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

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Abstract

Global trade has recently slowed down after a peak in the 1990s and early 2000s. Existing literature shows evidence of pro-competitive effects of trade liberalisation during this booming period on prices, productivity and markups. The goal of this paper is to assess whether such pro-competitive effects are still carried on in the manufacturing industry of five Euro Area countries (Austria, Germany, Spain, France and Italy). Our analysis is based on Melitz and Ottaviano (2008) theoretical framework and its empirical setup by Chen *et al.* (2004, 2009). Our contribution is twofold. First, we carry out a sectoral analysis to shed light on sectors in which price competition is dominant over quality competition. Second, unlike the existing papers we consider global value chains, by measuring trade in value added terms. Our main findings confirm the relevance of a sectoral analysis to assess the pro-competitive effect of globalisation, given the heterogeneity across sectors and countries. Furthermore, measuring trade in value added terms and not in gross terms improves the quality of estimation and is a better measure of trade liberalisation.

Keywords: Inflation, Trade openness, Competition, Markups, Productivity, Input-Output Tables and Analysis
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1 Introduction

Global trade has recently slowed down after a peak in the 1990s and early 2000s. Existing literature shows evidence of pro-competitive effects of trade liberalisation during this booming period on prices, productivity and markups. As mentioned in Bernard *et al.* (2012), it is generally admitted that trade liberalisation can induce welfare gain with a broader range of product varieties ("taster for variety"), reallocation of resources with the exit of low-productivity firms and direct pro-competitive effects on markups lowering the price level and so forth.

The goal of this paper is to assess whether such pro-competitive effects of trade are still carried on in the Euro Area, while taking into account firm heterogeneity. Our analysis builds on Melitz and Ottaviano (2008) theoretical model of heterogeneous firms' response to international trade and its empirical setup by Chen *et al.* (2004, 2009). Chen *et al.* (2004, 2009) estimate the model of Melitz and Ottaviano (2008) at the sector level and present the short- and long-run dynamics of production price level, markups (price-cost margins) and labour productivity over the period 1989-1999 and for European countries. In a similar way, through sectoral data on prices, markups, productivity, the number of domestically producing firms and the market size, we attempt to assess and quantify the pro-competitive effects of trade openness, as measured by import penetration in domestic markets. We use a cross section of ten manufacturing industries in five Euro Area countries (Austria, Germany, Spain, France and Italy). Our data covers the period 1995-2013, which allows us to control for the Great Recession.

Our main findings are that trade pro-competitive effect is variable across sectors. When significant, in most cases, trade openness is positively correlated with labour productivity and negatively correlated with markup, in line with the theoretical predictions of the Melitz and Ottaviano (2008) model. An increase in labour productivity and a decrease in markup are negatively related to production price. Unlike Chen *et al.* (2009), we do not find opposite effects of trade in the short- and in the long-run.

The novelty of our paper is twofold. First, we carry out a sectoral analysis to shed light on sectors in which price competition is dominant in the context of globalisation. Indeed, our model mainly focuses on the price-competition, which means that tougher competition would induce a lower price and lower markup. Second, unlike the existing papers on the same subject, we consider developments in global value chains (GVC), by measuring trade in value added terms. Since gross trade flows are recorded each time they cross borders, they include re-exported imports and re-imported exports and can hence overstate the size of competitive effect. In addition, the measures of global value chain has enabled a thorough analysis of the international trade since traditional measures of trade are unable to take into account the full interdependence of markets and economies.

As our paper is based on the Melitz and Ottaviano (2008) model, the focus is on the competitive effect of globalisation occurs on prices. However, firms can opt for different strategies. They can maintain high level of prices, if they choose to compete on the quality of their products, if they hold a monopoly position, or if they manage to reduce their costs by specialising in a certain stage of the production process. They can also benefit from tariff barriers and regulations set by countries to protect their market share. Given this, we attempt to measure how quality factors can mitigate the competitive effect of globalisation or how globalisation can enhance the quality factor in the extension.

Second, unlike the existing papers on the same subject, we consider developments in global value chains (GVC), by measuring trade in value added terms. Since gross trade flows are recorded each time they cross borders, they include re-exported imports and re-imported exports and can hence overstate their importance to competitiveness. In addition, the increasing importance of global value chains has made the analysis of international trade more complex and traditional measures of trade are unable to take into account the full interdependence of markets and economies.

The remainder of this paper is as follows. Section 2 presents a review of the related literature. Section 3 exposes the theoretical framework leading to the empirical model we introduce in section 4. Section 5 deals with descriptive analysis and introduces preliminary results from a principal component analysis, while section 6 gives away results from our baseline estimation using gross import penetration ratio and compare them with the estimation using value added import penetration ratio.

2 Review of literature

Globalisation and increased trade disrupt the economic environment and interconnections between countries can make economy less sensitive to domestic factors. Indeed, Romer (1993) finds a robust, statistically significant and large relationship between the average rates of inflation and the degree of openness of economy. The idea stems from Kydland and Prescott (1977) according to which benefits of a surprise inflation by central banks are decreasing in the degree of openness since a surprise monetary expansion is related to a stronger depreciation and damages of depreciation are more serious in an open economy. More recently, Benigno and Faia (2010) find an increased link between the domestic inflation and global factors by identifying two pass-throughs: first, a larger impact of the import prices on the overall price level due to an increase in the number of foreign products in domestic markets; and an increase in the dependence of the pricing strategies of domestic firms on foreign components.

Traditional international trade theories such as Ricardo or Hecksher-Ohlin models mainly focus on interindustry trade based on heterogeneous characteristics across countries and homogeneous productivity across firms. With the idea of the "taste for variety" and the monopolistic competition *à la* Dixit and Stiglitz (1977), Krugman (1980) introduced the new trade theory based on intra-industry trade. Since, instead of considering national comparative advantage, industries become the determining actors of trade. Melitz (2003) is the seminal paper building the so-called "new-new trade theory" according to which, micro-based firm heterogeneity influences and determines the aggregate outcome. Melitz and Ottaviano (2008) further develop this approach with firm-level productivity heterogeneity. The model provides evidence for a minority of highly productive firms (and not industries) exporting to the foreign markets, less productive firms supplying to the domestic market and crowding-out of the least productive firms.

Chen *et al.* (2004, 2009) propose an estimable version of a reduced form of the Melitz and Ottaviano (2008) model at country level. The 2004 version uses a simultaneous equations system and the 2009 version an error correction model to assess the pro-competitive effects of increased import penetration (as a measure of trade openess). Increased trade openness implies more varieties and larger market size. The increase in the number of firms induces a tougher competition which has two effects. First, markups decrease since the model gets closer to the perfect competition situation. Second, higher competition leads to the leaving of the least productive firms and increases average productivity. Both effects would contribute to a decline of the prices.

However, Chen *et al.* (2004, 2009) overlook the effect of product quality. Higher competition can encourage firms to invest in research and development in order to improve the product quality, as a ”defensive innovation” strategy (Acemoglu, 2003). Indeed, on French manufacturing firm-level data, Bellone *et al.* (2014) provide evidence that markups are higher for exporters and quality-enhancing effect can be more relevant than price-lowering effect within the globalisation. Also, 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 the quality-upgrading in order 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.

Concerning the effect of globalisation on productivity,Mcmillan and Rodrik (2014) show that globalisation improves the way resources are used: labour can move from low-productivity sectors to high-productivity ones and enhancing allocation efficiency. Furthermore, as GVC developed over the last decades, firms can also choose 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. Since a country can specialise in the most productive stage of the production process, it can then enhance productivity.

3 Theoretical framework

Our theoretical framework stems from Melitz and Ottaviano (2008) who develop a monopolistically competitive model of trade which link prices, productivity and markups to market size and trade. Their model also distinguishes short-run from long-run dynamics. Before introducing our empirical framework, we present here the key features of the Melitz and Ottaviano (2008) theoretical model to lay ground for the steps leading to our empirical setup. More specifically we present here how prices are directly related to markups and productivity and how these three variables are linked to the number of firms supplying the market and to trade costs. The model presents two economies (domestic and foreign). Foreign variables are marked with an asterisk (*).

3.1 Consumer behaviour

Consumer preferences are assumed to be identical across all countries. For a representative consumer, indexed by i, the utility from consumption in each sector is derived from a quasi-linear preferences over a continuum of varieties indexed by ω and given by:

$$U^i = \alpha \int_{\omega\in\Omega} q^i_\omega d\omega - \frac{1}{2}\gamma \int_{\omega\in\Omega} (q^i_\omega)^2 d\omega - \frac{1}{2}\eta \left(\int_{\omega\in\Omega} q^i_\omega d\omega \right)^2 \quad (1)$$

where q^i_ω represents the agent’s consumption level of each variety ω. The demand parameters α, η and γ are all positive. The parameter γ measures the degree of product differentiation between the varieties ω. For $\gamma = 0$, varieties are perfect substitutes and consumers only care about their sectoral consumption level $Q^i = \int_{\omega\in\Omega} q^i_\omega d\omega$.

Inverted demand is determined by solving the consumer's problem, which is given by:

$$\max_{\{q^i_\omega\}_{\omega\in\Omega}} U^i \text{ subject to}$$

$$R > \int_{\omega\in\Omega} p_\omega q^i_\omega d\omega$$

where R is the total revenue and p_ω is the price of variety ω

Solving the consumer's problem leads to: $p_\omega = \alpha - \gamma q^i_\omega - \eta Q^i$. In the limit case where $\gamma = 0$, prices then only depend on the aggregate quantity of varieties supplied to market. By defining the aggregate sectoral price index, $\overline{p} = \frac{1}{N}\int_{\omega\in\Omega} p_\omega d\omega$, aggregate production for a consumer i can be defined: $Q^i = \frac{(\alpha-\overline{p})N}{\gamma+\eta N\overline{p}}$ where N is the number of firms supplying to the domestic market. Both domestic and foreign firms compete for a variety ω in the market. Demand for variety ω remains positive as long as $p_\omega \leq \frac{1}{\gamma+\eta N}(\alpha\gamma + \eta N\overline{p}) = p_{\max}$, where $p_{\max}$ represents the price at which there is no demand for variety ω.

Summing over all consumers gives total demand in the home country for variety ω as:

$$Q_\omega = Lq^i_\omega = \frac{\alpha L}{\gamma+\eta N} - \frac{L}{\gamma}p^i_\omega + \frac{1}{\gamma}\frac{\eta N L}{\gamma+\eta N}\overline{p}^i = \frac{L}{\gamma}(p_{\max} - p_\omega) \tag{2}$$

Demand for each variety is linear in prices (equation 2), but unlike the classic monopolistically competitive setup *à la* Dixit and Stiglitz (1977), the price elasticity of demand depends on the number of firms in the sector (N), which is a feature introduced in Ottaviano *et al.* (2002).

3.2 Firm behaviour

Labour is the only factor of production with a unit cost c and is perfectly mobile domestically between firms in the same sector, but not across countries. International wage differences are therefore possible in each sector. As a result, the variation in labour costs across firms in a sector solely stem from technological reasons, *i.e.* differences in sectoral productivity. In contrast, sectoral unit costs vary across countries due to differences in wages and technology. Entering a differentiated product sector entails fixed costs including the firms' expenses in research and development and production start-up costs. After entering, each firm produces at marginal cost c (equal to the firm's unit labour cost).

Domestic firms can sell to the domestic market, or export with *ad-valorum* cost (also called, "iceberg costs") $\tau^* > 1$, reflecting transportation costs or tariffs determined in the foreign economy. Production for domestic markets has unit cost c and for exports $\tau^* c$. Transportation costs for foreign goods entering the domestic economy are symmetrically denoted by τ. Firms' entry and exit decisions entail a fixed cost f_E, which firms have to pay to establish production in whichever economy. Since our sample includes only Euro Area countries that mainly trade with each other and are submitted to the same trade regulations, we assume trade costs are symmetric, *i.e.* $\tau = \tau^*$[1]. Domestic firms' profit $\Pi_D(c)$ and foreign firms' $\Pi_X(c)$ are given by:

$$\Pi_D(c) = (p_D(c) - c)q_D(c) \tag{3}$$
$$\Pi_X(c) = (p_X(c) - c\tau)q_X(c) \tag{4}$$

[1] This assumption will be further analysed in section ??.

