LFS and national accounts; authors' calculations.

Note: Column "Total" is equal to the sum of the remaining columns by products and displays the same figures as Table 3.5.1. In each panel, the first row is equal to the sum of the remaining rows.

3.5.3 Are skill-biased changes driven by external shocks?

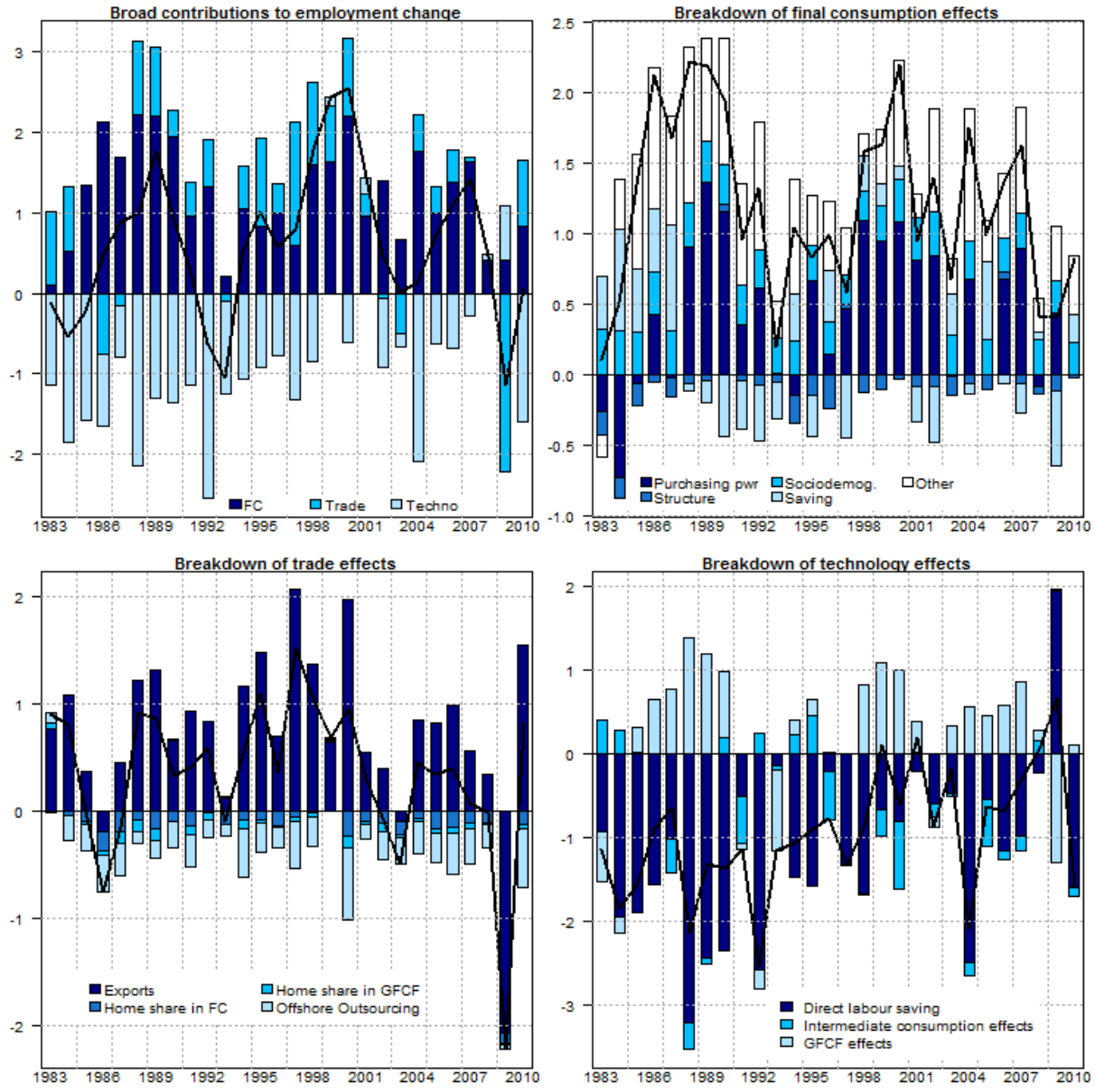
Apart from sector development, skill-biased changes can also result from external determinants, such as crises, labour policies, international environment... Depending on these external shocks, the average annual effects of final consumption, trade and technology on employment changes could be driven by a single year or a specific period. For instance, as displayed in Figure 3.5.1, final consumption effects are closely related to the business cycle, with a decreasing impact during years of crises (1993, 2003 and 2009). Trade and technology effects have particularly irregular profiles in 2009 and 2010, as direct consequence of the 2008-2009 economic and financial crisis.

More specifically in the case of trade, the period of the 90's is of great interest since it is linked to the rise of globalization. Hence the effect of both exports and imports on employment changes dramatically increased during this period. Exports effects for tradable services are almost twice as important in the period 1994-2000 than in 1987-1992 and in 2001-2008.[28]. In addition, with the development of high-technology manufacturing over the same period, exports also benefit to higher-skilled jobs required for this kind of products. Within these three periods, the effect of offshore outsourcing remains relatively similar.

Finally in the case of technology, its diminishing effect on employment changes over time is related to fading productivity gains, as underlined by Schreiber and Vicard (2011). This concerns more specifically low-skilled jobs in manufacturing in the period 1998-2008, in line with a reduction of employer costs implemented from 1995 and also the negative impact in this sector of the switch to the 35-hour working week (Biscourp and Kramarz, 2007; Schreiber and Vicard, 2011).

[28] 1986, 1993 and 2009-2010 are excluded from the following estimates, as they represent years of crisis. Tables are made available in Pak and Poissonnier (2016)

Figure 3.5.1: Contributions to total employment changes (in %), 1983-2010



Source: Insee, LFS and national accounts; authors' calculations.

3.6 Concluding remarks

To investigate changes in employment in France over the period 1982-2010, we provide a structural decomposition analysis based on time series of Input-Output Tables. This approach allows us to take into account the effects on employment changes of technology, trade and final consumption altogether, conversely to most previous studies on the same subject. Our decomposition is based on textbook methodologies but uses innovative data. More precisely we convert Insee's Supply and Use tables in the new European System of Acccount (ESA2010) into Input-Output tables, both in current and in previous year price (using specific deflator for consumption, investment...). We then use the Labour Force Survey to measure the skill level from the occupation classification.

