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ABSTRACT

This paper investigates the role of international trade in the increase in the employment share of non-tradable sectors (services and construction). Borrowing insights from the vast theoretical literature on the determinants of structural change, we build an empirical model allowing to distinguish between long-run and short-run effects. We use this model to investigate the relative importance of the main traditional demand-side and supply-side channels of structural change, assessing, in this context, the role of trade variables. To this end, we use an unbalanced panel of countries for the period 1960-2011 from the EU-KLEMS and the GGDC 10-sector databases. Our preliminary results suggest that both Engelian income effects, i.e. the so-called demand-side drivers, and relative productivity, i.e. the supply-side channel, are relevant drivers of structural change. We show that the import and export shares are positively and negatively related, respectively, with the employment shifts to non-tradable sectors in the long run, in particular, for mature and transition economies. In the short run, a positive and significant relationship between the import share and structural shifts towards tradable sectors emerges.

Keywords: Structural change, International trade, ECM.

JEL codes: F1, F4, O1, O4.

1 Introduction

The shift in the composition of the economy towards service sectors characterises all countries along the process of development. Since the second half of the past century, we have been observing decreasing employment shares in the tradable sectors of the economy, i.e. agriculture, manufacturing and mining, in countries at a different stage of development, mature economies and transition and developing countries (see Figure A.1-3 in the Appendix). This fact is very well known and investigated in the literature on the determinants of structural change (Herrendorf et al., 2014).

A second well-known fact characterising the last decades is the increase in international trade, both in final and, more recently, due to the international fragmentation of production, in intermediate goods (Baldwin and Lopez-Gonzalez, 2015). As reported by Kehoe et al. (2017), there is ample historical evidence on the relationship between the sectoral reallocation of resources and trade balance dynamics, such as the evidence related to Spain joining the EU in 1986 or Baltic countries' liberalisation of capital markets in 1990, both experiencing a deterioration of the trade balance and a decrease in the share of the good-producing sectors.

The theoretical literature on determinants of structural change is mainly developed in a closed economy framework, with some relevant exceptions which we examine in Section 2.2. Demand-side and supply-side engines of structural change are usually pointed out in this literature as jointly affecting the dynamics of the sectoral composition. As for the former, the literature refers to Engelian effects in demand, the service sector being the income elastic one. The supply side channel, or Baumol's effect, works through sector-specific productivity growth and low-substitutability in either final or intermediate demand, where the service sector is typically the sector with lower productivity growth.

This paper attempts to empirically investigate the role of international trade with respect to structural change, particularly focusing on the transition to non-tradable sectors.

There are several channels via which a relationship between structural change and international trade flows might emerge. A direct channel, where foreign demand adds as a new component to the domestic demand-side and supply-side factors (Matsuyama, 2009), and two indirect channels, which work through the two main domestic engines of structural change: trade affects GDP per capita and relative productivity, this way activating the two internal demand side and supply side channels (Matsuyama, 2017; Uy et al., 2015). Despite a common feature of a decreasing employment share in the tradable sectors, the speed and timing characterizing this development vary substantially from country to country. This casts doubt on the conjecture that convergence patterns of sectoral composition are identical across countries. Several puzzles reveals countries asymmetries in structural change have been recently highlighted, such as differences in the speed of structural change between Korea and the US (Teigner, 2017), faster de-industrialisation process in lower income countries with respect to mature economies, the Asian exception (Rodrick, 2016) and slower decrease in the manufacturing employment share in countries belonging to clusters participating in the Global Value Chains (Baldwin and Lopez-Gonzalez, 2015).

Exploring the role of international trade flows for structural change is therefore relevant along two different dimensions. On the one hand, international trade might be a channel of structural change contributing to the common transition path we mentioned above. On the other hand, it might help in explaining differences across countries in the speed and timing of structural change, since countries are asymmetric in their trade relationships, while they may not be so in the dynamics of preferences and technology. Focusing on trade could explain some of the puzzles mentioned above. Moreover, if international trade emerges as a relevant determinant of structural change, this will call for a greater role of trade policies for the structural change dynamics and timing.

The sectoral composition of an economy and its dynamics are relevant factors affecting income level and growth rate, both along the transition path and looking at the long run, together with the employment level and dynamics since structural change implies reallocation of resources across sectors requiring different skills and education levels. This imply that trade policies should also be considered in light of their potential role in asymmetrically affecting long-run growth and employment composition across countries through structural change. Therefore, deeper understanding of the channels through which trade affects structural change, i.e. in which direction and to which extent, becomes very relevant.

We employ a dynamic panel setup, allowing to distinguish between long-run and short-run, to investigate the relative importance of trade variables, controlling for the main traditional demand-side and supply-side channels of structural change. This is done by using an Error Correction Model framework. We also make an attempt to distinguish between direct and indirect channels through which trade potentially impact on structural change (via a panel VAR). We use EU-KLEMS data and the GGDC 10-sector database for the period 1960-2010 for a panel of mature, developing and transition economies (the panel is unbalanced due to data availability for the latter two groups). Our results confirm the role of Engelian effects in demand and differences in relative productivity growth, i.e. the so-called Baumol effect, in driving the shift to services. Trade variables emerge as relevant factor in affecting structural change, in particular in mature and transition countries. The direct effects, i.e. the ones driven by foreign demand composition, of the export share and the import share in GDP in the long-run go in opposite direction. Exports negatively affect the shift to services, while imports have a positive and larger effect on it. In the short-run the import share negatively affects the transition to services. Our first explorations of the potential indirect effect of trade on structural change through GDP per capita reveals that an indirect effect is at work for the export share, but not for the import share. We show that distinguishing between short-run and long-run is important since the magnitude of the coefficients and, in some cases, the sign is different. Reallocation of resources across sectors takes time and our analysis suggests that this dimension must be taken into account when assessing the determinants of the sectoral dynamics.

The structure of the paper is as follows. The next Section 2 reviews the literature, illustrating the main channels through which trade and structural change are related. Section 3 describes our methodology and provides our empirical estimation of the relationship between trade and structural change. Sections 4 and 5 present the main results and some robustness checks, while Section 6 concludes.

2 Main drivers of structural change in the recent literature

In this section we briefly review the main drivers of structural change, i.e. the dynamics of the sectoral composition of an economy, as highlighted by the recent literature (for a recent exhaustive review, see Herrendorf et al., 2013). Our main aim is to single out the channels via which the relationship between trade and structural change may develop. We are particularly interested in those contributions when it comes to the transition to services or non-tradable sectors in modern economies.

2.1 Drivers of structural change in a closed economy framework

Most of the contributions to the determinants of structural change are developed in a closed economy framework. There are two main mechanisms highlighted, generally referred to the demand-side and supply-side explanations of structural change.

The demand-side explanation points out the role of Engelian effects in final demand, i.e. non-homothetic or quasi-homothetic preferences, where agricultural goods are income inelastic, manufacturing goods exhibit either unitary or less than unitary income elasticity, this depending on the level of development and on the exact sectoral split adopted, and services are typically income-elastic (Echevarria, 1997; Kongsamut et al., 2001; Bonatti and Felice, 2008; Foellmi and Zweimuller, 2008; Herrendorf et al., 2013; Alonso-Carrera and Raurich, 2015, 2016). This means that, independently on potential sectoral heterogeneity in technology level and dynamics, the consumption share and the employment share shift to the service sector as income grows.

The supply-side channel works under the assumption of sectoral heterogeneity in technology level and/or technological progress and/or factor intensities; this intrinsic industry characteristic, coupled with low substitutability between goods in either final demand (Ngai and Pissarides, 2007; Moro, 2012; Herrendorf et al., 2015) or intermediate demand (Alvarez-Cuadrado, et al. 2017, Acemoglu and Guerrieri, 2008) generates structural change. In particular, since agriculture and manufacturing are generally assumed to be capital intensive and to exhibit higher rates of technological progress, the employment share shifts to services, if goods and services are low-substitute.

The most recent contributions jointly consider the two channels in the same framework in order to quantitatively assess their relative weights (Boppart, 2015; Comin et al., 2015), by using, in particular, a preference system allowing to disentangle income effects from substitution effects in demand.[1] Both demand-side and supply-side engines are shown to be at work. Boppart (2015), by calibrating his model on data for the US economy, shows that Engelian effects prevail for lower income level. while price substitutability gains importance as income grows. This result implies that Engelian effects are likely to be relevant in explaining the transition from agriculture to manufacturing sectors while the shift from manufacturing to services should be driven by a larger extent by productivity differences.As mentioned before, these contributions do not consider the potential role of countries' asymmetries in trade specialisation in affecting structural change.

2.2 Structural change in an open economy framework: the role of trade

In an open economy framework, the dynamics of the sectoral composition of the economy are driven not only by domestic demand and supply forces as listed in the previous section, but also by foreign demand and its determinants (Matsuyama, 2000, 2009). Matsuyama (2017) provides a unified theoretical framework to study how income effects in demand, innovation and trade are interconnected in generating structural change. As for the link between trade and structural change, he also differentiates between direct and indirect effects.

- **Direct channel: trade affects structural change through foreign demand (trade specialisation).** This channel is induced by either countries' comparative advantage or their differences in income per capita. Going from autarky to trade could generate countries' asymmetries in foreign demand due to trade specialisation according to comparative advantage. Countries that are relatively more productive in the manufacturing sectors (or generally more in the tradable sectors) will be net exporters in those sectors. For these countries becoming more open to trade will slow down the domestic price-elasticity mechanism driving structural change, i.e. shrinking of the tradable high-productivity sectors. If countries differ in the per capita income, the higher income ones will specialise in income elastic sectors. Therefore the predicted shrinking of the tradable sector in high income countries should be larger the more open the economies are. [2]

[1] Some other approaches focus on the role of labour market frictions (Lee and Wolpin, 2006), or home production as a substitute for service goods (Buera and Kaboski, 2009 and 2012; Bonatti and Felice, 2010) or the role of public expenditure composition for manufacturing and services (Felice, 2016) for structural change.