Profit maximisation problems for the domestic and foreign firms are given by:

$$\max_{p_D(c),\, q_D(c)} \Pi_D(c) = (p_D(c) - c) * q_D(c) \text{ subject to } q_D(c) = \frac{L}{\gamma}(p_{\max} - p_D(c)) \tag{5}$$

$$\max_{p_X(c),\, q_X(c)} \Pi_X(c) = (p_X(c) - c\tau) * q_X(c) \text{ subject to } q_X(c) = \frac{L*}{\gamma}(p_{\max} - p_X(c)) \tag{6}$$

Assuming that markets are segmented, each firm separately maximises its profit across countries based on the demand for the variety (equation 2) derived in the previous section. This yields:

$$q_D(c) = \frac{L}{2\gamma}[p_D(c) - c] \quad \text{and} \quad p_D(c) = \frac{1}{2}(p_{\max} + c)$$

$$q_X(c) = \frac{L^*}{2\gamma}[p_X(c) - \tau c] \text{ and } p_X(c) = \frac{1}{2}(p^*_{\max} + \tau c)$$

From these equations, cut-off cost c_D expresses the threshold such that for firms with $0 \leq c < c_D$ produce to supply to the market whereas for firms with $c > c_D$ stop producing and leave the market. Since $p_{\max}$ corresponds to the maximum price that consumers are willing to pay to get a variety (consumer side) and c_D is the cost above which, firms stop supplying to the market (firm side), at the equilibrium, $c_D = p_{\max}$. In other words, c_D is the unit cost of the firm which is indifferent between staying and leaving the market. As its price is directly driven down by its marginal cost, the marginal firm achieves its zero profit at $p(c_D) = c_D$. Likewise the marginal exporting domestic firms has costs $c_X = \frac{c^*_D}{\tau}$. 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 each sector is assumed to follow a Pareto distribution with cumulative distribution function $G(c) = \left(\frac{c}{c_M}\right)^k$, with k a parameter measuring the dispersion of cost draws and $c \in [0, c_M]$. In this setup, $1/c_M$ represents the lower bound of productivity of the sector. To allow cross-country productivity differences, we 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).

The Pareto assumption simplifies the expressions for the aggregate sectoral price index $\overline{p}$ and average cost $\overline{c}$, given by:

$$\overline{c} = \frac{1}{G(c_D)} \int_0^{c_D} c\, dG(c) = \frac{k}{k+1} c_D \tag{7}$$

$$\overline{p} = \frac{1}{G(c_D)} \int_0^{c_D} p(c)\, dG(c) = \frac{2k+1}{2(k+1)} c_D \tag{8}$$

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

$$\overline{\mu} = \frac{1}{2(k+1)} c_D \tag{9}$$

Using the previous theoretical framework and equations (8), (7) and (9), price is linked to the cost and the markups, which are both related to the marginal cost c_D.

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

Until now, the theoretical framework accounts for the long-run relationship. We now introduce Melitz and Ottaviano (2008) approach to explain dynamic effects of trade liberalisation.

3.3 Short-run implications

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

$$N = \frac{2\gamma(k+1)}{\eta}\left(\frac{\alpha}{c_D} - 1\right) \tag{10}$$

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 aggrgated demand Q^i and lower number of varieties. This characterises the demand side of the economy.

In the short run, firm location is fixed and the decision is whether to produce or not and which markets to supply, *i.e.* the number of firms located in each economy is assumed to be constant.

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

Using Pareto distribution, the previous equation gives :

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

From the previous equation, c_D for the short-run can be deduced:

$$N = \left(\frac{\overline{N}_{SR}}{c^k_M} + \frac{1}{\tau^k}\frac{\overline{N}^*_{SR}}{(c^*_M)^k}\right)c^k_D \tag{11}$$

In the short run, as cut-off costs c_D directly depend on the number of firms N and the trade costs τ, so do unit costs c, markup μ and prices p. The increase in c_D is associated with an incrase in the number of firms. The above equations characterise the supply side of the economy and firms production decisions. The larger the level of cut-off costs c_D, the larger the number of producing firms. Changes in transport costs τ also affect firms' production decisions and the marginal costs and thus, modify the number of firms supplying to domestic and foreign markets. For instance, a decrease in transport costs leads to a lower c_D and consequently to lower price, costs and markups, implying pro-competitive effects of globalisation.

3.4 Long-run implications

Equation (10) derived from the consumer side is still valid to characterise the demand side of the economy. In the long run, firms can decide to relocate elsewhere, and incur the fixed costs f_E or f^*_E. On the long run, the number of firms located in a country is determined by free entry and the zero profit condition:

$$\int_0^{c_D} \Pi_D(c)dG(c) + \int_0^{c_X} \Pi_X(c)dG(c) = f_E$$

Combining with $\Pi_D(c) = (p_D(c) - c) * q_D(c)$ and $\Pi_X(c) = (p_X(c) - c\tau) * q_X(c)$, it is possible to solve the system of equations to obtain c_D as an expression of τ, c_M, c^*_M and L as well as for c^*_D.

On the long run, c_D does not depend on N but on characteristics of an economy.

Letting N_{LR} and N^*_{LR} denote the endogenous long run equilibrium number of firms located in each country. The total number of firms is the sum of the domestic and foreign firms with costs below the threshold level. The proportion of firms with marginal cost below c_D is given by $G(c_D)$.

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

Using Pareto distribution, the previous equation gives :

$$N = N_{LR}\left(\frac{c_D}{c_M}\right)^k + N^*_{LR}\frac{1}{\tau^k}\left(\frac{c_D}{c^*_M}\right)^k$$

However, the number of firms supplying to domestic market and to foreign market are no longer fixed and vary on the firm entry and exit. Free entry of domestic firms in a country implies zero expected profit. Using the Pareto distribution, zero expected profit conditions in each country pin down closed form solutions for N_{LR} and N^*_{LR}. Recall that $c_X = c^*_D/\tau$ to obtain the following expressions for the costs of the marginal form:

$$\begin{aligned} c_D^{k+2} &= \frac{\phi(\tau)}{(1-\tau^{-2k})L}\left[1 - \frac{1}{(\tau)^k}\left(\frac{c^*_M}{c_M}\right)^k\right] \\ &= \frac{\phi(\tau)}{L}\left[\frac{1-(\tau\lambda)^{-k}}{1-\tau^{-2k}}\right] \end{aligned} \tag{12}$$

where $\phi(\tau) = 2(k+1)(k+2)c^k_M f_E(\tau)$ and $\lambda = c_M/c^*_M$. The cut-off cost is pinned down by the distribution of costs (c_M), the level of fixed costs ($\phi(\tau)/c^k_M$), market size (L) and trade costs (τ). From system of equations, we deduce that in the short-run, costs, markups and hence prices all depend also depend on market size (L) and trade costs (τ).

Depending on the variations of trade costs τ, trade liberalisation can have either anti-competitive or pro-competitive effects. Indeed, a fall in domestic trade costs leads to a upward shift in marginal costs and in equilibrium, to a fall in N. This decrease in the number of firms implies higher prices, higher markups and higher costs. Given this, the long run effect of trade liberalisation can be ambiguous, depending on the relative transport costs between domestic and foreign economy.

3.5 Differentiated model

Following the theoretical framework, price, costs and markup are linked via the cut-off cost c_D. In the long-run, the cut-off cost is given by equation (12). Total differentiating the system of equations with respect to λ, τ and τ^* leads to:

$$\begin{cases} \hat{p} = \frac{\bar{c}}{\bar{c}+\bar{\mu}}\hat{c} + \frac{\bar{\mu}}{\bar{c}+\bar{\mu}}\hat{\mu} \\ \hat{c} = a\hat{\lambda} + b\hat{\tau} + h\hat{L} \\ \hat{\mu} = a\hat{\lambda} + b\hat{\tau} + h\hat{L} \end{cases}$$

with

$$\begin{cases} a = \frac{k}{k+2}\frac{(\lambda\tau)^{-k}}{1-(\lambda\tau)^{-k}} \\ b = \frac{1}{k+2}\left(\frac{\phi'(\tau)\tau}{\phi(\tau)} + k\frac{(\tau\lambda)^{-k}}{1-(\lambda\tau)^{-k}} - k\frac{(\tau)^{-2k}}{1-(\tau)^{-2k}}\right) \\ h = \frac{-1}{k+2} \end{cases}$$

4 Empirical framework

In this section, we adapt the theoretical framework to more estimable models. To assess the pro-competitive effect of trade liberalisation, an error-correction model is used. It allows to study the short run and long run dynamics of prices, productivity and markups. We then introduce assumptions we make to adapt the theoretical model, as well as the issues related to such assumptions.

4.1 Empirical setup

As highlighted in Chen *et al.* (2009), domestic and foreign transport costs, τ and τ^*, are key variables characterising trade liberalisation. However, since reliable estimates of trade costs are difficult to obtain at the sectoral level, we use the import penetration ratio as a measure of openness. It is defined as the weight of imports in total domestic demand and enables to proxy the degree of import competition within a country.

$$\theta = \frac{\int_0^{c_X^*} p_X^*(c) q_X^*(c) dG^*(c)}{\int_0^{c_D} p_D(c) q_D(c) dG(c) + \int_0^{c_X^*} p_X^*(c) q_X^*(c) dG^*(c)}$$

Since $p_D(c) = \frac{1}{2}(c_D + c)$ and $p_X(c) = \frac{1}{2}(c_X^* + c)$, under the Pareto distribution, it implies:

$$\theta = \frac{1}{1 + \left[\frac{1}{\tau^k}\left(\frac{c_M}{c_M^*}\right)^k\right]^{-1}} \tag{13}$$

Domestic openness falls with the transport costs applied to foreign imports, and increases with domestic relative costs. Symmetric effects hold for foreign openness. We use these expressions to replace trade costs with directly observable import shares in each of our equations for prices, markups and productivity.

By rearranging terms in equation (13), the previous equations yield:

$$\frac{1}{\tau^k}\left(\frac{c_M}{c_M^*}\right)^k = \frac{\theta}{1-\theta} \tag{14}$$

These expressions highlight that trade costs can be approximated by a ratio of import penetration, assumming $\frac{c_M}{c_M^*}$ does not change over time. c_M represents the cut-off cost, which stems from the zero-profit condition. As Schwerhoff and Sy (2014) assume a time trend to capture technological progress, when applicable, we assume a time trend evolution. Although approximate it is, by substituting transport costs τ with the import penetration ratio, the equations become estimable.

Cost function of firms are not easily observable and due the data accuracy and availability issues, productivity variable is used to make the model estimable. Assuming that unit costs depend only on wages and a negative relationship between cost and productivity variable, we define productivity z based on the following expression: $z = \frac{w}{c}$ where w denotes the nominal wage. Since w is fixed and $1/c$ follows Pareto distribution and using the expression of $\bar{c}$, $\bar{z}$ is given by:

$$\bar{z} = \frac{k^2}{k^2-1}\frac{1}{(c_M/c_D)^k - 1}\frac{w}{\bar{c}} = \frac{k}{k-1}\frac{1}{(c_M/c_D)^k - 1}\frac{w}{c_D}$$

$\bar{z}$ is inversely proportional to c_D. Furthermore, the relationship translates teh fact that in the short run, given the assumption that the number of firms is fixed and the equillibrium determines the number of firms and the cut-off cost c_D. If the degree of openness increases (via a decrease in τ), it increases the number of firms and accordingly, increases productivity and decreases markup level. In the long run, firms can flexibly reallocate and consequently, c_D is determined by structural aspects of economies.

4.2 Empirical model

Following the theoretical framework, the "direct" effect of globalisation can be through the markup and cost channels. Prices can be decomposed into markup and productivity effects. Our theoretical framework lends itself to a simultaneous equations system. In order to estimate, we use the error correction model.

Given this, we choose to estimate the effect of globalisation on prices through a simultaneous equations approach. We also clean prices from monetary policy effects, by estimating relative prices, *i.e.* for a given industry, we divide its nominal production price by the total manufacturing price. Monetary base variables would have been more adapted to correct prices. However since our scope of countries cover European Eurozone countries, monetary base data per country is not available.

Using the assumptions made in the previous section, productivity is substituted to the cost. In the short-run, c_D can be replaced with expressions from equation (11). By using the expression given in equation (14), it is possible to express the previous system with the openness (θ).