The main determinant to skill-biased changes in employment is technology which benefits to high-skilled jobs, especially to those required to produce services (e.g. R&D and information and communication), but is detrimental to lower-skilled jobs (especially those required for low-technology manufactured products). The important contribution of final consumption is explained by the development of services at the expense of agriculture and low-technology manufactured products. Trade has a small but nonetheless positive effect regardless of the skill level. Finally, we found no strong evidence of polarisation in France, even at the sector level, conversely to other works on this subject (Harrigan *et al.*, 2016; Malgouyres). This could be related to the way we classify skills which is at a very aggregated level. More disaggregated data on occupations would have allowed us to have a more refined classification.

In terms of the policy implications, lifelong learning should be provided to lower-skilled workers who are at risk of losing they jobs because of technology change, as well as to workers on more offshorable jobs. This will help them be re-deployed in other firms within the same industry or in other industries. Another policy implication concerns trade policies. Since the number of jobs created by exports is higher than the number destroyed by imports, this should discourage attempts to promote protectionism.

The approach chosen in this article could be subject to further research. First, since our approach cannot reveal underlying causal links between employment and its determinants in the long-run, our results are to be interpreted as short-term effects. Adopting the temporal inverse analysis introduced by Sonnis and Hewings (1998) would shed light on structural changes in an economy over time and highlight trends of changes in indirect temporal impacts of final demand on output (Okuyama *et al.*, 2006). Second, we could investigate the contribution of relative prices to further disentangle the contributions of technology, trade and consumption. Third, the approach of Bohn *et al.* (2016) could bring additional insights on trade contribution to employment. By comparing labor footprints with domestic labor force, they can estimate if a country can produce every goods and services alone or if it needs foreign workers.

Appendix

3.A The retropolation of Input-Output Tables

National accounts and in particular the Supply and Use Table (SUT) are produced in compliance with ESA2010 and Naf Rev2 since 2013. From the 2010 accounts, the SUT is converted by the national accountants into a symmetric Input-Output Table (IOT) based on detailed information (138 products and industries) (Rodriguez, 2014). From 1980 to the reference year (2010), we have replicated the methodology of the national accounts at a less detailed level based on the available information in order to produce IOT with the same concepts and nomenclature as the current national accounts. *This is the first advantage of our dataset: covering thirty years in compliance with the most up to date official accounts.* In particular, two consecutive changes in the reference year (2005 and 2010) have introduced important changes in nomenclature and concepts which have markedly impacted the frontier between goods and services, the definition of investment and intermediate consumption and the measure of foreign exchanges.

The IOT differs from the standard SUT (Eurostat, 2008, Chapter 11). First in the IOT, uses are valued at basic prices, that is excluding trade and transportation margins as well as taxes and subsidies on products (first of which VAT). Second, the computation of the IOT requires a treatment for CIF-FOB (cost insurance freight-free on board) of imports to value them at the frontier of the exporting country (FOB) to match the concept for exports. Third, the concept of industry is converted to a concept of product[29] consistent with the rows of the SUT. This is done through the matrix of transfers, recording the production of each industry (mainly non market and agricultural) in secondary products. With this conversion for instance, the intermediate input table records the consumption of intermediate inputs for the production of each output rather than each industry. Fourth, uses must be split between those addressed by domestic production and by imports. In the absence of additional information, this division is based on hypothesis (both in our retropolation and the official compilation of the IOT). Note that in theory there are no imports re-exported recorded in the national accounts and in practice very few.

[29] A symetric choice can also be made for instance in the World Input-Output Database (Dietzenbacher *et al.*, 2013).

An analysis on the year 2010, for which data at the detailed level (138 products) are also available, shows that transposing the *symmetrisation* methodology to a SUT with only 48 products and industries generates only small discrepancies (Poissonnier, 2015b). Some adjustments were made to correct the largest discrepancies, stemming from the ventilation of taxes and subsidies on products other than VAT. In retropolation, missing information on VAT on intermediate consumption by industry and transportation margin by uses were built from the ventilation structure in 2010 and adjusted to match the totals known for each year. As for the partition between imported and domestic demands, an analysis with even more detailed information (332 products) in 2010 showed that there is a 10% uncertainty on this partition for each component of demand (excluding exports) but the official IOT and ours concur at 2% for 2010.

Compared to other datasets, we have benefited from detailed information allowing us to conduct the first three operations with greater precision than done for instance in the WIOD (Dietzenbacher *et al.*, 2013) or by the OECD (Yamano and Ahmad, 2006). Our dataset is nevertheless limited to France. As for the separation between imported and domestic uses, we replicate the methodology from the official IOT while the WIOD in particular uses a bilateral trade database to refine this last step.

To be cleared from price effects, decomposition (3.4.9) must be computed between an IOT in volume (previous year prices) and the IOT of the previous year in value, consistent with changes in chained linked volumes. To do so we have extended the compilation of IOT in values developed by the national accountants to IOT in previous year prices. *This is the second advantage of our dataset: estimates in previous year prices based on detailed price information.* For the most part prices and volumes are inherited from the SUT. However, for some treatments (CIF-FOB, transportation margins by uses) the same weights are used in previous year prices and values which maintain prices specific to the operation and are not affected by the price of use. For other specific operations (VAT on intermediate consumption by industry, other taxes and subsidies), as much as possible the volume growth is based on that of the use, to be in line with national accounting concepts. For domestic and imported demands (excluding exports), prices are such that the relative price index of an imported and domestic use is the relative price index of imports and production while the relative price of two imported (resp. domestically produced) uses is the relative price of these uses. As for exports, the small share of re-exported imports are assumed to follow the same prices as imports.

3.B Employment by skill level

How skill is measured Several indicators provide information about the skill level of employment. The main indicators found in the literature are the average hourly wage, the educational attainment

and the occupation. Measuring skill level according to the average hourly wage is rather simple to implement. However, it leaves out self-employed workers and does not control for structural determinants (age, gender, experience, seniority...). Education level – either defined as the highest level of diploma or the years of studying – is an alternative used in some papers (Los *et al.*, 2014; Ludwig and Brautzsch, 2014; Michaels *et al.*, 2014). However, it can also bias our analysis. While the level of diploma can be a hiring condition, training and experience make it possible for workers to get more skilled jobs. Further, educational attainment has increased within jobs over the last decades (Goos and Manning, 2007).