[2] This can be induced by several channels documented in the trade literature. Higher income countries are more abundant in the

- **Indirect channel (I): enhancing the internal channel working through income effects in demand.** The trade-induced productivity gains will increase GDP per capita which, in turn, will feed back to structural change through the Engelian effects in demand mentioned in Section 2.1.

- **Indirect channel (II): enhancing the internal channel working through productivity differences**. Going from autarky to trade will increase productivity growth differences across sectors by increasing the market size and therefore the incentives for innovation (Schmookler, 1966; Matsuyama, 2017) and by increasing the number of varieties available as differentiated inputs in production (Krugman, 1980). This classical effect through which trade works as technological progress is likely to affect more either the tradable goods, where initial comparative advantage is strengthened through trade, or the sector using relatively more intensively tradable intermediate inputs. This effect of trade on productivity differentials across sectors will then feed back into structural change through the price elasticity channel, shifting resources to the non-tradable sectors. It is worth noting that by strengthening the initial comparative advantage, it could also reinforce the direct channel mentioned above acting in the opposite direction and increasing resources in the tradable sectors in the net exporting country.

There are only few contributions in the structural change stream of literature considering structural change in an open economy framework and assessing its role quantitatively. Uy et al. (2015), provide a general equilibrium framework with three sectors, agriculture and manufacturing (tradable goods) and services (non-tradable).When a country opens to trade the employment shares in the tradable sectors are affected by both direct effects of trade specialization (net foreign demand) and indirect effects, i.e. where trade affects domestic expenditure shares by impacting on income per capita and relative prices. In the non-tradable sector only the indirect channels are at work. Interestingly enough, the authors show that in the short run the direct effect of net exports may prevail, increasing the employment share in the tradable sector. In the long run, the non-tradable sector may exhibit an increase in employment shares, when the indirect channels start working as contrasting forces: 1) TFP growth is increasing faster in the tradable sectors activating the domestic supply channels (and therefore shifting employment to services); 2) income grows, activating the domestic demand side channel since services are income-elastic (again shifting employment to services). Over the entire period, the effects of trade are mainly explained by the indirect channels. By calibrating their model to quantify the role of trade in South Korean structural change in the period 1971-2005, they show that, in general, trade works as a relevant transmission channel allowing the open economy model to fit the data better than the closed economy one. Income effects nevertheless turn out to be more relevant than trade. Similarly, Teigner (2017) introduces Ricardian trade specialisation in a general equilibrium neoclassical growth model with two sectors (agriculture and non-agriculture). He shows that international trade explains a large part of the transition out of an agriculture-driven economy for the Great Britain and explains the positive, but relatively smaller role, for South Korea. Kehoe et al. (2017) have a three-sector model where intermediate and final goods (and services) are assumed to be tradable, while the construction sector only is taken as not-tradable. The preferences are non-homothetic and TFP growth is sector specific. By calibrating their model on US data for the period 1992-2012, the authors show that faster productivity growth in the goods sector is the main reason for the long-run shift to services and construction, while the saving glut, affecting the trade balance, has been

factor used more intensively in income-elastic goods, which leads them to specialise in these goods according to a factor proportion trade model (Caron et al., 2014). Higher income countries may exhibit higher technologies/capabilities in income elastic goods and therefore specialize in these goods in a Ricardian approach to trade (Matsuyama, 2009; Fieler, 2011). Specialisation in income-elastic goods could also be driven by the joint work of the Engelian effect in demand and a home market effect (Linder, 1961; Matsuyama, 2017).

relevant, but only temporarly. It has nevertheless affected its long run trajectory. Sposi (2015) focuses on a different mechanism through which trade may affect structural change, i.e. cross-country/cross-sectoral differences in the intensity of intermediate inputs, this opening room for the role of intersectoral linkages and intermediate demand in affecting structural change. He documents that in the agricultural sector rich countries use intermediate goods more intensively than poor countries and that rich countries use services as intermediate goods more intensively than poor countries do, in particular, in the service sector itself. Sectoral linkages matter for structural changes since 1) they result in asymmetric responses in the sectoral composition to identical changes in the composition of the final demand; 2) they result in asymmetric responses of relative prices and comparative advantage to identical changes in productivity. Sposi incorporates country-specific sectoral linkages into a multi-country, open economy general equilibrium model of structural change where income and price elasticities contribute in driving structural change. He quantitatively assesses the weight of different engines of structural change by calibrating the model to match the data for 41 countries. In his results, international trade plays a role for structural change, but this is less relevant than the heterogeneity in the intersectoral linkages across countries. Cravino and Sotelo (2016), move from the stylised fact showing that employment share in manufacturing has been falling in both net exporters and net importers of manufacturing goods. They highlight the role of the indirect channel linking trade and structural change through productivity differences and investigate how trade contributes in reducing the relative size of the manufacturing sector and in increasing the skill premia. By calibrating the model on US data for the period 1977-2007, they show that trade enhance productivity growth in manufacturing sectors relatively more than in services, this shifting employment into the service sectors in presence of low-substitutability across goods and services. They show that trade plays a substantial role in explaining the decrease in manufacturing employment, highlighting the role of intersectoral linkages in quantitatively accounting for the trade effect.

The main shortcoming of these works is that the different engines of structural change are quantitatively assessed by focusing on one country or a few countries only. Swieki (2017) represents an exception by assessing in a unified framework [3] the main forces driving structural change. It does so by using a model calibrated on 45 countries for the period 1970-2005. He shows that income and price elasticities are fundamental forces driving structural change in all countries, with the relative weights depending on the stage of the structural change. Income effects are more relevant at the initial stages in accounting for the shifts out of agriculture, while substitution effects are more relevant at later stages in considering the shift from manufacturing to services, in line with Boppart (2015). Trade and labour market frictions are important in labour reallocation over time for individual countries only, and their effect is less systematic. Lastly, Rodrick (2016) investigates the different path of structural change in both advanced and developing countries. His analysis suggests that the structural change path has been mainly driven by different rates of productivity growth, i.e. supply-side determinants, between manufacturing and services in the advanced countries, while he speculates that in developing and low-income countries the main engine of structural change has been trade specialization, this explains the different timing of structural change and the relationship with per capita income.

This very recent stream of literature gives some insights on the channels through which trade specialization may affect the sectoral composition and its dynamics. Summing up, it emerges that trade may affect structural change both directly, through trade specialisation, and indirectly, by enhancing the domestic channels.

[3] He builds a general equilibrium model of international trade where agriculture and manufacturing are among the tradable sectors and services are listed in the non-tradable one in a Ricardian model of comparative advantage following Eaton and Kortum (2002). He also allows for sectoral and aggregate trade imbalances.

3 An empirical investigation of the relationship between trade and structural change in the short-run and in the long-run

The literature mentioned in the previous section highlights that international trade is likely to affect structural change through several channels with potentially asymmetric effects across countries. Nevertheless the assessment of the role played by trade in structural change dynamics is very scant and with some exceptions, like Swieki (2017), confined to the analysis of single countries. This paper represents an attempt to fill this gap.

3.1 Description of the data, taxonomy and samples

3.1.1 Data and sources

Our dependent variable is the relative employment share of tradables over non-tradables. We split the economy into two macro sectors: 1) non-tradable goods (NT) which consist of services, construction and public utilities and 2) tradable goods (T), as the rest of the economy [4]. We make use of two main sources to construct the share, namely: the GGDC 10-Sector Database (Timmer et al., 2015) and the EU-KLEMS data base (November 2009 release, Timmer et al., 2010). We use Penn tables for the real GDP per capita (PWT 9.0, Feenstra et. al., 2015) and Word Bank Indicators for the trade variables, exports and imports in goods and services as a share of GDP.

3.1.2 Samples and taxonomy

The GGDC 10-Sector Database reports information on sectoral employment (persons engaged) and value added (Gross Value Added at current national prices and Gross Value Added at constant 2005 national prices), at one digit level, for 42 countries for the period 1947-2013, while the EU-KLEMS data base has information on many variables for growth accounting, among which we use the employment (number of persons engaged), for 29 countries and 32 industries, in the interval 1970-2007. We exclude from the sample lower-income countries since we are interested in the transition to services in economies where agriculture is a modern sector characterised by high productivity growth and it represents a small share of the total employment. This means that the empirical specification that we employ and the sectoral taxonomy that we use are borrowed from the literature analysing structural change in economies which have already undergone a take off phase out of a poverty trap. We think that lower income countries, particularly African countries, would require a different framework. It would be misleading to pool them with countries at a development stage which is too different and in which goods and services are produced with completely different technologies, this questioning the use of the same taxonomy. We also drop countries - mainly from Latin America - that are not reporting data for employment in the public sector, which is part of our non-tradable sector. In the specifications where we include the relative sectoral productivity we must use the GGDC 10-Sector Database which contains information for the sectoral value added at constant 2005 prices. We therefore end up with an unbalanced panel of 38 countries for the period 1960-2011 for the larger sample, when we do not control for the relative productivity, and an unbalanced panel of 17 countries for the same period when we do control for the relative productivity (see the Appendix for the list of countries).

[4] As for the sectors included in the in the Tradable and Non-Tradable categories, we follow Buera and Kabosky (2011) and Valentinyi and Herrendorf (2008); the same classification is used by Cravino and Sotelo (2017) under the label Manufacturing and Services.