Our empirical model implies an error correction model with the number of firms D in the short-run and the market size L in the long-run. Also, for labour productivity, the remuneration level is included. To account for the technological progress of $\frac{c_M}{c_M^*}$, we add sector and country dummies as well as a time trend when it is applicable. All in all, our simultaneous equations system suggests the following log-linear expression:

$$\begin{cases} \Delta \ln p_{ijt} = \alpha_0 + \alpha_1 \Delta \ln z_{ijt} + \alpha_2 \Delta \ln \mu_{ijt} + \beta \left[\ln p_{ijt-1} + \gamma_0 + \gamma_1 t + \gamma_2 \ln z_{ijt-1} + \gamma_3 \ln \mu_{ijt-1} \right] + \varepsilon_{ijt} \\ \Delta \ln z_{ijt} = \alpha_0^z + \alpha_1^z \Delta \ln \theta_{ijt} + \alpha_2^z \Delta \ln D_{ijt} + \beta^z \left[\ln z_{ijt-1} + \gamma_0^z + \gamma_1^z t + \gamma_2^z \ln \theta_{ijt-1} + \gamma_3^z \ln L_{ijt-1} + \gamma_4^z \ln w_{ijt-1} \right] + \epsilon_{ijt} \\ \Delta \ln \mu_{ijt} = \alpha_0^\mu + \alpha_1^\mu \Delta \ln \theta_{ijt} + \alpha_2^\mu \Delta \ln D_{ijt} + \beta^\mu \left[\ln \mu_{ijt-1} + \gamma_0^\mu + \gamma_1^\mu t + \gamma_2^\mu \ln \theta_{ijt-1} + \gamma_3^\mu \ln L_{ijt-1} \right] + \nu_{ijt} \end{cases}$$

where α_0 is an intercept, θ_{ijt} the import penetration ratio of country i in sector j at time period t, D_{ijt} the number of domestic firms, L_{ijt} the market size (measured by the gross domestic product) and w_{ijt} the real remuneration level. We allow for country fixed effects and time dummies, which are selected based on observed shocks and exogeneous events.

4.3 Instrumenting openness

As underlined in Chen *et al.* (2004, 2009), approximating trade costs with openness in our model also introduce endogeneity, since openness θ also depends on domestic factors. 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.

To tackle the endogeneity issues, a number of instruments are chosen to reflect trade liberalisation. We however focus on variables related to trade costs (*i.e.* transport an transaction costs), since we took openness as proxy of trade costs. To instrument the costs of transport, we appeal to traditional tariff and non-tariff barrier variables as well as some competitiveness variables.

For tariff barriers, we use a bulkiness variable and apparent tariff rate. 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). This would then reduce incentives to import. The bulkiness is built as the ratio of exports in value to exports in volume (weight in kg) for each sector. In order to wipe out potential endogeneity, we take the US exports which are computed as the sum of the exports of the countries in scope minus those of the country. The formal expression is given as follows:

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

where i indexes country, j sector, t time period and $valX$ and $volX$ designate respectively the exports in value and in weight (tons).

Since our database contains Eurozone countries, same tariff rates apply for all the imports. In order to assess the impact of trade liberalisation, Ahn *et al.* (2016) have built an effective tariff rate. In a similar way, import-weighted tariff rates are computed at the sector level using the following formula:

$$\tilde{\tau} = \frac{\sum_{k \in K_j} \tau_{ijkt} m_{ijkt}}{\sum_{k \in K_j} m_{ijkt}} \text{ where } m_{ijkt} \text{ designates import of country } i \text{ in sector } j \text{ of variety } k \text{ at time } t$$

The higher the apparent tariff rate is, the more the country imports products which have high tariff rate. It can be a proxy for the degree of protection of the domestic suppliers. It is hence expected to be negatively correlated to import penetration in final demand.

We use gravity variables for non-tariff barrier. The gravity model of international trade provides an explanation for the empirically observed regularity of the trade flows. From the 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 (measured as gross national products) and inversely proportional to the distance separating these two countries:

$$G_{ijt} = \sum_{k \neq i} \frac{RGDP_{kjt}}{d_{ikt}} \text{ where } RGDP_{kjt} \text{ designates the real GDP of country } k \text{ in sector } j \text{ at time } t$$

Finally we add competitiveness variables since increased competitiveness also can reduce trade costs. The real effective exchange rate is a traditional competitiveness indicator. Since it is built as a weighted[2] average of bilateral exchange rates, it takes into account a set of exchange rates – and thus, better reflects the value of a currency – and the trade structure of the country.

Following Martin and Mejean (2014), we include the Balassa index which measures revealed comparative advantage by comparing a country's export shares in an industry to the reference area's average export shares enables to compute the revealed comparative advantage of country i compared to the reference area a:

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

[2]In our paper, we use double-weighting (Turner and Van't dack, 1993) method to build the variable.

5 A preliminary investigation: descriptive analysis

5.1 Data processing

Our sample covers five Euro Area countries (Austria, France, Germany, Italy and Spain), ten manufacturing sectors[3] and over the period 1995 to 2013 for most countries. We combine data from Eurostat, OECD, WIOD and BACH (See Appendix A for further details on our dataset). More specifically, for our price data, we use annual producer price index in manufacturing industry for domestic market. Labour productivity is measured as the ratio of real value added and total employment, as provided by Eurostat. The number of active firms is also provided by Eurostat Structural Business Survey (SBS) database. Since we do not have access to the number of foreign exporting firms, we use this variable for N. Our country selection is based on data availability on the one hand and the fact that those five selected countries represent 61% of the GDP of European Union and around 85% of the GDP of the Eurozone.

To define the gross import penetration ratio, we use data from Eurostat and OECD STAN Bilateral Trade Database in goods. Import penetration is defined as the ratio of total imports relative to the total production dedicated to the domestic market, *i.e.* the sum of imports and sectoral output net of exports. For the value added import penetration, we use WIOD Input-Output Tables. Value added import penetration is computed as the content of foreign value added in the domestic final demand, based on Stehrer (2012) method (see Appendix B for a more detailed presentation). At the moment, we use Input-Output Tables from the 2013 release which includes data from 1995 to 2011 in NACE Rev. 1. We will update these data using the 2016 release, which are from 2000 to 2014 and in NACE Rev. 2.

To compute markups, we use the Bank for the Accounts of Companies Harmonized (BACH) database, which gathers harmonized economic and financial information of non-financial enterprises by size class and business sector. It covers eleven European countries[4]. However 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. But for most countries, subsets of the total population are available and large companies are generally overrepresented[5].

Markups represent the market power of a firm, i.e. its ability to set and sustain its price above its marginal costs. It is usually measured with Lerner index, defined as the difference between price and marginal costs divided by price. But since marginal costs are hard to observe, based on the BACH database and Chen *et al.* (2009) approach, we define markups using information on total variable costs only (*i.e.* cost of goods sold, materials and consumables plus staff costs):

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

5.2 Principal components analysis

In this preliminary investigation we introduce descriptive elements to understand the long-run relations among our variables of interest – or active variables – namely relative prices, labour productivity, markup, openness and the number of enterprises. There is neither systematic

[3]See Table 3 in Appendix A

[4]Austria, Belgium, Czech Republic, France, Germany, Italy, the Netherlands, Poland, Portugal, Slovakia and Spain. Denmark, Luxembourg, Romania and Turkey are expected to join the BACH database in the coming years.

[5]In the case of Italy, the entire population of non-financial corporations is well covered in the manufacturing sector.

decline in production prices, in markups nor systematic increase in productivity across countries and sectors (see graphs in Appendix C). We hence rely on a principal components analysis (PCA) to summarise long-run relations among our variables. Using PCA, we can estimate the variance structure of our dataset, *i.e.* the sum of the variances of our five variables.

Principal components are defined as a linear combination of these variables. The first component extracted accounts for a maximal amount of the total variance. Put differently, this means it is correlated with at least some of our variables. Likewise the following components account account for a maximal amount of the total variance that was not accounted for by the preceding components. The principal components are correlated with the variable of interest, but they are uncorrelated with one another. Usually only the first few components are expected to be meaningful and should be retain to be interpreted. Here according to The eigenvalue-one criterion[6], three principal components should be retained for interpretation. They account for 89% of the total variance (Table 1). Graph 1 is called a variables factor map or correlation circle, and displays the first two components which account for 68% of the total variance.

The first component (horizontal axis in Graph 1) relates to competition factors firms are facing, with domestic competition (*i.e.* the number of local active firms) on one side, and foreign competition (*i.e.* openness) on the other side. The second component (vertical axis in Graph 1) relates to variables directly linked to prices. As displayed on Table 2 and Graph 1, labour productivity and openness are tightly and positively correlated. Likewise the number of enterpreises is tightly and negatively correlated with labor productivity and openness, and uncorrelated with relative price and markup. As for relative price and markups, it is tempting to assert a positive correlation between these variables. However this correlation is weak as confirmed by looking at the map on the first and the third components. Theoretically we would expect a strong positive correlation between these two variables. But in reality some firms can establish a monopole position or have a brandmark. Hence while they benefit from low marginal costs they will maintain high markup. A more thorough investigation based on regressions will confirm whether there is a correlation between relative price and markup.

The PCA also enables us to observe relations among supplementary variables[7], here industries, countries and years. An interesting feature about supplementary variables is a division among industries: the first component opposes high-technology manufacturing on the right side of the axis (automobiles, chemicals, electrical equipments, pharmaceuticals[8]) to low-technology manufacturing. This last observation advocates for further investigation in each industries with econometric models. Further additional PCA estimated for each sector provide different results. While relations among productivity, openness and the number of enterprises hold in most sectors, relations differ between these variables and markup or prices (See Appendix D).

[6] We retain and interpret any component with an eigenvalue greater than 1.

[7] Supplementary variables do not contribute to the estimations of the principal components but they can be represented on the variables factor map.

[8] Pharmaceuticals' coordinates are (2.5, 1.6) on Graph 1.

Number	Eigenvalue	Difference	Proportion	Cumulative proportion
1	2,33	-	46,65%	46,65%
2	1,09	1,24	21,78%	68,43%
3	1,02	0,07	20,33%	88,76%
4	0,40	0,61	8,10 %	96,86%
5	0,16	0,25	3,14 %	100 %

Table 1: Eigenvalues of the active variables

Notes: The eigenvalue represents the amount of variance that is accounted for by a given component

Variable	PC1	PC2	PC3	PC4	PC5
Relative price	-0,02	0,83	-0,54	-0,13	0,08
Productivity	0,83	-0,03	0,35	-0,39	0,18
Markup	-0,14	0,61	0,75	0,19	-0,01
Openness	0,86	-0,02	-0,17	0,45	0,16
Nb entreprises	-0,94	-0,16	0,06	0,04	0,31

Table 2: Loadings of the active variables on the five principal components

Notes: The loading is the correlation between a component and a variable.

6 Econometric analysis and results

Theory is based on the framework designed in Chen *et al.* (2004) and Chen *et al.* (2009). On the contrary, our contribution is to further the estimation. Instead of pooling data, the error correction model is estimated for each sector. There are several reasons advocating this choice. First, our model does not capture technical progress and quality upgrading as mentioned in Martin and Mejean (2014). For instance, in certain sectors, firms can attempt to enhance the product quality in order to protect their market share. Such firm behaviours can thus increase their markups and prices. In this regard, it would be more accurate to distinguish the effects of trade across sectors and carry out a sectoral analysis. Second, the period of study is characterized by a very deep global recession with highly volatile economic environment. The magnitude of the impact of trade liberalisation would be variable across countries and sectors. Given this, country and time dummies should be put systematically. However, given the relatively short time period of estimation, year dummy variables capturing exogenous events are chosen based on its impact on the dependent variables.

6.1 Estimating the simultaneous equations system

In this section, we adapt the approach adopted in Chen *et al.* (2004) based on the estimation of simultaneous equations system (SES). There are three equations: first equation captures the relationship between the price, productivity and markups. Productivity is expected to be negatively correlated with price whereas markups are expected to be positively correlated. Second equations captures the relationship between productivity and openness and third equation

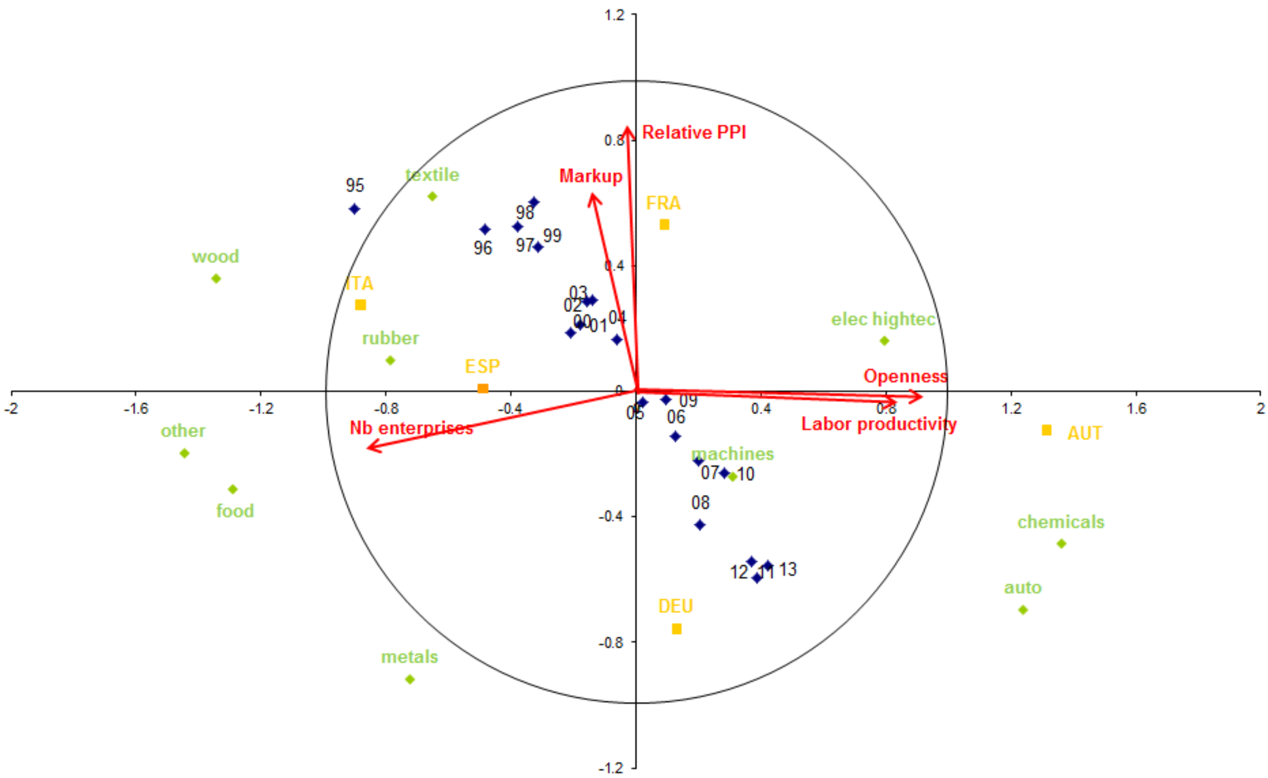


Figure 1: Variables factor map

Notes: Active variables are represented by arrows and supplementary variables by dots (green ones for industries,yellow for countries and blue for years). Their coordinates are given by their loadings.

between markups and openness.