The French occupational classification (PCS) classifies workers (employees and self-employed) based on the job they do. As such, it takes into account educational attainment, as well as experience and other specific features related to a given job (e.g. supervising other workers). Therefore, like Gregory *et al.* (2001), we consider the occupational classification as a relevant measure of skill level. The PCS classifies workers into nine major groups:

- Group 1: Farmers
- Group 2: Craft and related trades workers and chief executives
- Group 3: Managers (includes liberal professions)
- Group 4: Intermediate occupations (professionals and technicians)
- Group 5: Skilled service and sales workers
- Group 6: Unskilled service and sales workers [30]
- Group 7: Skilled machine operators and elementary occupations
- Group 8: Unskilled machine operators and elementary occupations
- Group 9: Other (Military contingents, unknown)

We then aggregate these nine groups into five broad skill levels. The "high-skill" group comprises Group 3 and the "low-skill" group comprises Groups 6 and 8. The "middle-skill" level is divided into a higher part (Groups 4) and a lower part (Groups 5 and 7). Groups 1, 2 and 9 are aggregated into "other".

Autor and Dorn (2013) propose another classification to focus on technology effects on employment. It also relies on the occupational classification but takes into account the tasks associated to each job. Three levels are then identified: abstract, routine and manual tasks. Blinder (2009) suggests another classification specifically designed to measure *offshorability*, based on an index he builds. However, these

[30] Groups 5 and 6 are based on (Amossé and Chardon, 2006) classification. Group 6 includes home help, caretakers, salesclerk...

classifications require a more detailed occupational classification, which is not available over a long period in the PCS classification[31].

Using the French Labour Force Survey Employment data by skill level and activity are taken from the Labour Force Survey (LFS) over the period 1982-2010. The main advantage of this data is its exhaustive coverage: both employees and self-employed are surveyed, regardless of the activity they are working in. These data are on headcounts basis. We could convert them into of full-time equivalent (FTE) by using a correction coefficient defined as the ratio of usual weekly hours of work for part-time workers on that of full-time workers (by occupation and by activity). This FTE conversion could be done only from 1990. Hence we favour employment in terms of headcounts. Converting into FTE would however not imply dramatic changes to our main results. First part-time is mainly focused on services. Second it is "involuntary" part-timers who have low usual weekly hours of work and lower-skilled workers are mainly concerned by this kind of part-time jobs (Pak, 2013). All in all, we expect the FTE conversion to increase technological skill-bias in services.

Other caveats need to be addressed to combine the LFS with national accounts data. First, from 1982 to 2010 LFS underwent several breaks:

- transition to the new occupational classification in 2003 (PCS-1982 to PCS-2003);
- transitions to different activity classifications (NAP to NAF in 1993, NAF to NAF Rev.1 in 2003, and NAF Rev.1 to NAF Rev.2 in 2008);
- changes in the survey questionnaire and in data collection, especially in 2003 (transition from annual to continuous survey)

Second, employment as defined by the International Labour Office (ILO) with LFS data slightly differ from those as defined in the national accounts. As the LFS cover households living in France, foreigners who live abroad but work in France are excluded from employment, while people living in France but working abroad are included. It is the opposite with the national accounts: only domestic employment is estimated. Another explanation for the discrepancies relies on the estimation of small part-time jobs and borderline jobs (partial or gradual retirement, students, limited activity...). Since estimations from LFS rely on spontaneous answers of the respondent, this kind of small jobs could be under-reported. In the case of limited activity, if respondents are unemployed the week they are surveyed but worked several hours during the previous months, they will be counted as active workers in the national accounts, but not in the LFS estimates.

[31] These nine groups are built up from more detailed sub-groups. We stick to these nine groups, since we need long series for our analysis and long series are not available for a more detailed level over the period 1982-2010.

To correct the former issues, we first address changes in the activity classifications by building transition matrices. In the case of the NAP-NAF transition in 1993 and the NAF Rev.1-NAF Rev.2 transition in 2008, we use the LFS dual coding available at the most highly disaggregated level (650 in NAP, 696 in NAF, 712 in NAF Rev.1, and 732 in NAF Rev.2). There is no dual coding in the LFS for the transition from NAF to NAF Rev. 1 in 2003 but, since very little changes were made between these classifications, we use a theoretical transition matrix. We also use a transition matrix to convert activities (in NAF Rev.2) into industries (national accounts classification at the level A38).

In a second step, we correct remaining breaks by benchmarking our employment matrices according to their skill levels and industries on two sets of series published by Insee: long series by occupation based on LFS data and long series by industries estimated by the national accounts.[32] Finally, we convert industries into products to fit the IOT concept.

The following figure illustrates the case involving the most numerous steps to correct LFS data, i.e. for activities defined in the NAP classification.

$$N^{activity}_{NAP,650} \Rightarrow N^{activity}_{NAF,696} \Rightarrow N^{activity}_{NAFrev1,712} \Rightarrow N^{activity}_{NAFrev2,732} \Rightarrow N^{activity}_{NAFrev2,129} \Rightarrow$$
$$N^{industry}_{NAFrev2,129} \Rightarrow N^{industry}_{NAFrev2,38} \xrightarrow{benchmarking} N^{industry}_{NAFrev2,38} \Rightarrow N^{product}_{NAFrev2,38}$$

[32] This benchmarking is based on a minimisation framework exposed in (Poissonnier, 2015a)

3.C Sector aggregation

Table 3.C.1: Sector aggregation into 5 broad categories

Aggregated sector	**Description**	**Average contribution** (in % per year)			
		FC	Exports	Imports	Tech.
Manuf. High Tech.	CE - Chemicals	0.4	2.8	-2.1	-3.2
	CF - Pharmaceuticals	3.3	4.0	-2.5	-4.5
	C3 - Electrical equip.	2.4	8.2	-6.1	-9.8
	CL - Transport equip.	-0.1	2.2	-1.2	-3.3
Manuf. Low Tech.	C1 - Food & drink	0.9	0.7	-0.5	-1.5
	CB - Textile & leather	-0.3	0.7	-4	-2.5
	CC - Wood & paper	0.8	1.2	-0.8	-2.8
	C2 - Coke & refined petroleum	0.7	1.0	-1.2	-2.8
	CG - Rubber & plastic	0.5	1.6	-1.3	-2.2
	CH - Metals	0	1.4	-1.3	-1.8
	CM - Other manuf.	0.1	1.4	-0.9	-1.8
Serv. non Tradable	FZ - Construction	0.2	0.1	0.0	-0.2
	IZ - Accomodation & food serv.	1.2	0.2	-0.1	0.6
	KZ - Finance	2.2	0.5	-0.1	-2.1
	LZ - Real estate	2.0	0.2	-0.1	-0.7
	OQ - Public adm.	7.1	0.1	-0.1	-1.7
	RU - Other serv.	6.0	0.7	-0.2	2.2
Serv. Tradable	GZ - Trade	1.4	1.0	-0.2	-1.5
	HZ - Transportation	1.1	1.1	-0.4	-1.2
	JZ - Info. & comm.	6.4	1.9	-0.8	-2.3
	MN - Business serv.	3.5	3.7	-1.7	3.8
Other	AZ - Agriculture	0.9	0.9	-0.6	-4.3
	DE - Energy & utilities	3.3	2.7	-3.7	-4.7

Source: Insee, national accounts; authors' calculations.