3.2 Empirical strategy

Our strategy develops as follows and will result in different specifications. In all of them the dependent variable, i.e. the proxy of structural change, is the relative employment share (tradable sector over non-tradable sector). In a baseline model where we consider Engelian effects, i.e. demand side, as a potential driver of structural change, proxied by real GDP per capita, we introduce export and import share in GDP, first separately, and then jointly to avoid omitted variables issues. This is shown in Table 1.

As a second step, we consider an alternative baseline model where we include also the relative productivity, proxied by the ratio of labour productivity in tradable sectors over non-tradable sectors, to capture the second main driver of structural change, i.e. the supply-side channel.

Since we have to use GGDC-10 sector data only, we rely on the second subsample of countries mentioned in Section 3.1. For comparison with results in Table 1, we show results of the new sample for the baseline model, i.e. including GDP per capita only (Column 1, Table 2) and including the trade proxies, export share and import share in GDP (Column 3, Table 2). We then introduce relative productivity (Column 2, Table 2), in the baseline model before, and then including the trade proxies (Column 4, Table 2).

As a third step, we make an attempt to investigate potential asymmetries in the relationship between trade and structural change across countries at a different stage of development. We therefore interact the trade variables with three country groups, i.e. mature, transition and developing countries (see Section 8 for a list of the countries), where the excluded category is that of mature economies in all specifications. First, we explore the role of countries asymmetries in the largest sample of countries, including also transition economies' category, without controlling for the relative productivity (Column 1, Table 3); as a second step we include the relative productivity, therefore considering the smaller sub-sample of countries (Columns 2 and 3, Table 3).

We will make use of two main methods in the empirical analysis, namely: panel Error Correction Models (ECM) and panel VARs (explained in details in the next sub-section). By employing ECM models and controlling for proxies of the two main demand and supply channels of structural change, the coefficient of our trade variables captures mainly the direct effects of trade on structural change. The indirect effect is not explicitly introduced in the model. Indeed, in order to explore the working of the potential indirect channels mentioned in Section 2.2 we turn to a different methodology by applying panel VAR techniques. In this case we deal separately with export and import shares and with the other main engine of structural change, i.e. the GDP per capita, in order to rely on the largest sample. In the latter, the direct effect is still present, but we can have a clear look also at the indirect transmissions. Lastly, we also make an attempt to explore the indirect channel going through changes in the relative labour productivity, in this case relying on the smaller sample, since we have to use the GGCD-10 sector data. [5]

3.3 Methodology

We analyse the impact of the main determinants of structural change by making use of a dynamic panel setup. Our first baseline framework follows the structure of an Autoregressive Distributed Lag (ARDL) model. In a further check, we make use of a simple panel VAR to take into consideration possible indirect effects and endogeneity across variables.

[5] Results are reported in Figures 1-2-3.

3.3.1 Pre-estimation tests

First, we need to perform some regular tests in order to apply the best possible estimator and the correct setup given our dataset. We tested for cross-sectional dependence (CSD), non-stationarity and cointegration. We started applying the test of Pesaran (2004) for cross-sectional independence, which is strongly rejected for every specification.[6] Therefore, in order to properly test for the presence of unit roots, we use a second-generation panel unit root test by Pesaran (2003), which is designed for this situation.[7] The null hypothesis assumes that all series are non-stationary. Our panel indeed accepts the null of non-stationarity for most of the series (including the dependent variable). For cointegration, we apply an error-correction-based panel cointegration test, i.e. the Westerlund (2007) test. This method does work in case of panel data with cross-sectional dependence. This cointegration test, however, cannot be performed for the entire panel when we combine our panel with EU-KLEMS data (38 countries).[8] Thus, we applied the test for the maximum number of countries possible with enough data points (i.e. excluding transition economies, Malta and Cyprus) and the null of no cointegration is always rejected at 5% significance level. The Westerlund (2007) test also reject the null in all the possible specifications when we apply it to the dataset for 17 countries (GGDC-10 sectors without EU-KLEMS data).

3.3.2 Econometric framework: the Error Correction Model

With this in mind, we reparametrised our ARDL model. Indeed, in a panel regression model with lagged endogenous variables, the fixed effects estimator has been proved to be inconsistent for finite T (Nickell, 1981). The bias in the dynamic FE estimator is almost negligible only in the case of large enough T (Roodman, 2006). T could not be always large enough in our case, mostly due to the annual frequency and unbalanced number of time observations in some specifications (see Section 3.1). Furthermore, we may also have a problem of endogeneity between the dependent variable and its lag and among explanatory variables (such as between GDP per capita, labour productivity and trade variables). The solution to this issue is usually found in IV-GMM estimators. However, the moment conditions of the GMM estimators are only valid if there is no serial correlation in the idiosyncratic errors (i.e. no CSD) and the slope coefficients are invariant across the individuals (i.e. homogeneous coefficients). In addition, IV-GMM cannot disentangle the effects in the short and long run, which is one of the main novelties in our contribution, and it is not designed for cointegrated series.

One possible way to deal with these issues is to reparametrise our ARDL setup (equation 1) into a panel error correction model (PECM), as shown in equation (2). We keep a limited number of lags, having data in annual frequency.[9] The number of lags has been selected based on the Schwarz's Bayesian information criterion (SBIC). This method has been proven to give a more accurate outcomes also in case of small samples for VARs and Vector ECMs (Ivanov and Kilian, 2005). We implemented this criterion country by country for the largest dataset and higher number of regressors. Only for a few countries the SBIC criterion would have chosen 2 lags.[10] Hence, in our setups, we applied only one lag for the overall panel to keep a higher degree of freedom.

Recalling an ARDL (1,1) model for the baseline:

[6] Not correcting for CSD results in misleading inference (Pesaran and Tosetti, 2011).

[7] Null hypothesis assumes that all series are non-stationary. This t-test is also based on Augmented Dickey-Fuller statistics as IPS (2003) but it is augmented with the cross section averages of lagged levels and first-differences of the individual series (CADF statistics).

[8] This is because at least 15 observations are required and some series do not contain sufficient observations.

[9] We limited the maximum number of lags to 2.

[10] These countries are namely: Germany, Hungary, Lithuania, the US and South Africa.

$$Y_{i,t} = \alpha_i + \beta_i Y_{i,t-1} + \zeta_{1i} X_{i,t} + \zeta_{2i} X_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

we take the difference of $Y_{i,t} - Y_{i,t-1}$ as dependent variable $\Delta Y_{i,t}$ and we use the equation for $Y_{i,t-1}$ in the expression above on the RHS as well. Reshuffling the terms, we obtain the PECM as the following:

$$\Delta Y_{i,t} = \phi_i (Y_{i,t-1} - \theta_{0i} + \theta_{1i} X_{i,t-1}) + \zeta_{1i} \Delta X_{i,t} + \mu_i + \varepsilon_{i,t} \tag{2}$$

Here Y is our dependent variable, i.e. the relative employment share (Tradable sector over Non-Tradable sector). And the $\Delta Y_{i,t}$ is our proxy for structural change.

Moreover, ϕ_i is basically $(\beta_i - 1)$ and represents the error correcting speed of adjustment term. This parameter is expected to be significantly negative and signals that the variables show a return to a long-run equilibrium (Blackburne and Frank, 2007). The vector $\theta_{.i}$ contains the long-run relationships between the variables and the short-run coefficient is instead ζ_{1i}. As for the long-run coefficients: θ_{0i} is $(\alpha_i/(1-\alpha_i))$ and θ_{1i} is $(\zeta_{1i}+\zeta_{2i})/(1-\alpha_i)$.

In this setup, the estimators we can apply are the following: the Mean Group (MG) of Pesaran and Smith (1995), the Dynamic Fixed Effects (DFE), or the Pooled Mean Group (PMG) of Pesaran, Shin, and Smith (1999). In the first one, all the coefficients in the short and long run are heterogeneous across individuals and then averaged. In the DFE, all the coefficients but the constant are taken as homogeneous. In between, the PMG gives only heterogenous short-run coefficients.[11] We believe that both short- and long-term coefficients may be different across countries, so in theory the MG estimator should be preferred. We tested for the best estimator by using a Hausman test as in Blackburne and Frank (2007) in every setup, finding that the difference in coefficients between the MG and DFE is not systematic. Moreover, in some specifications with more regressors we could not compute the MG given the limited number of observations. For these reasons, we therefore apply the DFE.

In order to also fully correct for CSD, we implement a panel dynamic factor model by using the Augmented Mean Group estimator by Eberhardt (2012).[12] This is taken only as a robustness check for our PECM setups. This estimator deals with dynamic, cross-sectional dependent panels with heterogeneous coefficients and it can also be used if the panel is cointegrated. Hence, it provides indeed a nice check to some of the PECM flaws and gives intuitions to possible role of spillovers. However, in the dynamic factor model we cannot disentangle short and long-run contributions and the dependent variable is the relative employment ratio in (log) level and not the variation (i.e. the structural change as such).[13]

3.3.3 Econometric framework: the panel VAR

In one of the checks, we also provide a simple panel VAR model as the one in equation (3) to look at our results with having an endogenous structure (see Canova and Ciccarelli, 2013).

$$Y_{i,t} = A_{0i}(t) + A_i(l) Y_{i,t-1} + u_{i,t} \tag{3}$$

where $Y_{i,t}$ is now the vector of our variables described in a preferred identification scheme. We compact into $A_{0i}(t)$ all the deterministic components of the data (constants, seasonal dummies and deterministic polynomial

[11] We do not consider here the PMG because for us there is no reason to have only heterogeneous short-term coeffcients.

[12] For a more detailed description of dynamic factor models, please refer to Pesaran and Tosetti (2011), Eberhardt (2012) and the online appendix in Comunale (2017).