Three-stage least squares estimation. We could estimate these equations through equation-by-equation ordinary least squares (OLS). But we would then overlook correlations between disturbance and regressors. Estimating our system with two-stage least squares (2SLS) would enable us to deal with this issue. However it does not take into account relations be between our three equations through their error terms. We hence estimate our system using a three-stage least squares(3SLS). This method is based on the same first two steps as 2SLS, but have a third step to compute GLS-estimator to deal with correlations between the error terms of our three equations. As we estimate our system with 3SLS, we also include a fourth equation to instrument openness using the instruments presented in section 4.3 as explanatory variables.

Stationarity and cointegration tests. Our theory predicts a long- and short-run relationship between dependent variables - prices, labour productivity and markups - with openness, the number of domestic and foreign firms and labour. Error correction model enables us to distinguish these dynamics among our variables. We also avoid spurious regressions by estimating only short- or long-term equations. Given this, we first find a long run relationship, also called the cointegration equation and carry out regressions of stationary dependent variables on stationary control variables.

In order to test the stationarity of our series, we use fisher-type unit root test consisting of performing a unit root test on each time series of the panel separately, then combine the p−values to obtain an overall test of whether the panel series contains a unit root. Four statistics are computed as proposed by Choi (2001) and presented in appendix E. The null hypothesis being tested is that all time series contain a unit root and the alternative hypothesis is that at least one time serie is stationary. Since our sample is short, the power of panel unit root tests will be lessened. Although our tests entail different conclusions, most tests do not reject the null hypohtesis, i.e. reveal evidence for non-stationarity. In our tests, some statistics differ in their conclusion. However, tests mostly cannot reject the null hypothesis.

6.2 Estimation based on gross import penetration ratio

In this section, a traditional measure of trade indicator, i.e. gross import penetration ratio, is to assess the pro-competitive effects of trade liberalisation on price, productivity and markups.

An error correction model is relevant when the error correction coefficient is negative and significant. Given this, the baseline model (tables 7 and 8) indicates that prices and labour productivity in the sector of wood, paper and printing (1618) does not qualify for an ECM model. We hence do not comment on the estimates for this sector. After instrumenting import penetration, prices in the sector of metals (2425) can be estimated with an ECM model, although the error correction coefficient is only significant at level 10%.

Conversely to Chen *et al.* (2009), there is not a reversal of sign between the short run and the long run. As highlighted in Baghli *et al.* (1998), we should keep in mind the distinction between the concept of ”economic long-run” and that of ”econometric or statistical long-run”. Indeed, given the short estimation period and data coverage, the long-run relationship, which can be derived from the theoretical economic model may not hold in estimated ”econometric long-run”. In our framework, the fact that we do not necessarily find a sign reversal between long-run and short-run coefficients might be explained by the fact that the economic long run implications of the trade liberalisation may need more decades in order to be properly studied.

According to our theoretical framework, price is expected to be negatively correlated with labour productivity and positively correlated with markup. When coefficients of these variables are significant, these relations are verified, except in the sector of metals (2425) where productivity is positively correlated to price and in the sector of chemicals (2000) where markup is negatively related to price. Only in the sector of rubber and plastic (2223), we have significant coefficients with the right sign for both productivity and markup. Further markup is more strongly correlated to price than labour productivity.

Openness has pro-competitive effect on productivity in the sector of metals (2425), but not in the sectors of textile and leather (1315), pharmaceuticals (2100), rubber and plastic (2223) and transport materials (2930).

Openness has pro-competitivie effect on markup in the sectors of food (1012), textile (1315), parmaceuticals (2100), rubber and plastic (2223) and electrical equipment (2627). But it is positively related to markup in the sector of chemicals (2000) which could imply that firms in that sector could have a monopoly position.

6.3 Estimation based on value-added based import penetration ratio

So far we have used a traditional measure of imports penetration – ratio of gross imports on final demand. However gross imports are recorded each and every time they cross borders. Hence gross statistics for imports can overstate their importance to competitiveness, as it includes re-exported imports. In addition, the increasing importance of global value chains (GVC) has made the analysis of international trade more complex and traditional measures of trade are unable to take into account the full interdependence of markets and economies (Javorsek and Camacho, 2015).

Interestingly, the results from the estimation using value added import penetration are closer to theoretical framework. are different from the previous ones. Furthermore, the significance of the estimation results is stronger when using input-output tables. However, the price equation shows that sectors of rubber and plastic (2223), machinery and equipment (2800) and motor vehicles and transport (2930) are not eligible for the ECM estimation (see Table 10).

7 Concluding remarks

The pro-competitive effect of globalisation has long been of economic, social and political interest. This paper presents an empirical version *à la* Chen *et al.* (2004, 2009) of the Melitz and Ottaviano (2008) model in order to assess the pro-competitive effect of globalisation on price, productivity and markup in ten sectors and five Euro Area countries. In a first step, we use OECD-STAN data to measure imports penetration in final demand. We can then directly compare our results with the existing literature on the same subject. In a second step, we use the update of World Input-Output Database (WIOD) through 2014 to build another value added imports penetration, based on Stehrer (2012) method.

The novelty of our paper is twofold. First, we carry out a sectoral analysis to shed light on sectors in which price competition is dominant over quality competition and believe in sectoral heterogeneity. Indeed, estimating on a pooled sample to obtain an economy-wide effect of globalisation may ignore the heterogeneity in technology, labour-capital allocation share and R&D status across sectors and countries. Consequently, it would conceal differences by averaging and smoothing the effects of trade. Furthermore, there is no reason why trade would affect all the sectors in a similar way. For some, price competition may be dominant but for the others, quality competition may be larger. As a result, an analysis at sectoral level enables to overcome such criticisms.

Second, unlike the existing papers we consider global value chains (GVC), by measuring value added imports penetration in final demand. Since gross imports are recorded each time they cross borders, they include re-exported imports and can hence overstate their importance to competitiveness. In addition, the increasing importance of global value chains (GVC) has made the analysis of international trade more complex and traditional measures of trade are unable to take into account the full interdependence of markets and economies. Indeed, we obtain stronger effects of openness using the GVC indicators.

The approach chosen in this paper could be subject to further investigation. We are currently working on robustness checks and extension. Our next step is to first control for the potential quality upgrading of trade liberalisation, using an indicator based on Martin and Mejean (2014) definition. Even though our model captures price competition in some sectors, it only focuses on the price competition and does not account for quality competition. But instead of decreasing the price, firms can protect its market shares by improving the quality of its product, i.e. favour their intensive development over their extensive development. For instance, Dinopoulos and Unel (2013) show that markups and quality are endogoeneous. Second, response to trade openness may differ depending on the trade partners. For instance, Auer *et al.* (2013) focus on the effect of trade with low-wage countries and find a negative effect on prices. Third, the position in GVC (upstream or downstream) also has an influence through trade costs (Koopman *et al.*, 2010), and hence on prices, markups and productivity. Finally, as mentioned in Chen *et al.* (2009), taking the labour productivity as a proxy of total productivity implicitly assumes the absence of differences in capital costs. This is a strong assumption given the existing international trade theories. Indeed, Auer and Fischer (2010) and Auer *et al.* (2013), the factor intensity differs across countries and they find that price competition with low-wage countries is relatively more important in labour-intensive sectors. We could then introduce the intensity of investment in both tangibles and intangibles as a proxy for capital.

A Data description

A.1 Sector aggregation

Code (from NACE Rev. 2)	Description
1012	Food, drink and tobacco
1315	Textile and leather
1618	Wood, paper and printing
2000	Chemicals
2100	Pharmaceuticals
2223	Rubber and plastic
2425	Metals
2627	Electrical equipment (e.g. computers, optics)
2800	Machinery and equipment
2930	Motor vehicles and transport
3133	Other and repair

Note: In the case of variables from BACH database, 1012 does not include tobacco (C12). In the case of trade variables and production prices for both Germany and Italy, 3133 does not include repair (C33).

Table 3: Manufacturing sector aggregation

A.2 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. Since most our data are classified according to the NACE Rev.2 economic activity-level classification, we nee to match data classified at good- or product-level. For this exercise, we use theoretical transition matrices 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 $A_1, A_2, ..., A_n$, we divide the observation classified in α by n, *i.e.* $1/n$ of α goes to each A_i with $i \in [1, n]$.

Trade data. External trade data are classified at different level depending on the sources. Total exports and imports, as well as intermediate imports, come from OECD databases (STAN and bilateral trade by end-of-use). These data are classified in ISIC4, which presents direct correspondence with Nace Rev.2. The bulkiness index, tariff rates and export market shares 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:

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

Quality changes. Quality changes is defined from a consumption approach (*i.e.* in Classification of Individual Consumption by Purpose, COICOP). More precisely, quality changes is defined as changes in unit value of consumption minus changes in consumption price index

(CPI) Martin and Mejean (2014). The construction of such a variable relies on the fact that CPI is considered as an ”ideal price” since it measures ”pure” price developments and is adjusted from quality changes (Guédès, 2004). On the other side, unit value of consumption include both pure price developments and price developments related to quality changes.
The following figures illustrate the steps to convert COICOP data NACE Rev.2 classification:

$$N_{COICOP2008}^{goods} \Rightarrow N_{HS2007}^{goods} \Rightarrow N_{CPA2008}^{products} \Rightarrow N_{NACErev2}^{activity}$$

Firms data: In the case of the number of enterprises and the markup, we use firms data (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 we rely on correspondences between NACE Rev.1 and NACE Rev.2 provided Eurostat. Unlike the two previous conversions, we do not rely on theoretical correspondene but on a ”linguistic” correspondence, like Auer *et al.* (2013). When a a single code α corresponds to $n \geq 2$ codes of the final classification $(A_1, A_2, ..., A_n)$, we choose the class that best matched the label of α. 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.

B Value added import penetration

Conversely to OECD-WTO database on TiVA, the World Input-Output Database (WIOD) provides a time-series of world Input-Output tables (WIOTs) from 1995 to 2011. We define value added imports penetration 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, we have the following equilibrium:

$$x = ic + f = A.x + f = L.f \tag{15}$$

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 i in j 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 a diagonalized $NK \times NK$ matrix of value added share of gross output.