Note: For each row of the table, the contributions of final consumption, exports, imports and technology sum to the total change in the jobs required to produce each kind of product. The sector employment is measured in terms of jobs required to produce its final output, and does not represent the employment within the sector.

3.D Breakdown of final consumption, trade and technology contributions to employment changes by skill and product

Table 3.D.1: Breakdown of final consumption contributions to employment change by skill and product. 1983-2010

Average contribution (in % per year)	**Total**	**Products in:** Manufacturing high-tech	Manufacturing low-tech	Services non-tradable	Services tradable	Agr. and energy
			Total			
Final consumption effects	1.21	0.02	0.05	0.70	0.40	0.04
Consumption structure	-0.08	0.00	-0.06	-0.02	0.02	-0.03
Purchasing power	0.44	0.01	0.05	0.16	0.18	0.04
Sociodemographic effects	0.27	0.01	0.04	0.09	0.11	0.03
Household saving	0.04	0.00	0.01	0.01	0.01	0.01
Gov. and NPISH consumption	0.55	0.00	0.01	0.46	0.08	0.00
			High skill			
Final Consumption effects	1.32	0.04	0.02	0.81	0.42	0.02
Consumption structure	0.07	0.01	-0.04	0.05	0.04	0.00
Purchasing power	0.38	0.01	0.03	0.15	0.18	0.01
Sociodemographic effects	0.23	0.01	0.02	0.09	0.11	0.01
Household saving	0.03	0.00	0.00	0.01	0.01	0.00
Gov. and NPISH Consumption	0.61	0.01	0.01	0.50	0.08	0.00
			Middle skill (higher)			
Final Consumption effects	1.34	0.03	0.03	0.86	0.38	0.03
Consumption structure	0.01	0.01	-0.04	0.01	0.03	0.00
Purchasing power	0.38	0.01	0.03	0.15	0.17	0.02
Sociodemographic effects	0.23	0.01	0.02	0.09	0.10	0.01
Household saving	0.03	0.00	0.00	0.01	0.01	0.00
Gov. and NPISH Consumption	0.69	0.01	0.01	0.60	0.07	0.01
			Middle skill (lower)			
Final Consumption effects	1.18	0.02	0.05	0.63	0.45	0.02
Consumption structure	-0.05	0.00	-0.07	0.00	0.01	0.00
Purchasing power	0.42	0.01	0.06	0.13	0.21	0.01
Sociodemographic effects	0.25	0.01	0.04	0.08	0.12	0.01
Household saving	0.04	0.00	0.01	0.01	0.02	0.00
Gov. and NPISH Consumption	0.53	0.00	0.02	0.42	0.09	0.00
			Low skill			
Final Consumption effects	1.27	0.02	0.06	0.8	0.37	0.03
Consumption structure	-0.19	0.00	-0.09	-0.07	0.00	-0.02
Purchasing power	0.50	0.01	0.07	0.21	0.18	0.03
Sociodemographic effects	0.30	0.01	0.05	0.12	0.10	0.02
Household saving	0.04	0.00	0.01	0.01	0.01	0.00
Gov. and NPISH Consumption	0.62	0.00	0.02	0.53	0.08	0.00
			Other skill			
Final Consumption effects	0.94	0.00	0.07	0.36	0.35	0.16
Consumption structure	-0.29	0.00	-0.06	-0.07	-0.01	-0.15
Purchasing power	0.59	0.00	0.07	0.15	0.18	0.18
Sociodemographic effects	0.36	0.00	0.05	0.09	0.11	0.12
Household saving	0.06	0.00	0.01	0.01	0.01	0.03
Gov. and NPISH Consumption	0.22	0.00	0.00	0.18	0.07	-0.02

Source: Insee, LFS and national accounts; authors' calculations.

Note: Column "Total" is equal to the sum of the remaining columns by product and displays the same figures as Table 3.5.2. In each panel, the first row is equal to the sum of the remaining rows.

Table 3.D.2: Breakdown of trade contributions to employment change by skill and product. 1983-2010

Average contribution (in % per year)	**Total**	**Products in:**				
		Manufacturing		Services		Agr. and
		high-tech	low-tech	non-tradable	tradable	energy
				Total		
Trade effects	0.34	0.05	0.01	0.03	0.23	0.03
Exports	0.74	0.12	0.15	0.05	0.36	0.06
Offshore outsourcing	-0.26	-0.05	-0.09	-0.01	-0.09	-0.02
Home share in FC	-0.10	-0.02	-0.04	-0.01	-0.03	-0.01
Home share in GFCF	-0.04	-0.01	-0.01	0.00	-0.01	0.00
				High skill		
Trade effects	0.32	0.06	0.01	0.05	0.2	0.01
Exports	0.67	0.15	0.08	0.08	0.34	0.02
Offshore outsourcing	-0.22	-0.06	-0.05	-0.02	-0.08	-0.01
Home share in FC	-0.08	-0.02	-0.02	-0.01	-0.03	0.00
Home share in GFCF	-0.04	-0.01	-0.01	0.00	-0.02	0.00
				Middle skill (higher)		
Trade effects	0.32	0.06	0.01	0.04	0.20	0.01
Exports	0.67	0.16	0.12	0.06	0.32	0.02
Offshore outsourcing	-0.23	-0.06	-0.07	-0.01	-0.08	-0.01
Home share in FC	-0.09	-0.02	-0.03	-0.01	-0.03	0.00
Home share in GFCF	-0.04	-0.01	-0.01	0.00	-0.01	0.00
				Middle skill (lower)		
Trade effects	0.37	0.06	0.01	0.03	0.26	0.01
Exports	0.81	0.14	0.18	0.05	0.42	0.02
Offshore outsourcing	-0.29	-0.05	-0.11	-0.01	-0.11	-0.01
Home share in FC	-0.11	-0.02	-0.05	0.00	-0.04	0.00
Home share in GFCF	-0.05	-0.01	-0.01	0.00	-0.01	0.00
				Low skill		
Trade effects	0.30	0.04	-0.01	0.02	0.23	0.01
Exports	0.72	0.10	0.18	0.04	0.37	0.04
Offshore outsourcing	-0.27	-0.04	-0.11	-0.01	-0.10	-0.02
Home share in FC	-0.11	-0.01	-0.06	0.00	-0.03	-0.01
Home share in GFCF	-0.03	-0.01	-0.01	0.00	-0.01	0.00
				Other skill		
Trade effects	0.38	0.01	0.01	0.03	0.21	0.12
Exports	0.78	0.02	0.11	0.05	0.31	0.28
Offshore outsourcing	-0.25	-0.01	-0.06	-0.01	-0.07	-0.11
Home share in FC	-0.12	0.00	-0.04	-0.01	-0.02	-0.05
Home share in GFCF	-0.02	0.00	-0.01	0.00	-0.01	0.00

Source: Insee, LFS and national accounts; authors' calculations.