[13] The complete set of results with this method is available on request. Some insights are provided in the section on robustness checks (in Section 5).

in time) if present. $A_i(l)$ are polynomials in the lag operators and $u_{i,t}$ are the identically and independently distributed errors. Lags of all endogenous variables of all units enter the model for i, i.e. we allow for "dynamic interdependencies". We provide this panel VAR identified by a Cholesky scheme and using a GMM-style estimator as in Albrigo and Love (2015).[14] The main identification is simply as the following: we have the employment ratio as our most endogenous variable, while exports (or generally trade variables) can affect simultaneously either GDP per capita or labour productivity. GDP per capita/labour productivity influences trade only after one period. Lastly, in our preferred VAR setup with both trade variables, the imports are affecting exports at time t.[15]

4 Results

4.1 Results: Error Correction Models

Table 1 shows that the GDP per capita is significantly and negatively related with the relative employment share in tradable sector, in all the specifications. This holds true both in the short-run and in the long-run. This allows us to say that the demand channel of structural change is at work, where Engelian effects are such that expenditure shares for tradable goods decreases as income grows.

[Insert Table 1 here]

It is worth noting that the coefficient of income per capita is larger in the long run, suggesting that structural change is typically a long run phenomena and that it takes time to reallocate resources across sectors following changes in demand composition. When trade variables are included, the coefficient of income per capita should capture the effect of income per capita on structural change beyond those induced by trade. If we turn the attention to the trade proxies, we see that, in the short run, when included one by one, both the trade proxies are positively and significantly related to the structural change. The exports alone are not related to structural change in the long run (Column 2, Table 1) and the import coefficient is negative and significant in the long run (Column 3, Table 1). This suggest that in the long run the two variables go in opposite directions hiding each other if they are not simultaneously included. In the last specification (Column 4, Table 1) we include simultaneously export and import shares. This reveals a positive and significant relationship of the export share in the long run with the relocation of employment into the tradable sectors and a larger negative and significant relationship of the import shares. Since the coefficients here should capture mainly the direct effects of trade on structural change, i.e. the foreign demand composition, so far we can claim that they go in the expected direction and that foreign demand emerges on average as a relevant channel of structural change. It is worth noting that the size of the negative coefficient of the import share is much larger, almost twice the one of income per capita, which we take as a proxy of income effects in domestic demand.

Interestingly enough, when exports and imports are simultaneously included, the coefficient of the export share is positive both in the long run and in the short run, even if not statistically significant in the short run, while the coefficient of the import share changes sign, being positive and significant in the short run and negative in the long run. This might be explained by the role of trade in intermediate goods and global value chain participation. In the short-run, importing intermediate inputs might reduce costs and increase the availability of inputs, which in turn

[14] In this case, the coefficients are also homogeneous. The confidence bands are set at 68% and we consider one-unit shocks.
[15] We also used an identification where it is the opposite and the results are robust.

increases the domestic production of the tradable sector. This is shown to be more intensive of intermediate goods. In the long-run, this channel might be more than offset by substituting the domestic production of intermediate inputs with imported goods.

Results reported in Columns 1 and 3 in Table 2 show us that the results shown in Table 1 (Columns 1 and 4) are robust to considering different countries, i.e. the smaller sample using 10-sector GGDC database only.

[Insert Table 2 here]

Turning to the role of relative productivity in Table 2, we see that it is negatively and significantly related to the structural change, i.e. the employment share decreases where the labour productivity is increasing faster, both in the short-run and in the long-run, with coefficients of a similar magnitude. This suggest that the supply side engine of structural change is also relevant, i.e. higher productivity growth in the tradable-goods coupled with low-substitutability between tradable and non-tradable goods shifts resources to non-tradable sectors. It is worth noting, by comparing Columns 1 and 2 in Table 2 that the inclusion of the relative productivity in the baseline model strongly reduces the coefficient of the income per capita, which nevertheless remains significant and of a relevant magnitude. This suggests that both demand-side and supply-side channels of structural change are at work and must be considered together.

When we look at the trade variables (Column 4 in Table 2) we see that in the short run the only coefficient with survives is the import share, which, as before, is positively and significantly related to the structural change. Both the trade variables and the relative productivity are not significantly related to structural change in the long-run in the whole sample.

Since what we find is an average effect across countries which might strongly differ in their position in the global markets, we proceed by exploring potential country asymmetries, by considering interaction with countries' groups, as explained in section 3.2.

The excluded category is the one of mature countries. Column 1 in Table 3 shows the results of considering different groups for the largest sample of countries, where we cannot control for the relative productivity.

[Insert Table 3 here]

Here the results for mature economies are in line with those of the aggregate sample reported in Table 1 (Column 4), both in the short-run and in the long-run. Transition countries follow a similar path except for the positive relationship between export and structural change towards tradable sectors in the long run which is of much larger magnitude than for mature economies. It is also worth noting that for both transition countries and mature economies a positive relationship between export share and relative employment in tradable emerges also in the short run. As for the developing countries the result show a different story in which trade variables have a very small and in general not statistically significant effect on structural change with the exception of the positive and significant coefficient of the import share in the short run, which suggests a role for global value chain relationships, to be further investigated.[16]

[16] We also performed our exercise splitting the sample in the three groups. Especially for transition and developing countries, the number of observations is very small. We cannot run the sub-sample of transition countries in some of the specifications (i.e. when both exports and imports are included). Summing up, in the long run GDP per capita always affects very negatively structural changes. The other results for developing countries are less in line with the other groups and sometimes the coefficients are not significant. The complete set of results is available on request.

These results are confirmed on the restricted sub-sample,where we can control for the relative productivity (Column 2,Table 3), with the exception of the positive relationship between export share and structural change in the short run, which disappear.

An interesting result emerges from the model including as control variable the relative labour productivity (Column 3,Table 3). Here we see that results for mature economies are in line with the sample where we do not control for relative productivity (Column 1, Table 3) and with the aggregate sample in Table 1: import share is positively and significantly related with structural change in the short run, while it turns negative and significant in the long run. Export share is positively and significantly related with employment shifting into the non-tradable sector in the long run only. Trade variables have very minimal or insignificant effects in developing countries. This help explaining why in the aggregate sample in Table 2, trade variables were not significant when controlling for relative productivity and suggests that further analysis is called for in sub-samples of countries.

4.2 Results with a panel VAR: the role of indirect channels

As mentioned in Section 2.2, export and import shares can be related to the sectoral employment dynamics both directly and indirectly, through the effects that both export and import may have on GDP per capita, i.e. the indirect channel (I) and productivity, i.e. the indirect channel (II). We can see this direct as well as the indirect effect by using a VAR setup as explained in details in Section 3.3.

Figure 1 to 3 show our first attempt to investigate jointly direct and indirect channels linking the export and import share to the relative employment, by focusing in particular on GDP per capita as the mediating factor.

[Insert Figures 1 to 3 here]

In Figure 1 we see that, indeed, the export share positively impacts on the GDP per capita, which in turn is confirmed to negatively affect the relative employment in the tradable sectors. This means that an indirect effect of the export share on structural change is at work, as pointed out by the literature, going through the effect of export on GDP per capita. Results in Figure 1 also confirm that the direct channel of the export share is not significant, as shown in Table 1, column 2. Figure 2 shows, on the other hand, a negative (albeit borderline significant) direct effect of the import share on structural change, in particular in the long run, as reported in column 3 in Table 1, while no indirect channel seems to be at work through the GDP per capita (which is nevertheless confirmed to be negatively related to the relative employment share in the tradable sector).

In Figure 3, when both exports and imports are considered, the role of the indirect effect is confirmed: both export and import positively affect GDP per capita,[17] which in turn negatively affects the relative employment. Figures A.4 to A.6 then report the results when turning the attention to the second potential mediating factor in the relationship between the export/import share and the relative employment, i.e. the relative labour productivity.

[Insert Figures A.4 to A.6 here]

Results show an indirect channel going through the effect of trade on labour productivity, i.e. the indirect channel (II) mentioned in Section 2.2 In particular, Figure A.6 shows that imports have a positive, albeit small, effect on exports, suggesting that GVCs relationships may be at work. Exports have a positive effect on relative

[17] Exports have a negative impact on GDP per capita only at impact, then the effect is positive, significant and persistent. Positive shocks in imports play indeed a positive role for GDP, however the magnitude is very small compared to the role of exports.

productivity (import shocks also influence productivity in a positive way, however, the effect is borderline significant). This in turn, as predicted by the theory, has a negative effect on the relative employment, i.e. the supply side effect. The positive effect of export on relative productivity suggests that exports work as technological progress, by increasing the market size, as suggested by Matsuyama (2017). The positive effects of import on relative productivity is in line with the extensive literature on import of intermediate goods and innovation.

The role of the indirect channel going through labour productivity is confirmed when exports are included alone (Figure A.4), while results are not significant when imports alone are considered.

In general, these preliminary analyses suggest that both the indirect channels, the effects of trade going through GDP per capita and labour productivity, are at work. Exports and imports increase GDP per capita, which in turn negatively affects the relative employment, confirming the presence of Engelian effects in demand; exports and imports increase relative productivity, which in turn negatively affects the relative employment, confirming that also a supply-side engine of structural change is at work. Trade relationships, beyond working through a direct channel due to countries' specialisation, enhance the internal channel of structural change, both demand and supply-side channels.