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

$$\begin{bmatrix} x^r \\ x^s \\ x^t \end{bmatrix} = \begin{bmatrix} v^r & v^s & v^t \end{bmatrix} \begin{bmatrix} L^{rr} & L^{rs} & L^{rt} \\ L^{sr} & L^{ss} & L^{st} \\ L^{tr} & L^{ts} & L^{tt} \end{bmatrix} \begin{pmatrix} f^{rr} + f^{rs} + fr^{rt} \\ f^{sr} + f^{ss} + f^{st} \\ f^{tr} + f^{ts} + f^{tt} \end{pmatrix} \tag{16}$$

$f^c = f^{cr} + f^{cs} + fr^{ct}$ $(c = r, s, t)$ is a $N \times 1$ vector of demand for final products which are produced in country c for both domestic use and exports. We are interested in the country c's final demand (doemstically and imported), i.e. $\begin{pmatrix} (f^{rc})^t & (f^{sc})^t & \left(f^{tc}\right)^t \end{pmatrix}^t$

We now consider trade between countries r and s in this setting of three countries. To compute the value added from country s included in country r's final demand - the value added import of r from s - we set to zero value added from countries s and t, and final demand from r and t:

$$t_M^{rs} = \begin{bmatrix} 0 & v^s & 0 \end{bmatrix} \begin{bmatrix} L^{rr} & L^{rs} & L^{rt} \\ L^{sr} & L^{ss} & L^{st} \\ L^{tr} & L^{ts} & L^{tt} \end{bmatrix} \begin{pmatrix} f^{rr} + 0 + 0 \\ f^{sr} + 0 + 0 \\ f^{tr} + 0 + 0 \end{pmatrix} \tag{17}$$

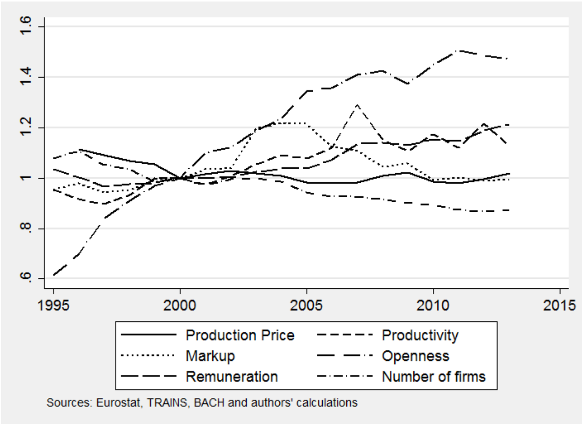
$$= v^s L^{sr} f^{rr} + v^s L^{ss} f^{sr} + v^s L^{st} f^{tr} \tag{18}$$

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 satisfay country r's demand for final products imported from country t.

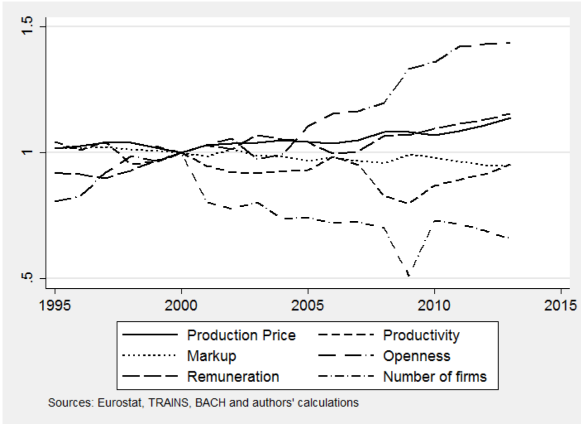
The ratio of imports of r from country s on final demand of r in terms of value added is then defined as:

$$tshare_M^{rs} = \frac{t_M^{rs}}{\sum_{p=r,s,t} t_M^{rp}} \tag{19}$$

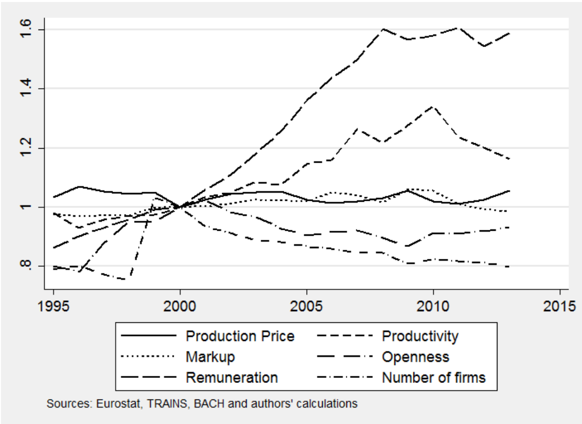
C Descriptive statistics



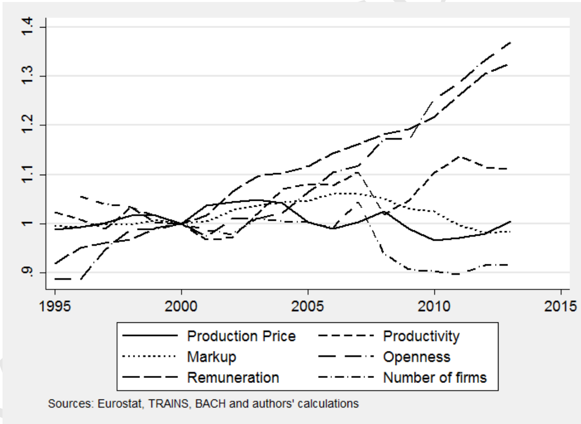
(a) Austria



(b) Germany



(c) Spain



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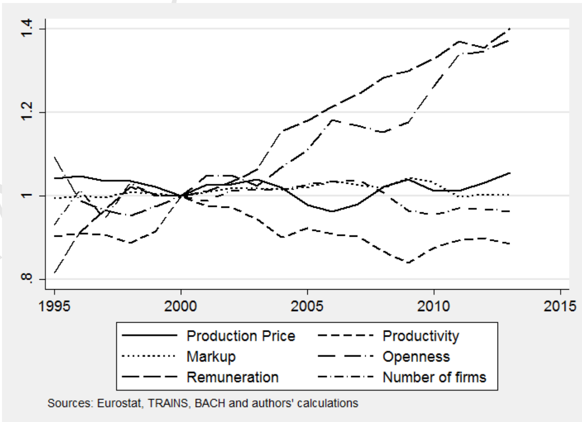
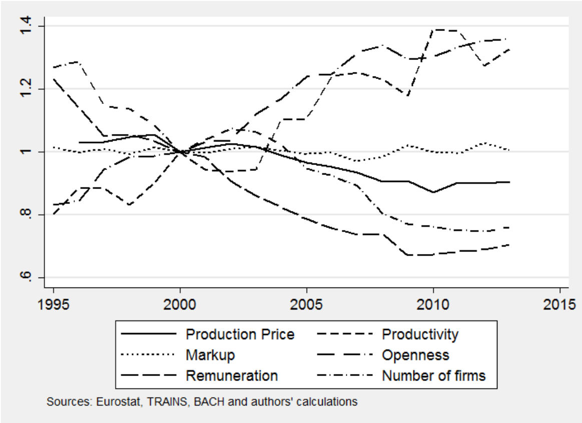


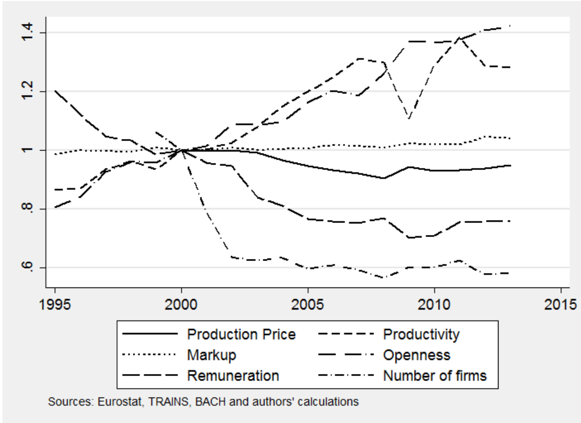
(e) Italy

Figure 2: 1012 - food, drink and tobacco

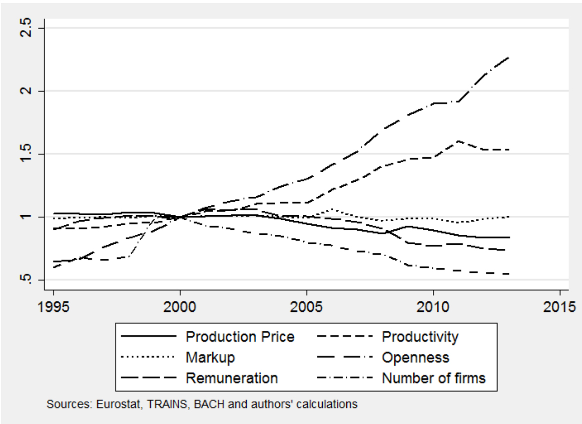
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



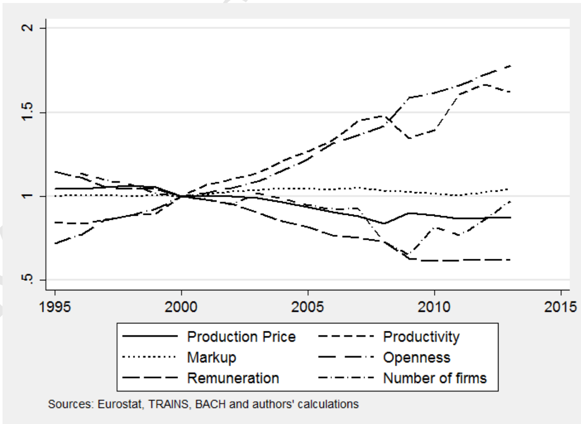
(a) Austria



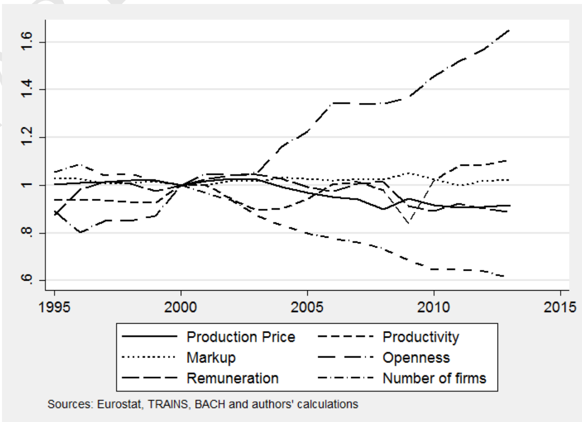
(b) Germany



(c) Spain



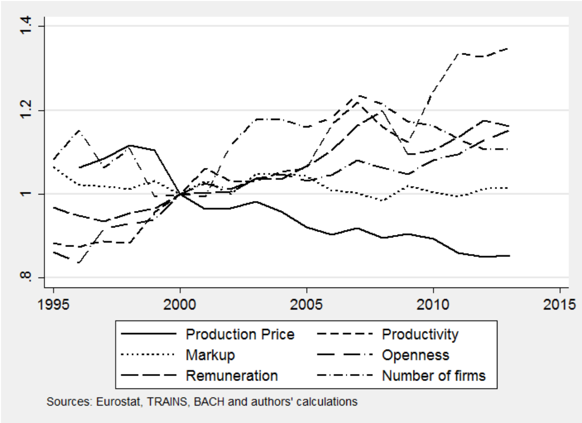
(d) France



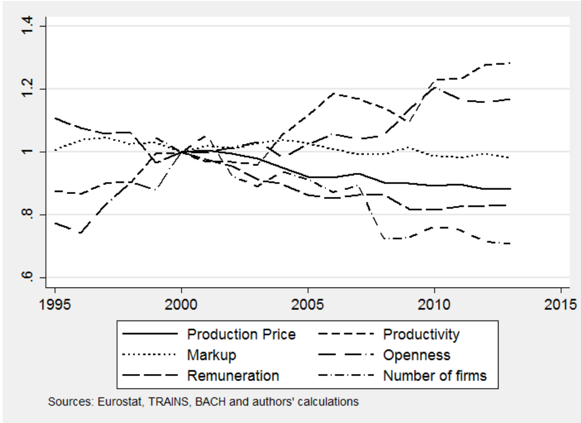
(e) Italy

Figure 3: 1315 - textile and leather

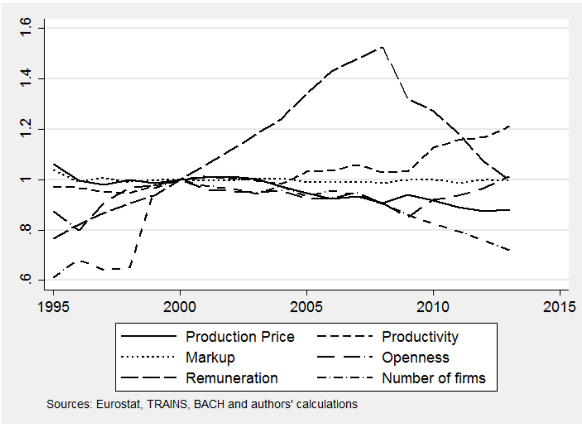
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