Note: Column "Total" is equal to the sum of the remaining columns by product and displays the same figures as Table 3.5.3. In each panel, the first row is equal to the sum of the remaining rows.

Table 3.D.3: Breakdown of trade effects to employment change by skill and product (focus on offshore outsourcing effects. 1983-2010

Average contribution (in % per year)	**Total**	**Products in:**				
		Manufacturing		Services		Agr. and
		high-tech	low-tech	non-tradable	tradable	energy
				Total		
Offshore outsourcing	-0.26	-0.05	-0.09	-0.01	-0.09	-0.02
Narrow offshore outsourcing	-0.12	-0.01	-0.03	-0.01	-0.06	-0.01
				High skill		
Offshore outsourcing	-0.22	-0.06	-0.05	-0.02	-0.08	-0.01
Narrow offshore outsourcing	-0.09	-0.01	-0.02	-0.01	-0.05	0.00
				Middle skill (higher)		
Offshore outsourcing	-0.23	-0.06	-0.07	-0.01	-0.08	-0.01
Narrow offshore outsourcing	-0.10	-0.01	-0.02	-0.01	-0.05	0.00
				Middle skill (lower)		
Offshore outsourcing	-0.29	-0.05	-0.11	-0.01	-0.11	-0.01
Narrow offshore outsourcing	-0.13	-0.01	-0.04	-0.01	-0.07	0.00
				Low skill		
Offshore outsourcing	-0.27	-0.04	-0.11	-0.01	-0.1	-0.02
Narrow offshore outsourcing	-0.13	-0.01	-0.04	0.00	-0.07	0.00
				Other skill		
Offshore outsourcing	-0.25	-0.01	-0.06	-0.01	-0.07	-0.11
Narrow offshore outsourcing	-0.13	0.00	-0.02	-0.01	-0.07	-0.03

Source: Insee, LFS and national accounts; authors' calculations.

Note: Column "Total" is equal to the sum of the remaining columns by product.
Offshore outsourcing in the broad sense is defined as imported intermediate inputs from all productions, while narrow offshore outsourcing is restricted to those from the same product.

Table 3.D.4: Breakdown of technology contributions to employment change by skill and product. 1983-2010

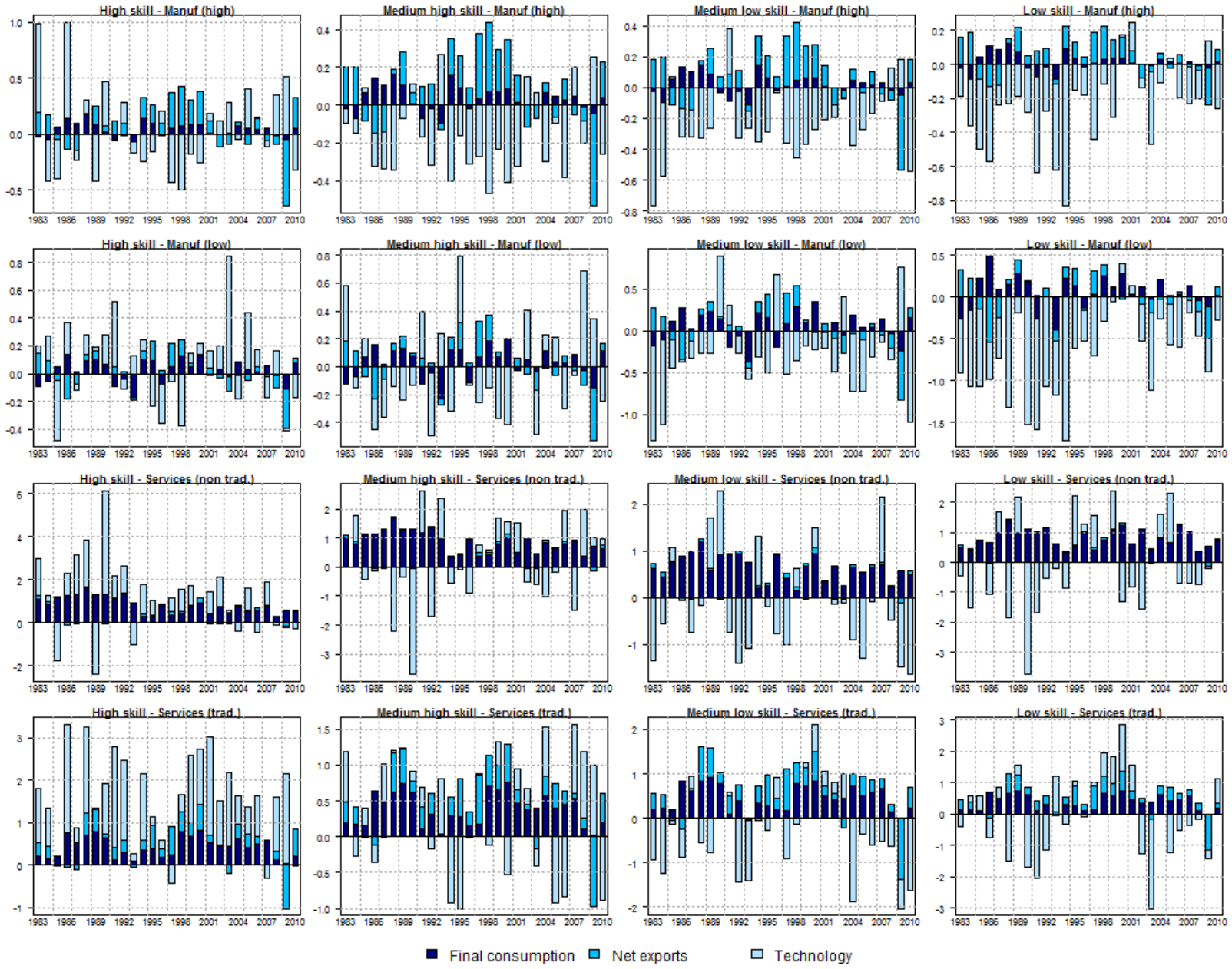
Average contribution (in % per year)	**Total**	**Products in:**				
		Manufacturing		Services		Agr. and
		high-tech	low-tech	non-tradable	tradable	energy
				Total		
Technology effects	-0.95	-0.15	-0.25	-0.21	-0.15	-0.19
Direct labour saving	-1.16	-0.18	-0.30	-0.10	-0.38	-0.21
IC effects	-0.08	0.01	0.01	-0.18	0.06	0.02
GFCF effects	0.30	0.02	0.04	0.06	0.18	0.00
				High skill		
Technology effects	1.73	0.02	0.05	0.61	1.00	0.04
Direct labour saving	1.35	-0.02	0.01	0.73	0.58	0.04
IC effects	-0.07	0.02	0.01	-0.17	0.07	0.00
GFCF effects	0.45	0.02	0.03	0.04	0.36	0.00
				Middle skill (higher)		
Technology effects	-0.28	-0.14	-0.03	-0.15	0.04	0.00
Direct labour saving	-0.44	-0.18	-0.08	0.03	-0.21	0.00
IC effects	-0.13	0.01	0.02	-0.22	0.07	0.00
GFCF effects	0.29	0.02	0.04	0.04	0.18	0.00
				Middle skill (lower)		
Technology effects	-1.17	-0.21	-0.23	-0.28	-0.43	-0.02
Direct labour saving	-1.49	-0.23	-0.30	-0.20	-0.73	-0.03
IC effects	0.01	0.01	0.02	-0.16	0.13	0.01
GFCF effects	0.32	0.02	0.05	0.08	0.16	0.00
				Low skill		
Technology effects	-1.46	-0.23	-0.60	-0.33	-0.26	-0.05
Direct labour saving	-1.46	-0.25	-0.63	-0.17	-0.34	-0.07
IC effects	-0.24	0.01	-0.01	-0.21	-0.04	0.02
GFCF effects	0.23	0.01	0.04	0.05	0.13	0.00
				Other skill		
Technology effects	-3.02	-0.04	-0.39	-0.62	-0.63	-1.35
Direct labour saving	-3.23	-0.04	-0.41	-0.61	-0.73	-1.44
IC effects	-0.03	0.00	-0.01	-0.12	-0.01	0.09
GFCF effects	0.24	0.00	0.03	0.10	0.11	0.00