5 Robustness

5.1 Structural change in value added shares at constant 2005 prices

In this Section we explore the relationship between trade, income per capita, relative efficiency and structural shifts in the value added shares in tradable and non-tradable goods at constant prices. We substitute our dependent variable, i.e. the ratio employment share in T over employment share in NT, with the ratio of the share in value added in T over the share in value added in NT at constant 2005 prices. We rely on the smallest sample, i.e. the unbalanced panel of 17 countries, since the GGCD-10 sector database only provide data on value added. This check should provide more information on the relative role of price and income effects on the sectoral composition, according to Herrendorf et al. (2013), and it should represent a check for the role of trade. Results are shown in Table 4. Both the relevance of income and relative productivity with respect to structural change are confirmed. Both in the long run and in the short run, income per capita is negatively and significantly (at 1%) related with the sectoral change in value added, confirming the role of non-homothetic preferences in driving demand towards the services, already highlighted by focusing on the employment shares. By contrast, the relative productivity, which was negatively and significantly related with the changes in the relative employment shares (Column 2, Table 2), is positively and significantly (at 1%) related with the structural change in value added shares (Column 1, Table 4). This suggests that the supply-side driver of structural change, i.e. the dynamics in the relative prices coupled with low-substitutability in demand is at work. Demand increases for the sector were the relative price decreases but low-substitutability implies that the increase in demand is not enough to compensate the increase in the relative efficiency and therefore the relationship with the employment share is negative.

As for the role of trade, results in Column 2 of Table 4 confirm those of Column 4 in Table 2. At the aggregate level, i.e. pooling all countries, exports and imports are not significantly related to the structural change in value added shares (like in the case of the relative employment), with the exception of imports which are positively and significantly related to structural change in both employment shares and value added shares in the short-run. Turning attention to potential country heterogeneity, by interacting the trade variables with the level of development, we see that the results, reported in Table 5, are in line with those referring to the employment

shares. Exports are positively related to structural change for mature economies and negatively for developing ones, while in the long-run the opposite holds for imports.

[Insert Table 4 and 5 here]

5.2 Endogeneity of trade

In the above analysis we look at the relationship between trade variables and the sectoral dynamics of the economy, including GDP per capita and relative productivity, but there might be other factors simultaneously affecting trade and structural change that we are not controlling for. A potential source of endogeneity could arise should either positive or negative selection take place. We address this potential source of endogeneity by estimating the baseline models in Columns 2-4 of Table 1 by using as trade variables the values of export and import predicted by a standard gravity model. We use bilateral export and import from the World Input-Output Database (WIOD,Timmer et al. 2015).[18] The gravity model we employ includes time invariant bilateral variables (common language, colonial relationships, population-weighted bilateral distances, contiguity) all taken from the GeoDist database from Cepii, described in Mayer and Zignago (2011). It includes origin and destination real GDP per capita from Penn World Tables (PWT 9.0, Feenstra et. al., 2015) and bilateral time variant dummies for regional trade agreements from Mario Larch's Regional Trade Agreements Database (Egger and Larch, 2008). It also includes origin, destination and year fixed effects.[19]

We build new export and import variables as predicted by year fixed effects, all the bilateral time invariant variables (common language, colonial relationships, population-weighted bilateral distances, contiguity), the regional trade agreement dummies and the real GDP per capita of the destination country (the trade partner with respect to the countries in our sample).

We present the results in Table 6. Column 1, where we estimate the same model of column 4 in Table 1 on the new sample with WIOD data, shows that our results in the long run are robust to changing the sample, with the GDP per capita negatively correlated with the structural change and export and import share on GDP, positively and negatively correlated, respectively.

[Insert Table 6 here]

In this sample, both trade variables and GDP per capita are not significant in the short run. In this robustness check we cannot include simultaneously the export and import share when using the predicted values because they are strongly correlated between each other by construction. We therefore run the regressions separately for the two trade variables, export and import share, as we do in Column 2 and 3 in Table 1. Column 2 and 3 of Table 6 shows the results for the export share, with the actual variable and the predicted one, respectively. The export share is positively and significantly related to the structural change (differently from what reported in Table 1 for the main sample where export was not significant when included alone), and the result is confirmed when using the predicted value (Column 3).

Column 4 and 5 of Table 6 shows the results for the import share, with the actual variable and the predicted one, respectively. The import share is positively but not significantly correlated with the structural change (differently

[18] Wiod data, release 2013, reports data for 40 countries plus the Rest of the World for the period 1995-2011. By using GGDC-10 combined with EUKLEMS for the sectoral employment and WIOD 2013 for the trade variables we end up with an unbalanced panel of 35 countries for 1995-2011.

[19] Standard errors are clustered at the origin and destination level.

from what reported in Table 1 for the main sample where import was significantly and negatively related to structural change when included alone), and the result is confirmed when using the predicted value (Column 5).

5.3 Dynamic factor model

In order to also fully correct for CSD, we implement a panel dynamic factor model by using the Augmented Mean Group estimator by Eberhardt (2012). The coefficients in the dynamic factor model are overall robust compared to the ones for the short-run in Table 1 (see Table 7) and 2 (see Table 8). However, as pointed out in 3.3, by using this setup we cannot disentangle between short and long-run effects. Moreover, in the PECM the dependent variable is the variation in relative employment ratio (because of its reparametrisation from ARDL), while in the dynamic factor model the dependent variable is the ratio in (log) levels. Hence, the coefficients need to be compared with a grain of salt. In any case, keeping in mind these differences, the dynamic factor model seems to validate the results for the short-run effects in our PECM. Interestingly, the unobserved common factor (i.e. global factor or spillovers across countries) has a positive effect on the employment ratios.[20][21]

[Insert Table 7 and 8 here]

We employed also the dynamic factor model by using an alternative heterogeneous estimator, i.e. the Common Correlated Mean Group (CCEMG) as in Pesaran and Tosetti (2011). One key difference between AMG and CCEMG is that in the CCEMG, the set of unobservable common factors is treated as a nuisance, something to be accounted for but which is not of particular interest for the empirical analysis, while, in our opinion, spillovers and global factors may be important in analyzing the link between structural change and trade. Moreover the CCEMG does not correct for cointegration (for more details see Comunale, 2017). In any case, the results from the CCEMG are extremely robust compared with the ones in Table 7 with AMG.[22]

6 Conclusions

This paper investigates the role of international trade for structural change, in particular for the transition from more tradable to non-tradable sectors, i.e. services and construction in our study, by using a dynamic panel setup. We distinguish between long-run and short-run effects. We use EU-KLEMS data and the GGDC 10-sector database for the period 1960-2011 for an unbalanced panel of mature, developing and transition economies. We control for the demand side and supply side channels of structural change singled out by the literature and we also make an attempt to distinguish between direct and indirect channels through which trade potentially impacts on structural change (done by applying a simple panel VAR).

Our results suggest that both domestic channels of structural change, i.e. the demand side, the Engelian effects in presence of income elastic services, and the supply-side, i.e. lower productivity growth in services coupled with low-substitutability between goods and services, contribute to increase the employment share of non-tradable sectors. In particular, Engelian effects are much stronger in the long-run, suggesting that it takes time to reallocate resources across industries following changes in final demand. Trade emerges as a relevant direct driver of structural change, i.e. foreign demand matters in the reallocation of resources across sectors, in particular in

[20] The outcomes here described hold for the other specifications as well and these are available on request.

[21] We included, as a proxy for country size, the population of the countries (taken in logs). Population plays a negative role for the ratios. The rest of the coefficients are very robust compared to the baseline in Table 7. Results for this check are available on request.

[22] This further check's outcomes are available on request.

the long run. The import share has a large and positive relationship with the employment shift to non-tradable goods while the export share is negatively related with it and to a lesser extent. Interestingly enough, while the export share is not relevant in the short run, the import share coefficient changes sign between the short run and the long run. Imports are negatively related with the shift to services in the short run. In the short-run, importing intermediate goods might increase productivity or reduce costs in sectors which are intermediate goods-intensive. This result opens room for further investigation focusing into the role of intersectoral linkages and of country participation in the Global Value Chain in mediating between trade and structural change.

Our preliminary explorations on the indirect channels through which trade may affect structural change i.e. trade activating the domestic demand side and supply side channels, reveal an indirect effect of the export share working through and increase in GDP per capita, therefore enhancing the shift to services induced by Engelian effects. Further investigations with the aim of singling out the indirect channels are a natural development of this work. Our analysis clearly highlights that the relationship between trade and structural change is heterogeneous across countries. The mature and transition economies show in our sample a much more relevant role of trade for the shift to non-tradable sectors than developing countries. Further work on countries' sub-samples is therefore called for, but this is closely related with and depends on data availability.