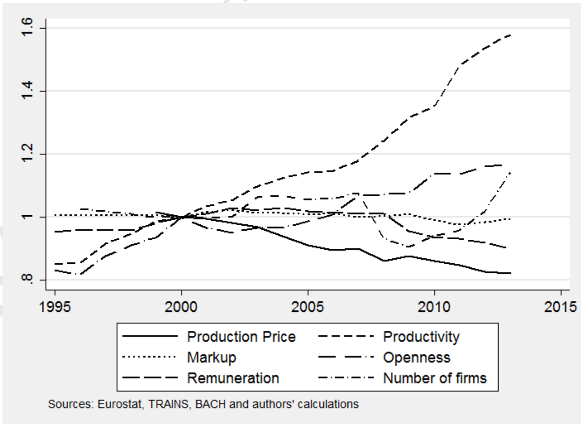
(a) Austria



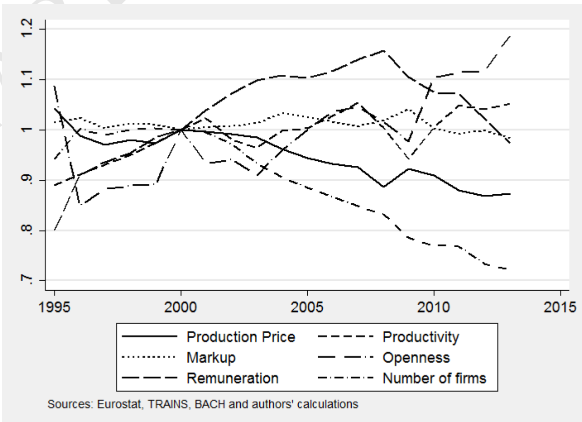
(b) Germany



(c) Spain



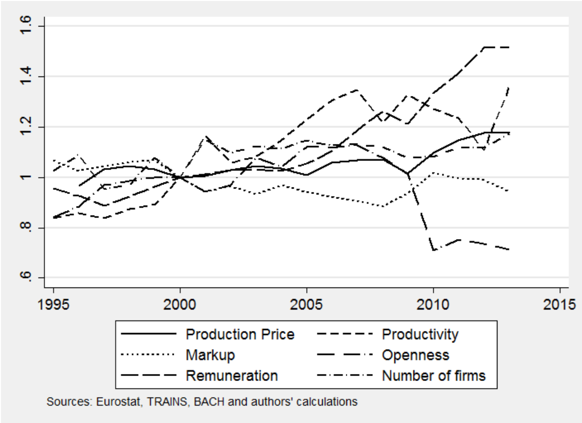
(d) France



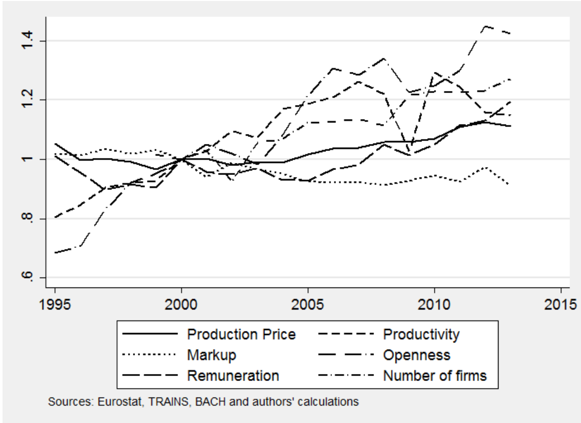
(e) Italy

Figure 4: 1618 - wood, paper and printing

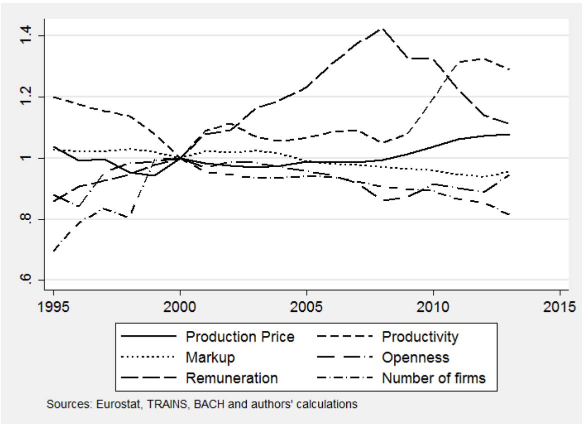
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



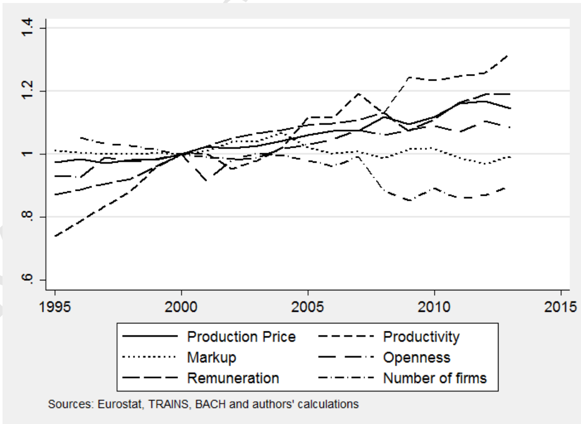
(a) Austria



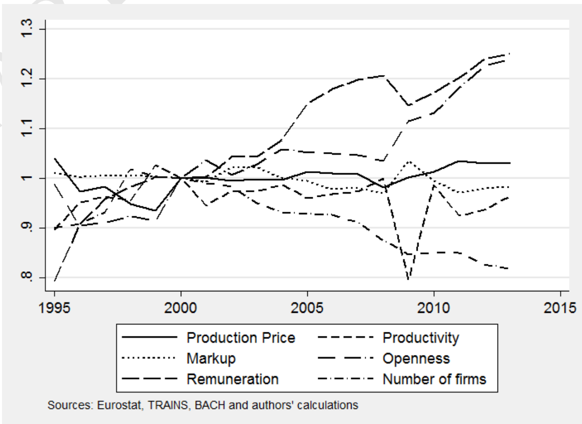
(b) Germany



(c) Spain



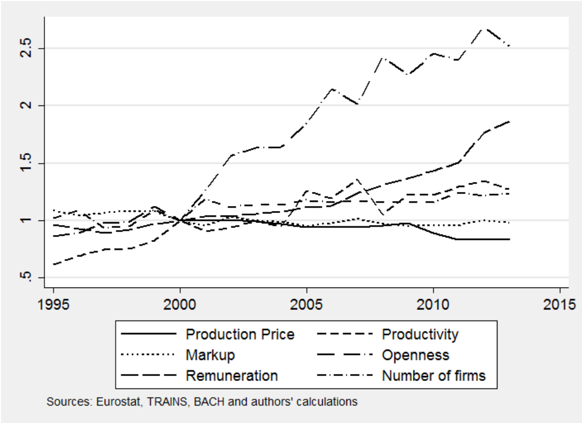
(d) France



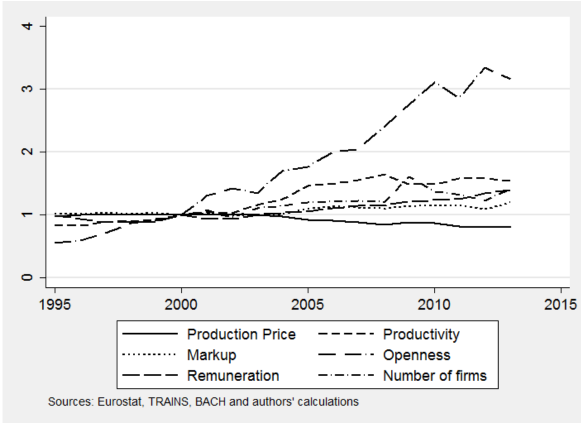
(e) Italy

Figure 5: 2000 - chemicals

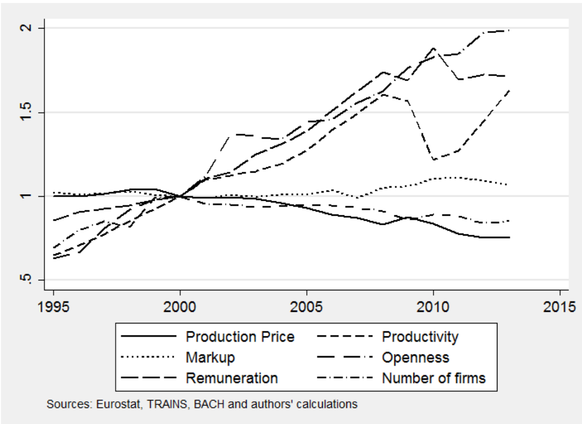
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



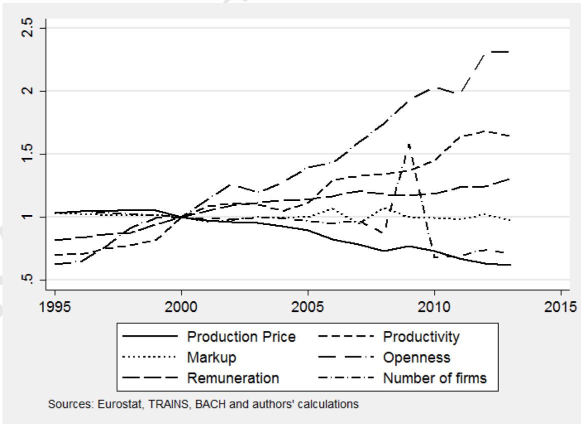
(a) Austria



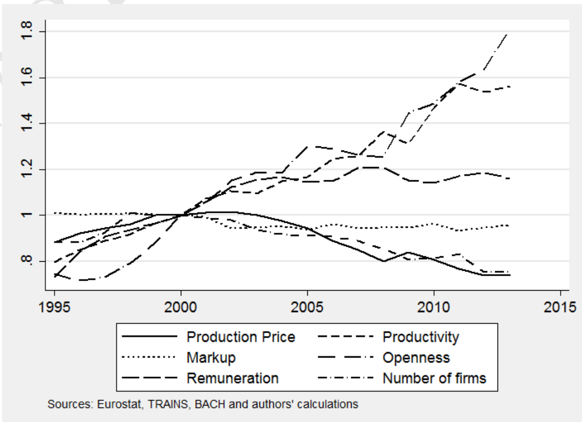
(b) Germany



(c) Spain



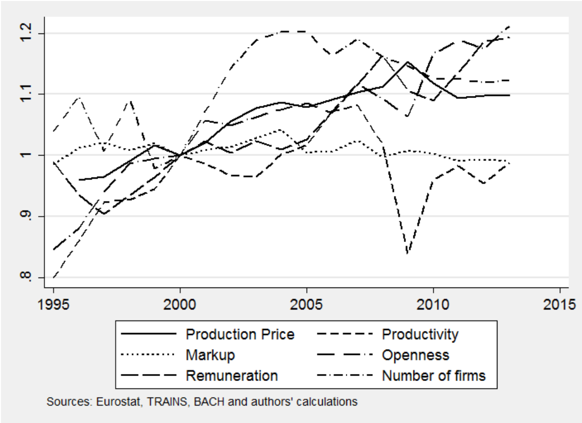
(d) France



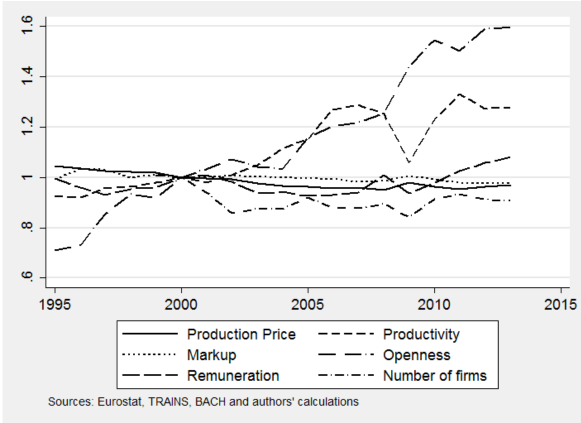
(e) Italy

Figure 6: 2100 - pharmaceuticals

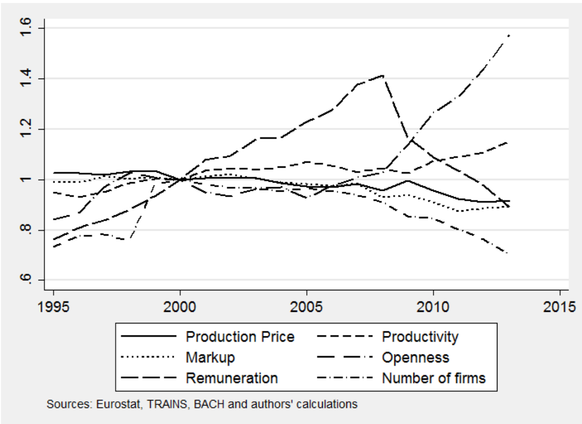
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