Source: Insee, LFS and national accounts; authors' calculations.

Note: Column "Total" is equal to the sum of the remaining columns by product and displays the same figures as Table 3.5.4. In each panel, the first row is equal to the sum of the remaining rows.

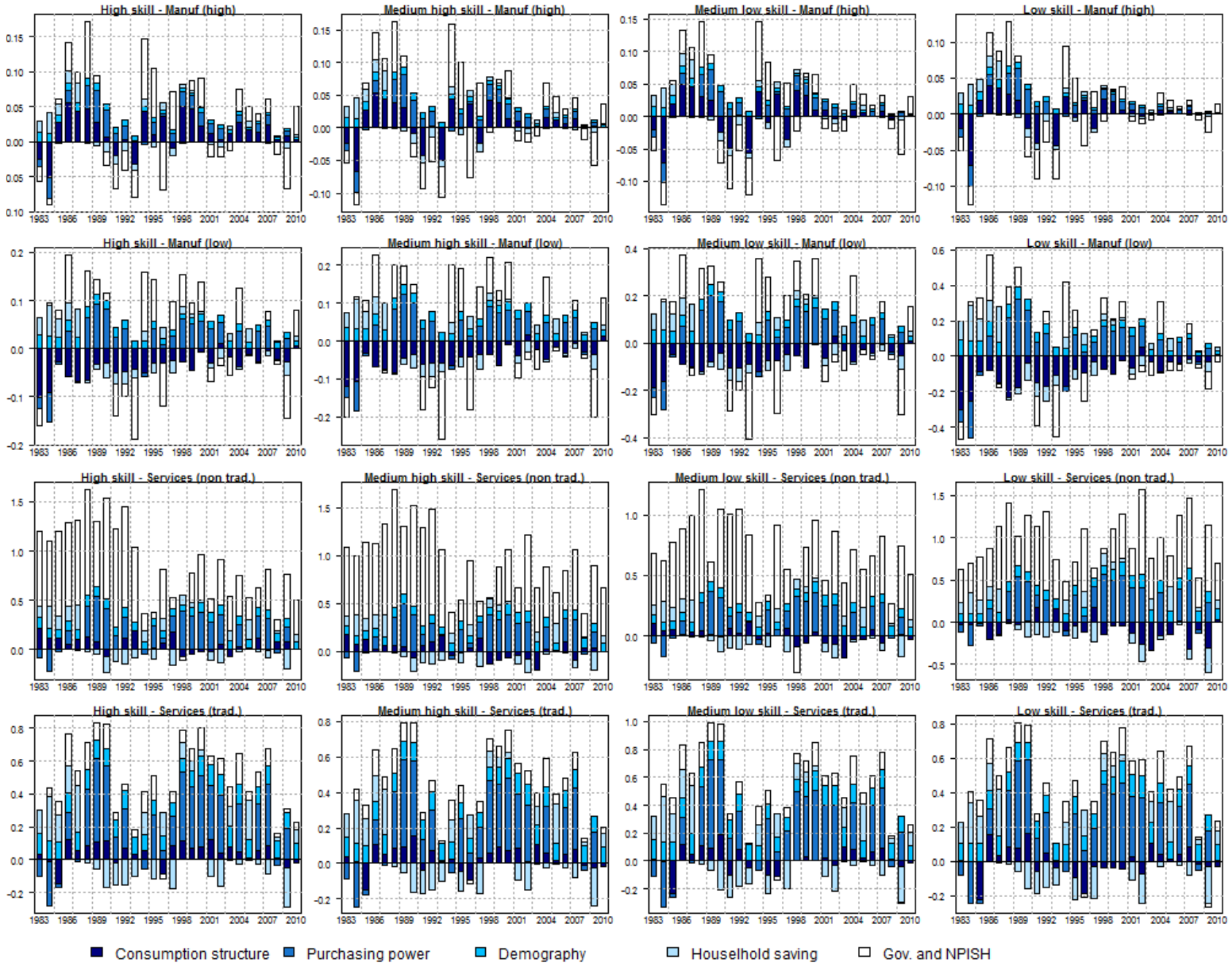
3.E Evolution of contribution to jobs creation by skill and sector

Figure 3.E.1: Final consumption, trade, and technology contributions to employment change, by skill level and product (in %). 1983-2010