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7 Tables and figures

Table 1: Baseline (whole sample)

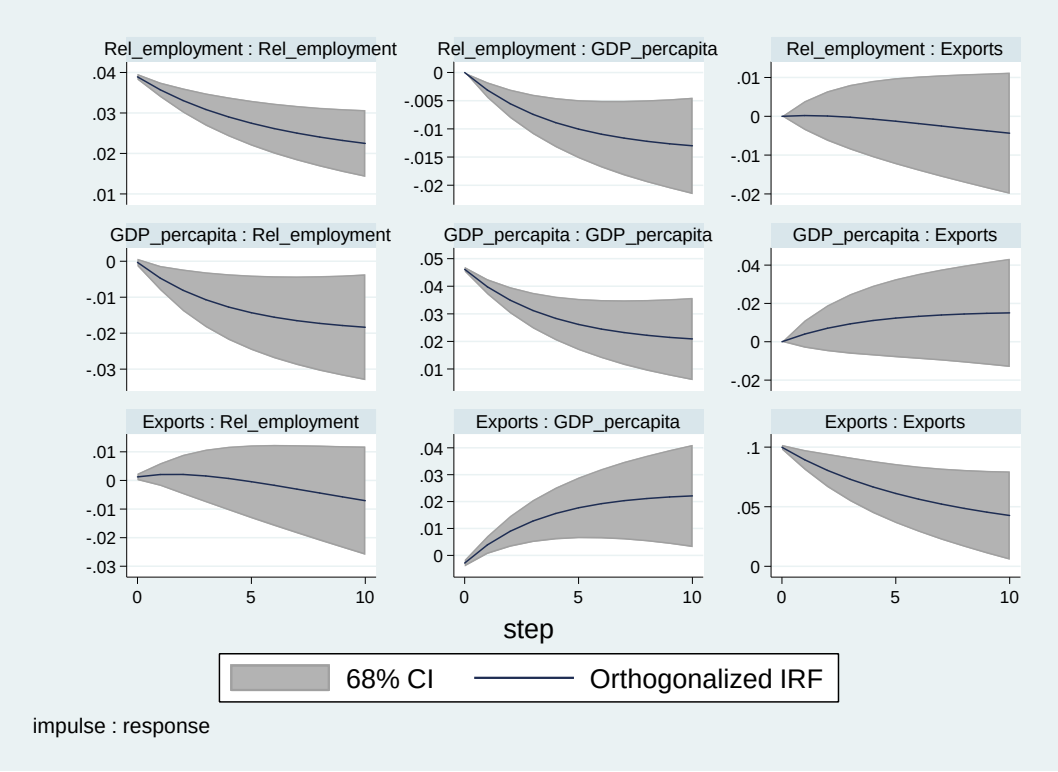
VARIABLES	(1) D.Empl. (T/NT)	(2) D.Empl. (T/NT)	(3) D.Empl. (T/NT)	(4) D.Empl. (T/NT)
SHORT-RUN				
ec	-0.0245***	-0.0336***	-0.0390***	-0.0389***
	(0.00502)	(0.00532)	(0.00568)	(0.00567)
D.GDP per capita	-0.101***	-0.0773***	-0.0832***	-0.0825***
	(0.0247)	(0.0244)	(0.0244)	(0.0246)
D.Exports		0.0216**		0.00471
		(0.0104)		(0.0121)
D.Imports			0.180***	0.171***
			(0.0554)	(0.0648)
Constant	0.221***	0.364***	0.357***	0.419***
	(0.0445)	(0.0550)	(0.0496)	(0.0582)
LONG-RUN				
GDP per capita	-1.139***	-1.289***	-1.069***	-1.168***
	(0.0998)	(0.134)	(0.0973)	(0.115)
Exports		0.0929		0.316**
		(0.152)		(0.158)
Imports			-1.461**	-2.399***
			(0.644)	(0.788)
Observations	1,382	1,382	1,382	1,382

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All the variables are taken in natural logs. ec is the error correction term. D. is the first difference.

Table 2: Baseline with labour productivity

VARIABLES	(1) D.Empl. (T/NT)	(2) D.Empl. (T/NT)	(3) D.Empl. (T/NT)	(4) D.Empl. (T/NT)
SHORT-RUN				
ec	-0.0161***	-0.0275***	-0.0355***	-0.0196**
	(0.00563)	(0.00754)	(0.00656)	(0.00778)
D.GDP per capita	-0.171***	-0.0505**	-0.168***	-0.0543**
	(0.0295)	(0.0245)	(0.0296)	(0.0237)
D.labour prod. (T/NT)		-0.532***		-0.543***
		(0.0236)		(0.0246)
D.Exports			-0.0163	0.00880
			(0.0136)	(0.0107)
D.Imports			0.332***	0.303***
			(0.0853)	(0.0725)
Constant	0.160***	0.127***	0.372***	0.265***
	(0.0494)	(0.0450)	(0.0670)	(0.0541)
LONG-RUN				
GDP per capita	-1.297***	-0.632***	-1.098***	-1.505***
	(0.208)	(0.140)	(0.152)	(0.498)
Labour prod. (T/NT)		-0.598***		0.164
		(0.158)		(0.384)
Exports			0.356*	0.248
			(0.194)	(0.350)
Imports			-4.492***	-2.516
			(1.111)	(2.632)
Observations	1,075	1,075	1,075	1,075

Figure 1: Panel VAR with exports - Impulse Responses



Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

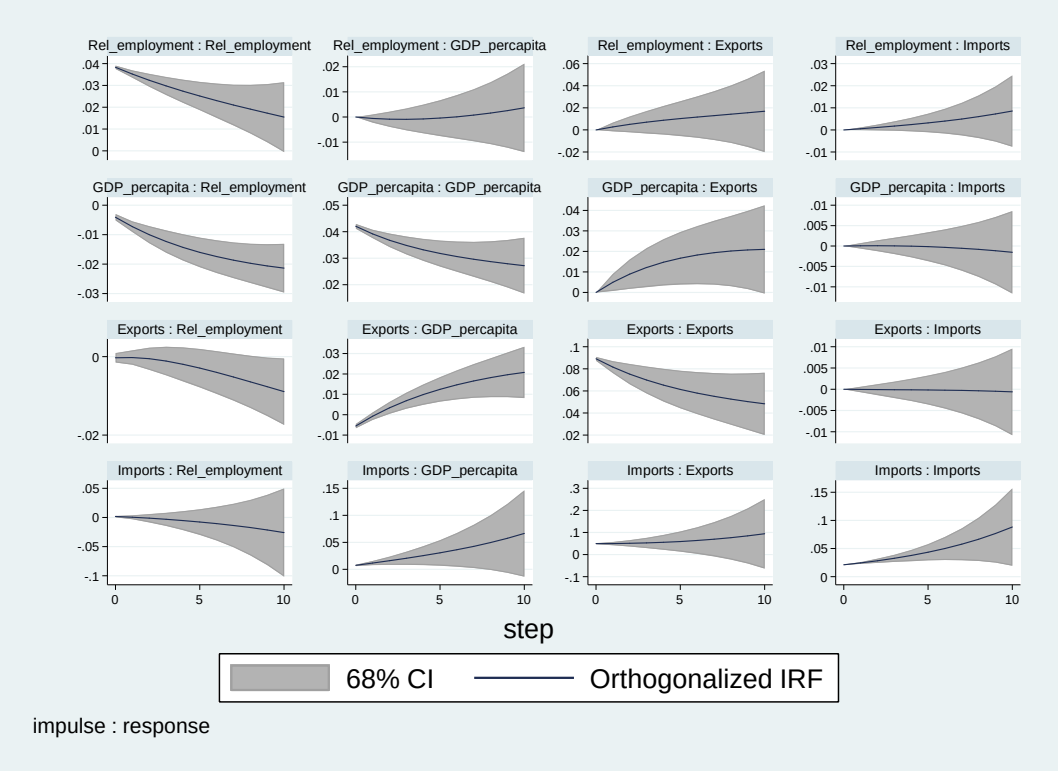
Table 3: Baseline with interactions

VARIABLES	(1) D.Empl. (T/NT)	(2) D.Empl. (T/NT)	(3) D.Empl. (T/NT)
SHORT-RUN			
ec	-0.0439***	-0.0455***	-0.0242***
	(0.00595)	(0.00719)	(0.00776)
D.GDP per capita	-0.0773***	-0.152***	-0.0497**
	(0.0243)	(0.0295)	(0.0233)
D.labour prod. (T/NT)			-0.561***
			(0.0245)
D.Exports	0.0543**	0.0323	0.0381
	(0.0232)	(0.0350)	(0.0289)
D.Imports	0.183**	0.319**	0.634***
	(0.0927)	(0.142)	(0.140)
D.ExportsXdev	-0.0632**	-0.0464	-0.0307
	(0.0272)	(0.0377)	(0.0307)
D.ExportsXtransit	-0.0999		
	(0.0757)		
D.ImportsXdev	-0.0317	-0.123	-0.556***
	(0.144)	(0.180)	(0.163)
D.ImportsXtransit	-0.324		
	(0.250)		
Constant	0.530***	0.488***	0.342***
	(0.0613)	(0.0713)	(0.0567)
LONG-RUN			
GDP per capita	-1.175***	-1.101***	-1.338***
	(0.107)	(0.123)	(0.357)
Labour prod. (T/NT)			0.102
			(0.314)
Exports	1.027***	1.004***	1.796**
	(0.273)	(0.324)	(0.833)
Imports	-5.150***	-7.160***	-15.04**
	(0.935)	(1.203)	(5.959)
ExportsXdev	-1.231***	-1.209***	-1.961**
	(0.310)	(0.350)	(0.841)
ExportsXtransit	3.672**		
	(1.655)		
ImportsXdev	6.531***	8.137***	16.81***
	(1.704)	(1.856)	(6.374)
ImportsXtransit	-7.337		
	(5.597)		
Observations	1,382	912	839

Figure 2: Panel VAR with imports - Impulse Responses

Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

Figure 3: panel VAR with exports and imports - Impulse Responses



Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

8 Appendix

8.1 Countries' list and split

The whole sample of 38 countries obtained by combining GGDC-10 Sector Database and EU-KLEMS, as explained in Section 3.1, includes: Argentina, Australia, Austria, Belgium, Brazil, China, Cyprus, Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Great Britain, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Lithuania, Luxemburg, Latvia, Mexico, Netherlands, Malta, Poland, Portugal, Slovakia, Slovenia, Sweden, Thailand, United States, South Africa.

The sub-sample of 17 countries we rely on when controlling for the relative productivity includes: Argentina, Brazil, China, Denmark, Spain, France, Great Britain, India, Indonesia, Italy, Japan, Mexico, Netherlands, Sweden, Thailand, United States, South Africa.