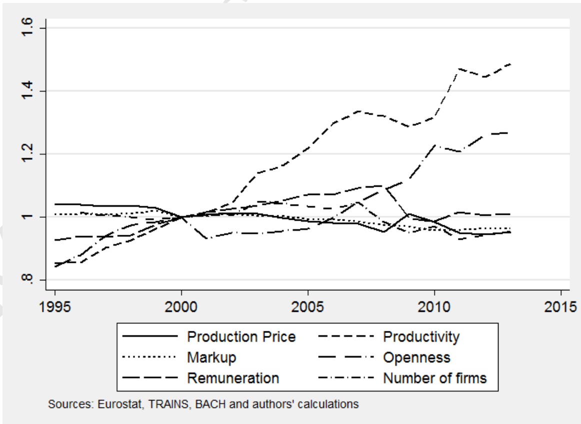
(a) Austria



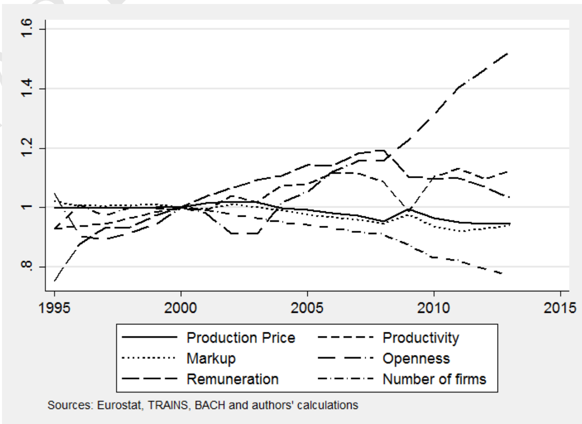
(b) Germany



(c) Spain



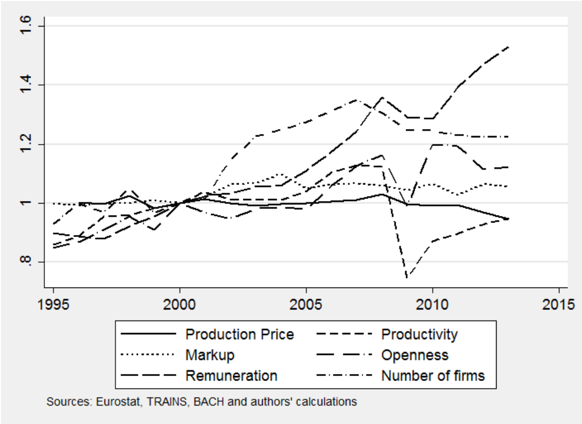
(d) France



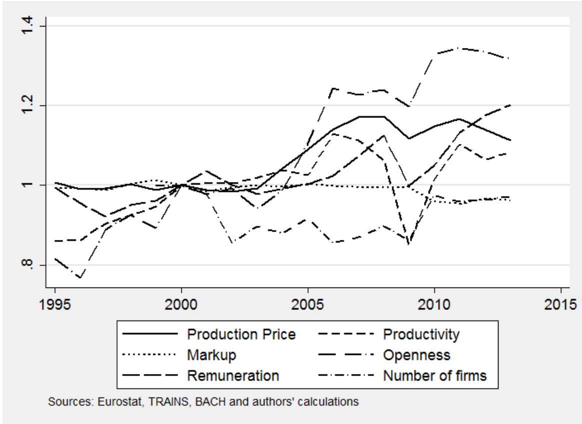
(e) Italy

Figure 7: 2223 - rubber, plastic porducts and other non metallic mineral products

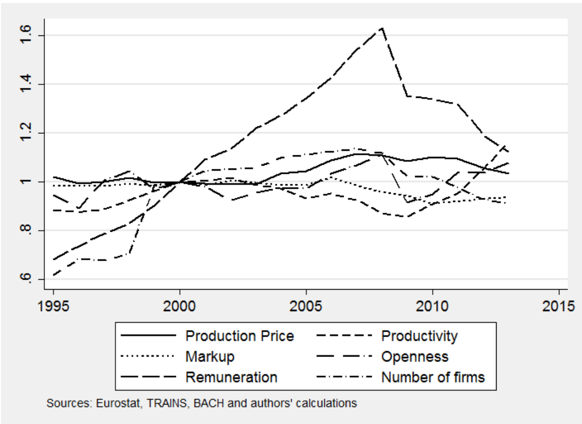
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



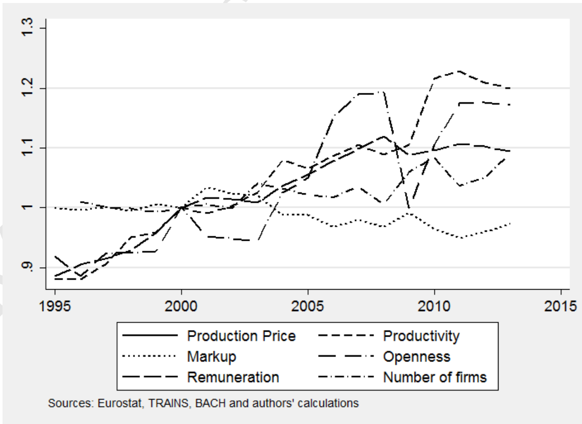
(a) Austria



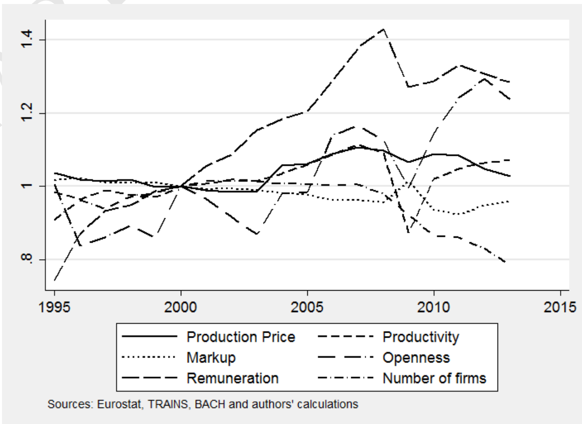
(b) Germany



(c) Spain



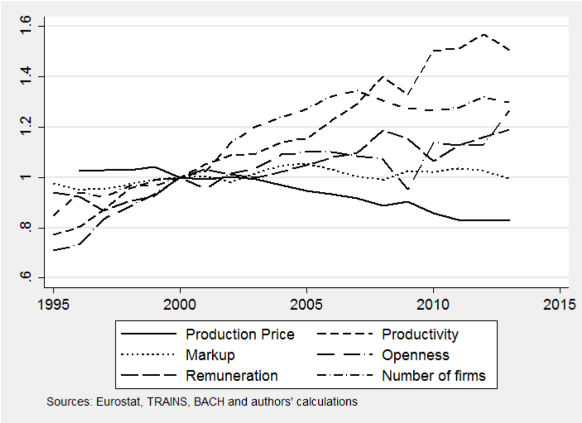
(d) France



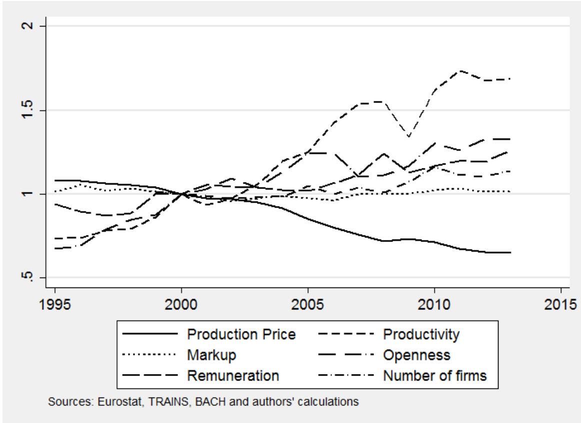
(e) Italy

Figure 8: 2425 - metals and basic metals

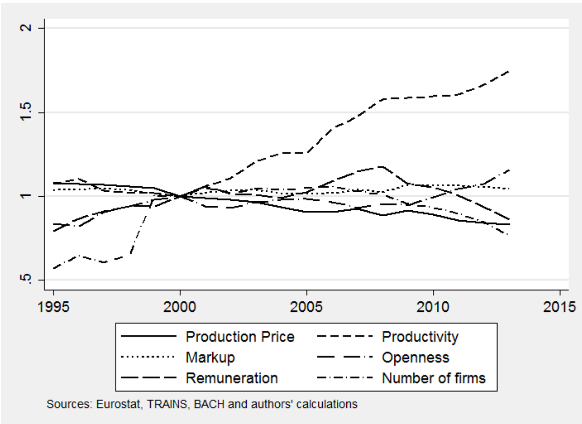
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



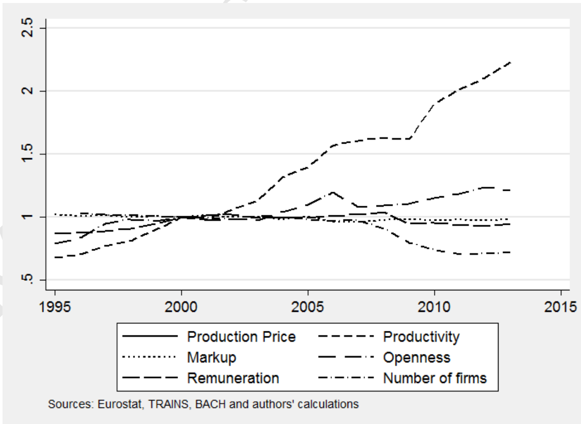
(a) Austria



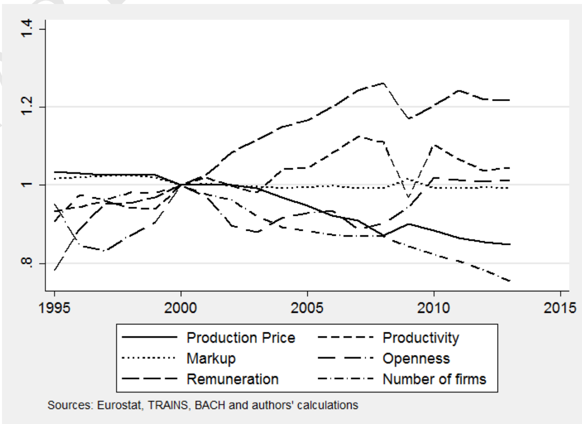
(b) Germany



(c) Spain



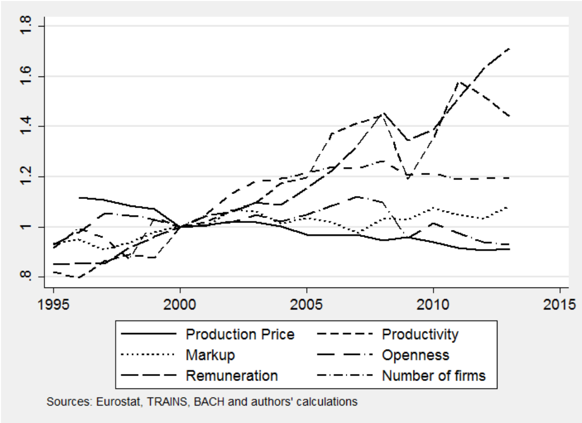
(d) France



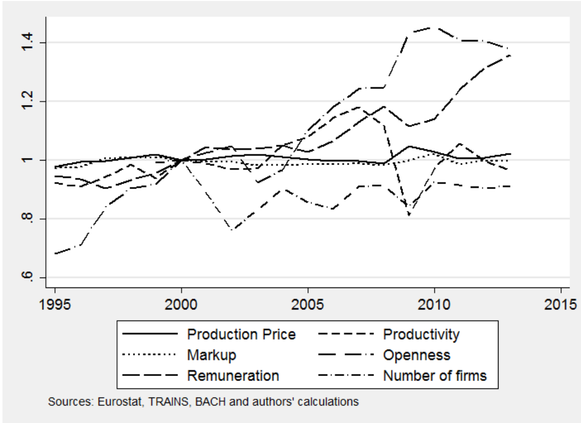
(e) Italy

Figure 9: 2627 - computer, electronic and optical products

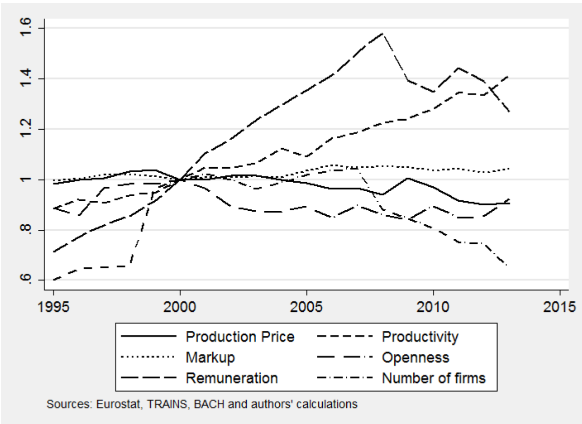
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