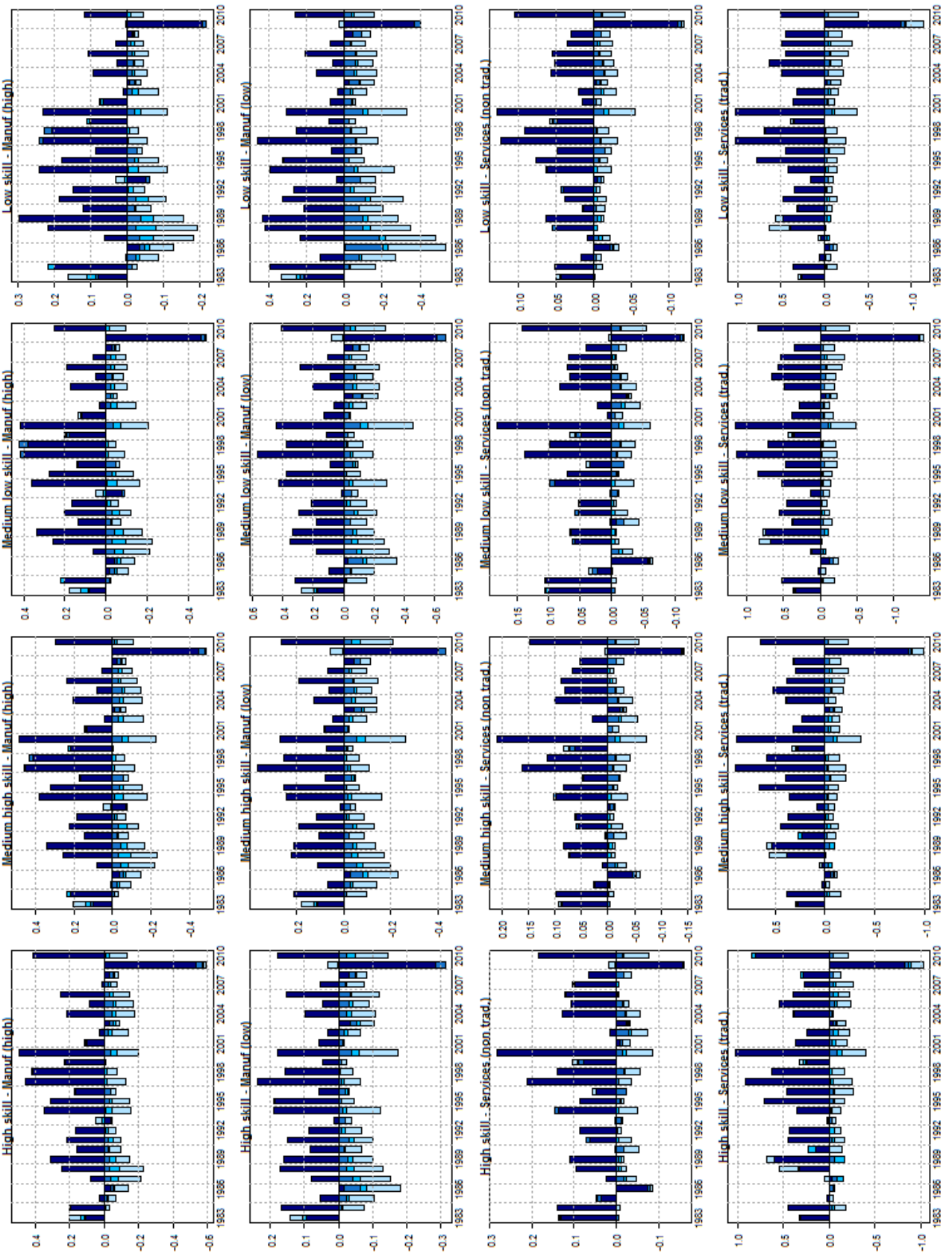
Source: Insee, LFS and national accounts; authors' calculations.

Figure 3.E.2: Breakdown of final consumption effects on employment change, by skill level and product (in %). 1983-2010



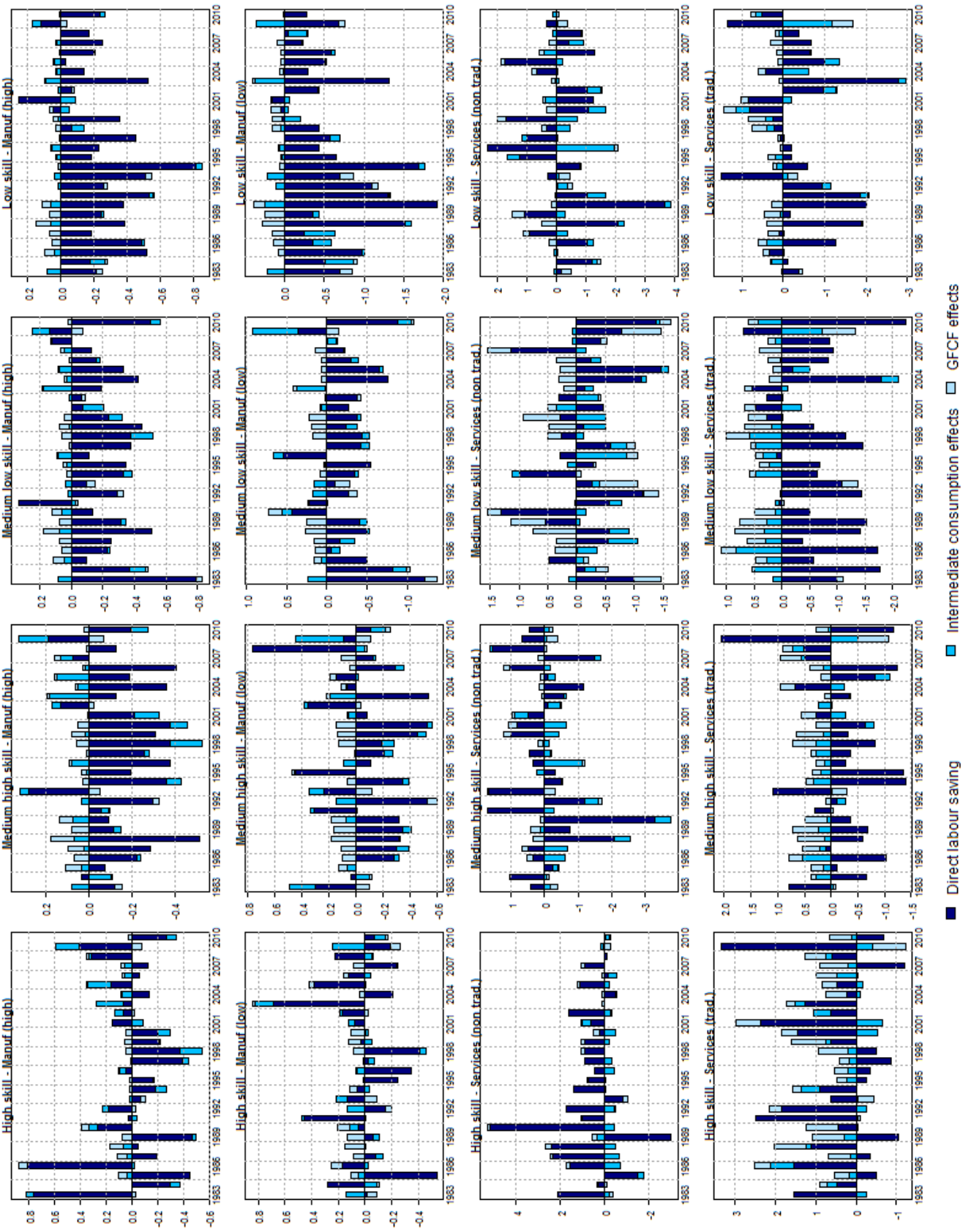
Source: Insee, LFS and national accounts; authors' calculations.