The groups of countries (referring to the largest sample) are:

Mature economies: Australia, Austria, Belgium, Germany, Great Britain, Japan, Hong Kong, Korea, Spain, France, Greece, Ireland, Italy, Luxemburg, Malta, Netherlands, Portugal, Finland, Sweden, Denmark, United States, Cyprus.

Transition economies: Czech Republic, Hungary, Poland, Slovakia, Slovenia, Lithuania, Estonia, Latvia.

Developing economies: Argentina, Brazil, China, India, Indonesia, Mexico, Thailand, South Africa.

Figure A.1: Employment share in developed economies

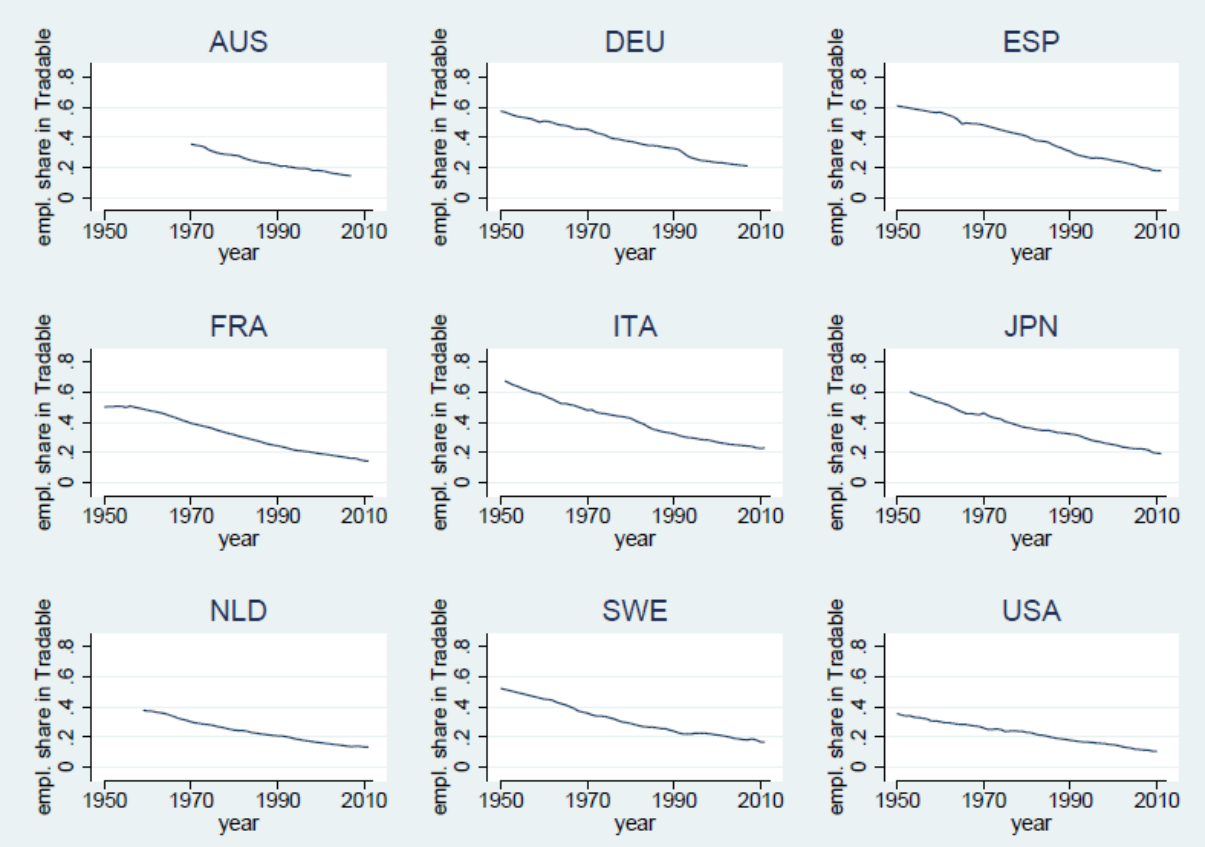


Figure A.2: Employment share in transition economies

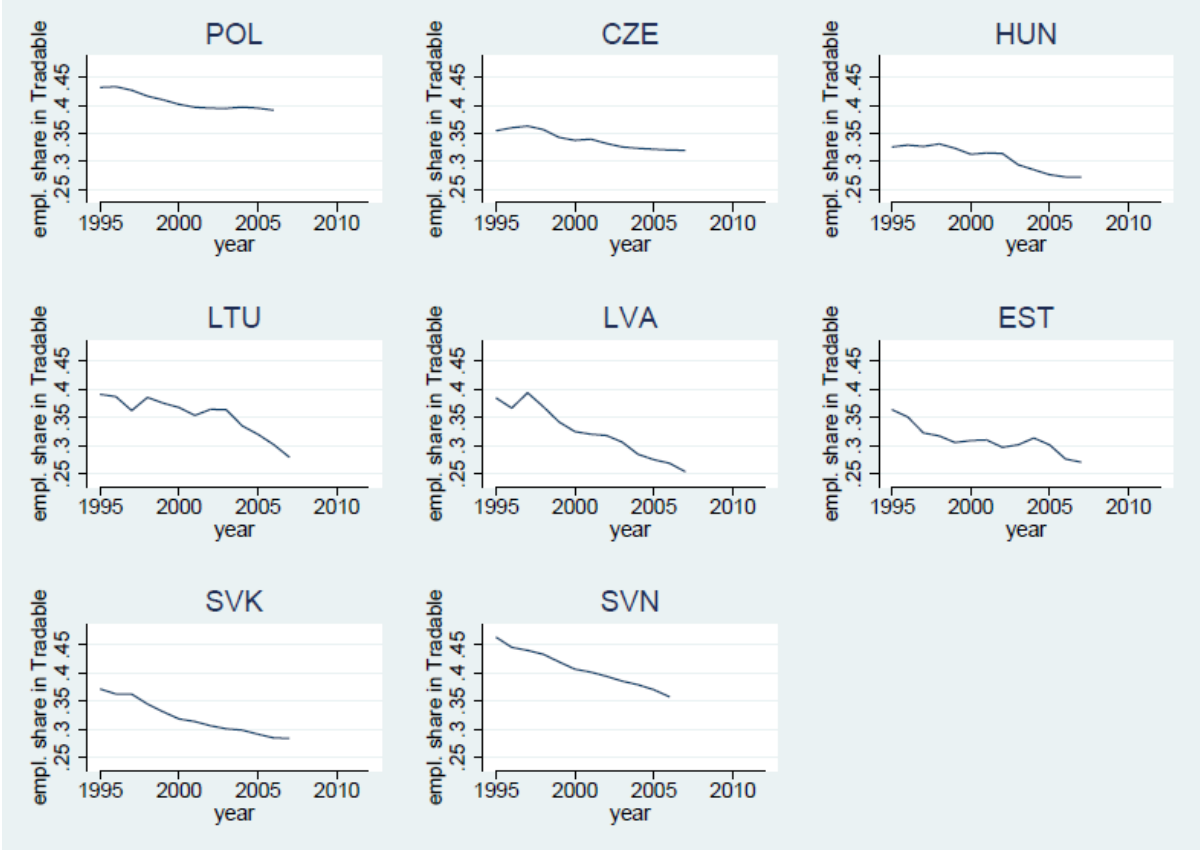


Figure A.3: Employment share in developing economies

8.2 Additional robustness checks: using value added as dependent variable

Table 4: Baseline with value added shares at constant prices as dependent variable

VARIABLES	(1) D.VA (T/NT)	(3) D.VA (T/NT)
SHORT-RUN		
ec	-0.0275***	-0.0196**
	(0.00754)	(0.00778)
D.GDP per capita	-0.0505**	-0.0543**
	(0.0245)	(0.0237)
D.labour prod. (T/NT)	0.440***	0.437***
	(0.0234)	(0.0241)
D.Exports		0.00880
		(0.0107)
D.Imports		0.303***
		(0.0725)
Constant	0.127***	0.265***
	(0.0450)	(0.0541)
LONG-RUN		
GDP per capita	-0.632***	-1.505***
	(0.140)	(0.498)
Labour prod. (T/NT)	0.402**	1.164***
	(0.158)	(0.384)
Exports		0.248
		(0.350)
Imports		-2.516
		(2.632)
Observations	981	839

Standard errors in parentheses
** p<0.01, ** p<0.05, * p<0.1

Table 5: Baseline with interactions and with value added shares at constant prices as dependent variable

VARIABLES	(1) D.VA (T/NT)	(2) D.VA (T/NT)
SHORT-RUN		
ec	-0.0278***	-0.0242***
	(0.00868)	(0.00776)
D.GDP per capita	0.113***	-0.0497**
	(0.0290)	(0.0233)
D.labour prod. (T/NT)		0.414***
		(0.0240)
D.Exports	0.0975***	0.0381
	(0.0307)	(0.0289)
D.Imports	-0.218	0.634***
	(0.136)	(0.140)
D.ExportsXdev	-0.0653*	-0.0307
	(0.0343)	(0.0307)
D.ImportsXdev	0.0896	-0.556***
	(0.185)	(0.163)
Constant	0.157***	0.342***
	(0.0600)	(0.0567)
LONG-RUN		
GDP per capita	-0.606***	-1.338***
	(0.204)	(0.357)
Labour prod. (T/NT)		1.102***
		(0.314)
Exports	1.086*	1.796**
	(0.637)	(0.833)
Imports	-7.184*	-15.04**
	(3.673)	(5.959)
ExportsXdev	-1.443**	-1.961**
	(0.698)	(0.841)
ImportsXdev	11.38**	16.81***
	(4.847)	(6.374)
Observations	963	839