Figure 3.E.3: Breakdown of trade contributions to employment change, by skill level and product (in %). 1983-2010



Source: Insee, LFS and national accounts; authors' calculations.

Figure 3.E.4: Breakdown of technology contributions to employment change, by skill level and product (in %). 1983-2010



Source: Insee, LFS and national accounts; authors' calculations.

Conclusion

The research reported in this thesis started few years after the global financial crisis and ended in the middle of another global crisis, the COVID-19 pandemic. The former crisis shed light on the dangers of accumulating external imbalances, as peripheral Euro Area countries accumulated sizeable deficits in their current account balance. The latter and ongoing crisis highlighted risks associated with the international fragmentation of production and the interconnectedness between countries through global value chains, as the supply of medical equipment or intermediate inputs was abruptly disrupted. This created important bottlenecks in domestic production and retail distribution, and raised debates on reshoring parts of the production. Overall, these two crises underline the importance of understanding how to fix external imbalances in a sustained and non-costly way, as well as keeping in mind the benefits of trade on firms and workers.

Regarding the policy implications of this thesis, they are complementary for chapters 2 and 3, but at odds between chapters 1 and 2. Recommending less stringent business regulations and lifelong learning to upgrade workers' skills benefit both firms and workers. Stringent regulations like barriers to entry to new firms mitigate the pro-competitiveness effect of trade on labour productivity as they keep low-productivity firms in the market. They also decrease consumers' welfare as markups and prices can be higher despite foreign competition. Lifelong learning can help workers with more offshorable jobs to be re-deployed in domestic firms or in other industries. However, less stringent business regulations are less likely to improve current account balances as they enhance investment. As highlighted in chapter 3, time horizon is important to account for the contribution of technology to employment: negative in the short-run, but positive in the long-run. Likewise, this result on business regulations could be related to an issue of time horizon. Less stringent business regulations may decrease the current balance in the short-term by stimulating investment, but increase the current balance in the long-term by improving productivity and competitiveness.

The link between the three chapters of this thesis could be further strengthened by investigating the effect of global value chain participation and position on current account balances as well. There is evidence that economies with stronger participation in global value chains and a more downstream

position in global value chains have larger current account surpluses or lower current account deficits (Brumm *et al.*, 2019; Haltmaier, 2015). However the main constraint lies in the availability of Input-Output tables for a large sample of countries and years. The main and underestimated challenge in empirical works is the availability of data, as there is usually a trade-off between choosing the relevant variables and the size of the sample.

Looking ahead, digitalisation is reshaping the way countries trade, by enabling exports of predominantly digitally deliverable services and the servicification of manufacturing (use of services in manufacturing as inputs, as production activities within the firm or as output sold bundled with goods). This may lead to more skill-biased effects of trade and stronger effects on productivity. The effects on prices, markups and current account balance may also be different compared to the more traditional effects of trade of goods. With the present technology and amid the COVID-19 pandemic, reshoring global value chains is not considered as an effective way of managing risks in value chains, as it may entail less competitiveness and diversification (OECD, 2020). However, the development of smart factories (Industry 4.0), as well as IoT and 3D printing, could address this issue by optimising the production system and enabling customised products at mass-production prices.

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RÉSUMÉ

Cette thèse examine empiriquement des théories communément acceptées en économie internationale. La flexibilité du taux de change contribue-t-elle vraiment à réduire les déséquilibres extérieurs? La mondialisation exerce-t-elle toujours une pression à la baisse sur les prix de production et les markups? Le commerce favorise-t-il les travailleurs très qualifiés au détriment des travailleurs moins qualifiés dans les économies avancées? Le premier chapitre explore les déterminants d'ajustements durables et de taille importante de la balance courante, grâce à un modèle de sélection qui évalue conjointement les déterminants des retournements de la balance courante et leur ampleur. Ces déterminants incluent les régimes de taux de change, ainsi que des variables d'intégration financière et des politiques structurelles. Le deuxième chapitre met en évidence des réponses différentes selon les secteurs des prix, de la productivité et des markups face à une concurrence accrue venant des firmes étrangères. Dans le cas de réponses anti-concurrentielles, deux pistes sont étudiées: la concentration du marché et l'amélioration de la qualité des produits en réaction à la concurrence des pays à bas salaires. Le troisième chapitre présente une décomposition comptable des évolutions de l'emploi, à partir de tableaux entrée-sortie, suivant la contributions de trois facteurs: la consommation finale, le commerce et la technologie. Cette décomposition met en avant les facteurs de l'évolution de l'emploi en faveur des travailleurs qualifiés dans le cas de la France.

MOTS CLÉS

Balance courante; Commerce international; Tableaux entrée-sortie symétriques; Politiques structurelles; Concurrence; Emploi.

ABSTRACT

This thesis empirically investigates commonly accepted theories in international economics. Do flexible exchange rates really help reducing external imbalances? Does globalisation always put downward pressure on production prices and markups? Does trade favour high-skilled workers at the expense of lower-skilled workers in advanced economies? The first chapter explores determinants of sustained and sizeable current account adjustments, based on a selection model to jointly assess determinants of current account reversals and their magnitude. These determinants include exchange rate regimes, as well as financial integration variables and structural policies. The second chapter highlights cross-industry heterogeneous responses of prices, productivity and markups to increased foreign competition. In the case of anti-competitive responses, two leads are investigated: market concentration and quality upgrading to address competition from low-wage countries. The third chapter presents an Input-Output decomposition of changes in employment into three channels: final consumption, trade and technology. This decomposition indicates drivers of skill-biased changes in employment in the case of France.

KEYWORDS

Current account; International trade; Input-Output tables; Structural policies; Competition; Employment.