8.3 Additional robustness checks: using predictors from gravity

Table 6: Results with predictors from gravity

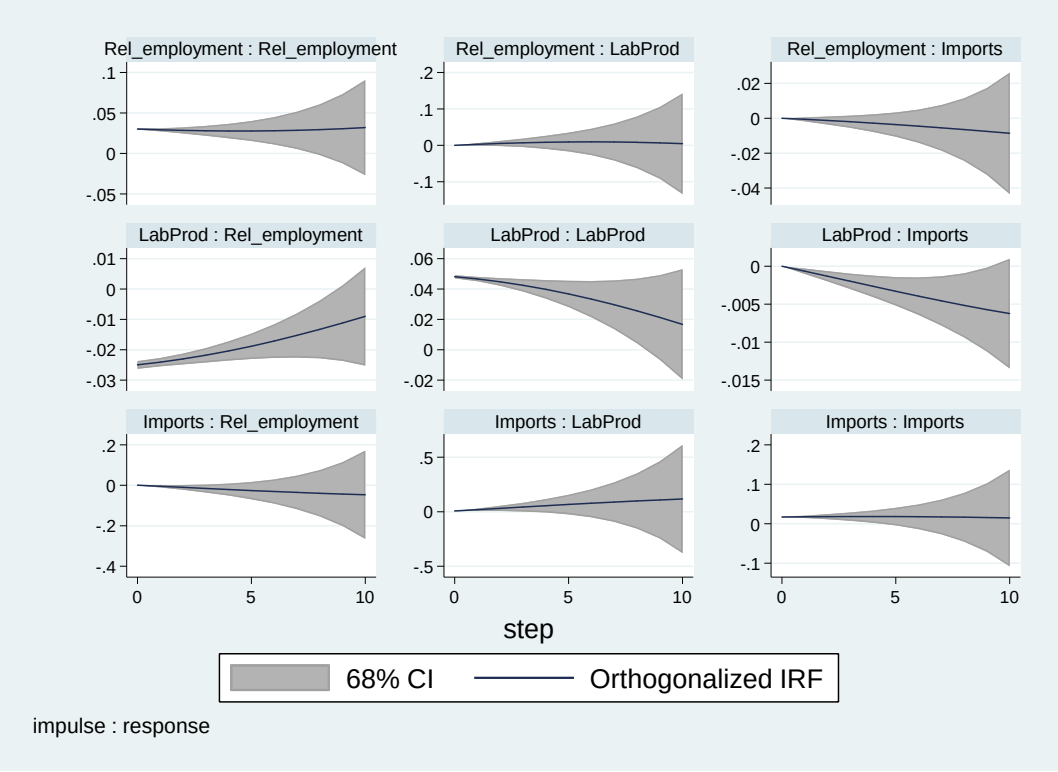
VARIABLES	(1) D.Empl. (T/NT)	(2) D.Empl. (T/NT)	(3) D.Empl. (T/NT)	(4) D.Empl. (T/NT)	(5) D.Empl. (T/NT)
SHORT-RUN					
ec	-0.0925***	-0.0859***	-0.0905***	-0.0939***	-0.0896***
	(0.0178)	(0.0176)	(0.0176)	(0.0181)	(0.0178)
D.GDP per capita	0.0240	0.0246	0.0536	0.0226	0.0521
	(0.0438)	(0.0430)	(0.0429)	(0.0442)	(0.0429)
D.Exports	0.0171	0.0327*			
	(0.0296)	(0.0172)			
D.Exports_pred			0.0150		
			(0.0157)		
D.Imports	0.0272			0.0325*	
	(0.0315)			(0.0184)	
D.Imports_pred					0.0162
					(0.0156)
Constant	0.805***	0.903***	0.520***	0.868***	0.551***
	(0.155)	(0.150)	(0.190)	(0.157)	(0.188)
LONG-RUN					
GDP per capita	-0.999***	-1.160***	-0.732***	-1.052***	-0.773***
	(0.148)	(0.162)	(0.146)	(0.152)	(0.140)
Exports	0.742***	0.354**			
	(0.259)	(0.167)			
Exports_pred			0.321**		
			(0.154)		
Imports	-0.622**			0.141	
	(0.270)			(0.161)	
Imports_pred					0.296*
					(0.153)
Observations	475	475	475	475	475

8.4 Additional robustness checks: VARs

Figure A.4: Panel VAR with labour productivity & exports - Impulse Responses

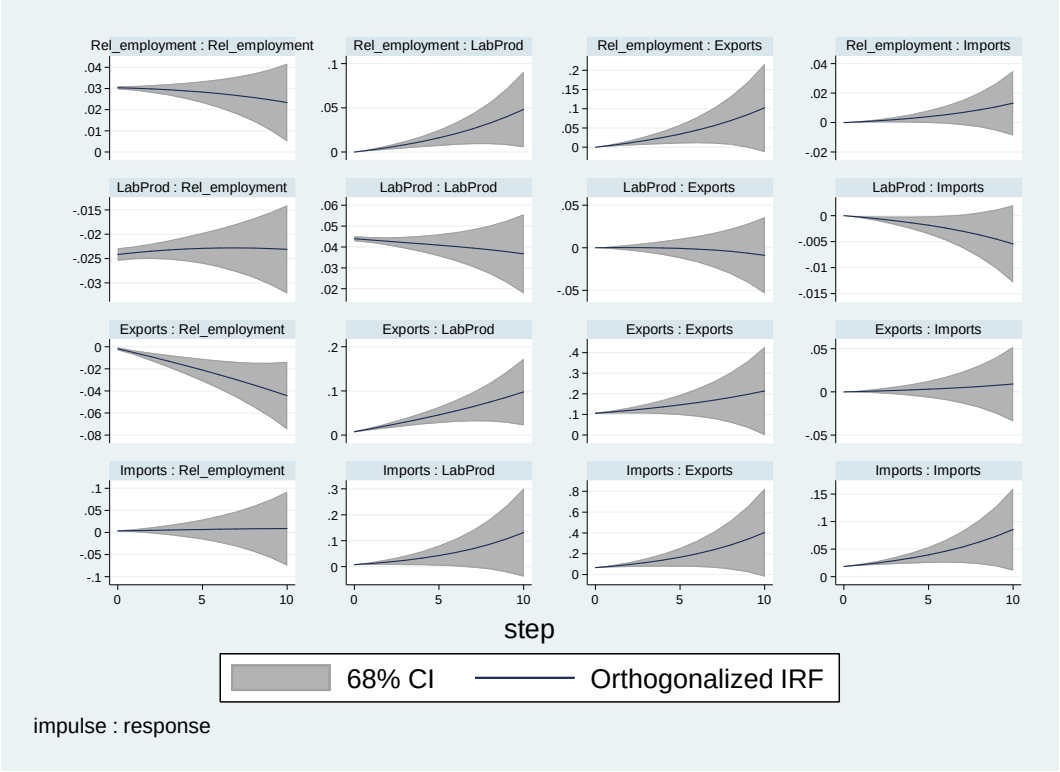
Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

Figure A.5: Panel VAR with labour productivity & imports - Impulse Responses



Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

Figure A.6: Panel VAR with labour productivity & exports and imports - Impulse Responses



Note: shocks are of 1 standard deviation, 68% confidence bands. We shock the first variable and we look at the impact on the second one (impulse:response). Therefore, we have the same shock in each row and different responses in each column.

8.5 Additional robustness checks: the dynamic factor model

Table 7: Baseline by using a dynamic factor model (AMG estimator)

VARIABLES	(1) Empl. (T/NT)	(2) Empl. (T/NT)	(3) Empl. (T/NT)	(4) Empl. (T/NT)
Lag_Employment ratio(T/NT)	0.716***	0.692***	0.687***	0.655***
	(0.0396)	(0.0410)	(0.0425)	(0.0488)
GDP per capita	-0.0566	-0.0512	-0.0637*	-0.0798**
	(0.0386)	(0.0365)	(0.0356)	(0.0347)
Exports		0.0495***		0.0509*
		(0.0146)		(0.0282)
Imports			0.217***	0.0644
			(0.0506)	(0.101)
Constant	0.229	0.174	0.189	0.398
	(0.385)	(0.371)	(0.362)	(0.339)
unobserved common factors	0.357***	0.464***	0.435***	0.457***
	(0.130)	(0.131)	(0.129)	(0.137)
Observations	1,545	1,395	1,395	1,395
Number of countries	39	38	38	38

Standard errors in parentheses
** p<0.01, ** p<0.05, * p<0.1

Table 8: Baseline with labour productivity by using a dynamic factor model (AMG estimator)

VARIABLES	(1) Empl. (T/NT)	(2) Empl. (T/NT)	(3) Empl. (T/NT)	(4) Empl. (T/NT)
Lag.Employment ratio(T/NT)	0.847***	0.687***	0.837***	0.679***
	(0.0257)	(0.0574)	(0.0300)	(0.0590)
GDP per capita	-0.0754***	-0.0851***	-0.0842***	-0.0935***
	(0.0272)	(0.0179)	(0.0251)	(0.0212)
Labour prod.		-0.188***		-0.202***
		(0.0544)		(0.0558)
Exports		0.0418***	0.0311	0.0481**
		(0.0123)	(0.0208)	(0.0203)
Imports			0.0822	0.0380
			(0.0881)	(0.0908)
Constant	0.567**	0.605***	0.661***	0.676***
	(0.250)	(0.180)	(0.209)	(0.187)
unobserved common factors	0.137**	0.366***	0.174***	0.336***
	(0.0617)	(0.0504)	(0.0615)	(0.0636)
Observations	1,075	851	925	851
Number of countries	20	17	19	17

Standard errors in parentheses
** p<0.01, ** p<0.05, * p<0.1