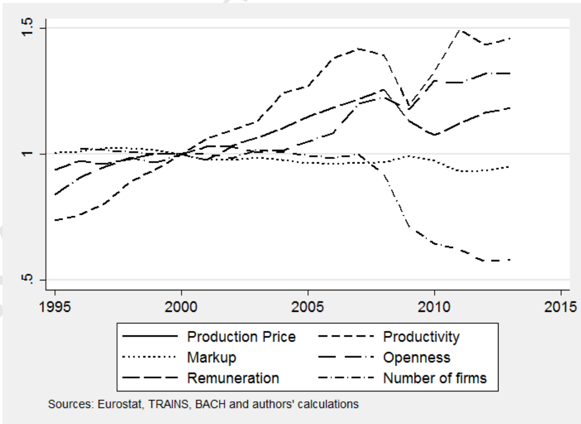
(a) Austria



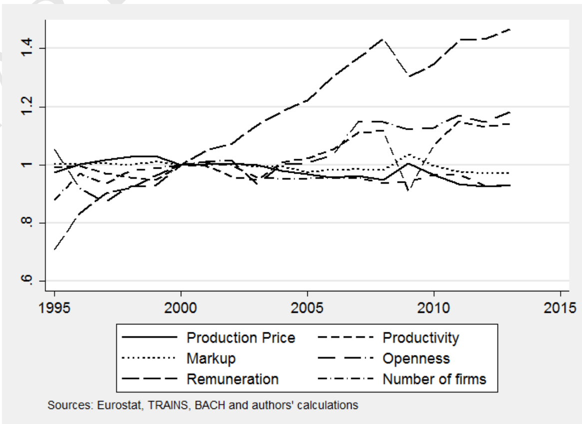
(b) Germany



(c) Spain



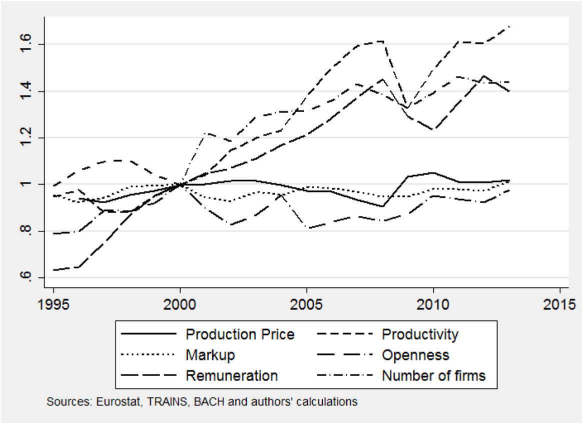
(d) France



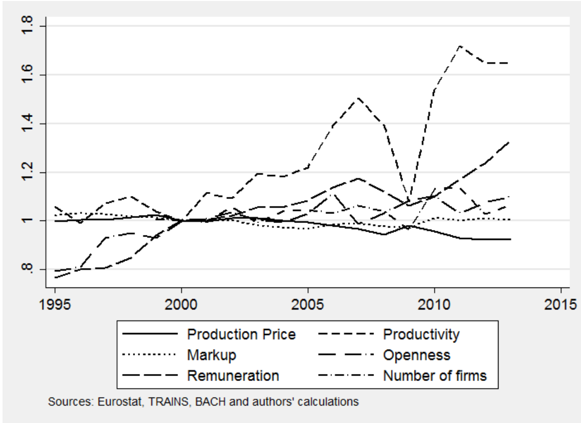
(e) Italy

Figure 10: 2800 - machinery and equipment

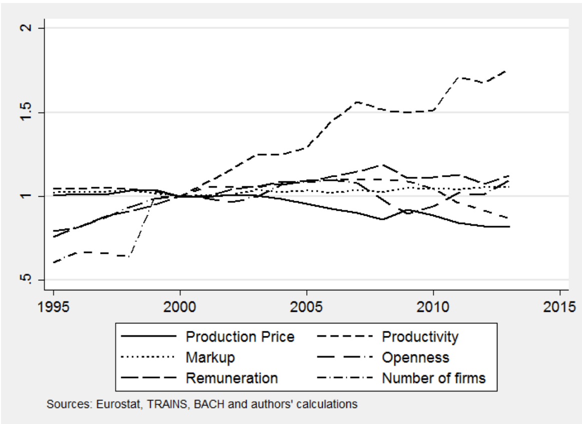
Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.



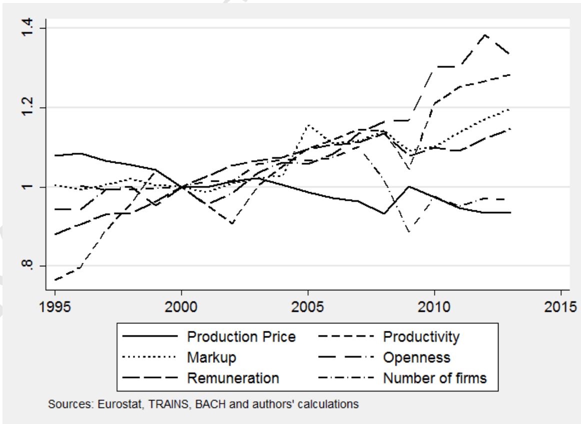
(a) Austria



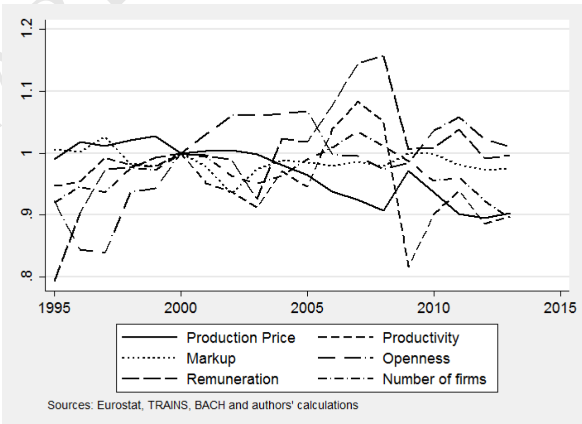
(b) Germany



(c) Spain



(d) France

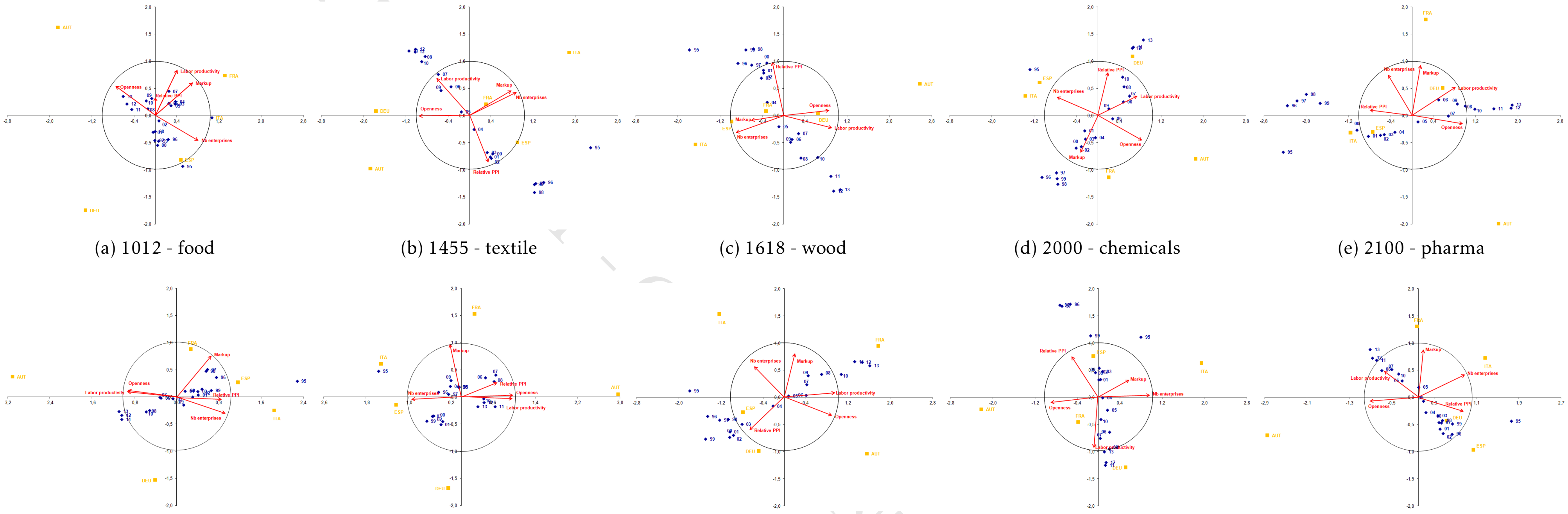


(e) Italy

Figure 11: 2930 - motor vehicles, trailers, semi-triailers and transport equipment

Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.

D Variable factor map by sector



(a) 1012 - food (b) 1455 - textile (c) 1618 - wood (d) 2000 - chemicals (e) 2100 - pharma

(f) 2223 - rubber (g) 2425 - metals (h) 2627 - elec hightec (i) 2800 - machines (j) 2930 - auto

Figure 12: Variable factor map on the first two components by sector

Source: Eurostat, OECD STAN, SBS, BACH and authors' calculations.
Note: The first two components account for between 68% and 86% of the total variance depending on the sector.

E 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 4: 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 5: 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 6: 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..

F Results

Table 7: Baseline estimation based on gross import penetration ratio

VARIABLES	(1) 1012	(2) 1315	(3) 1618	(4) 2000	(5) 2100	(6) 2223	(7) 2425	(8) 2627	(9) 2800	(10) 2930
PRICE										
$\Delta \ln z_{it}$	-0.07	-0.44***	0.20	0.19	-0.26***	-0.16***	0.39***	-0.08	-0.10	0.00
	(0.07)	(0.11)	(0.13)	(0.20)	(0.07)	(0.05)	(0.11)	(0.08)	(0.33)	(0.05)
$\Delta \ln \mu_{it}$	0.02	0.42	0.31	-0.28	-0.28	0.94***	1.29**	-0.86	-1.70*	0.40
	(0.24)	(0.57)	(0.41)	(0.33)	(0.32)	(0.19)	(0.64)	(0.95)	(0.98)	(0.29)
$\ln \frac{\text{PPI}_{it-1}}{\text{PPItot}_{t-1}}$	-0.27***	-0.42***	-0.17	-0.48***	-0.18***	-0.10**	-0.01	-0.15***	-0.58***	-0.11**
	(0.06)	(0.11)	(0.11)	(0.17)	(0.05)	(0.04)	(0.08)	(0.05)	(0.19)	(0.05)
$\ln z_{t-1}$	-0.04	-0.19***	-0.01	0.11	-0.11**	-0.00	0.11**	-0.08	-0.12	0.05**
	(0.04)	(0.07)	(0.07)	(0.09)	(0.05)	(0.02)	(0.05)	(0.06)	(0.17)	(0.02)
$\ln \mu_{it-1}$	-0.16	0.40	-0.01	-0.02	-0.06	0.29***	0.89**	-0.28	-0.92	0.26
	(0.15)	(0.41)	(0.11)	(0.09)	(0.16)	(0.09)	(0.44)	(0.44)	(0.71)	(0.23)
$\ln L_{it-1}$	0.04	0.07	-0.06	-0.11**	0.08	0.02	0.06**	0.07	0.09	-0.16***
	(0.03)	(0.08)	(0.04)	(0.05)	(0.07)	(0.03)	(0.03)	(0.11)	(0.08)	(0.05)
Constant	-0.37	-0.12	0.82	-9.04***	6.90*	-0.26	-1.39***	-0.44	-0.63	1.72***
	(0.24)	(0.79)	(0.52)	(2.14)	(4.00)	(0.30)	(0.51)	(1.20)	(0.51)	(0.52)
LABOUR PRODUCTIVITY										
dopenness_	-0.04	-0.21**	0.01	0.01	-0.24**	-0.23**	0.46***	-0.08	-0.13	-0.29**
	(0.11)	(0.10)	(0.08)	(0.11)	(0.12)	(0.12)	(0.10)	(0.10)	(0.11)	(0.13)
$\Delta \ln D_{it}$	0.10*	-0.02	-0.03	0.02	-0.03	0.03	0.15	-0.01	0.09	0.12
	(0.06)	(0.05)	(0.05)	(0.12)	(0.05)	(0.08)	(0.11)	(0.08)	(0.09)	(0.10)
$\ln z_{t-1}$	-0.42***	-0.46***	-0.09	-0.35***	-0.59***	-0.28***	-0.40***	-0.22***	-0.57***	-0.42***
	(0.09)	(0.07)	(0.06)	(0.08)	(0.10)	(0.06)	(0.10)	(0.07)	(0.09)	(0.08)
lopenness_	-0.03	0.03	0.06	-0.08	0.01	-0.15**	0.05	-0.02	-0.06	-0.16
	(0.04)	(0.04)	(0.07)	(0.06)	(0.07)	(0.07)	(0.08)	(0.10)	(0.06)	(0.11)
$\ln L_{it-1}$	0.22***	0.19	0.07	0.24***	-0.16	-0.32***	-0.03	0.28***	0.26**	0.60***
	(0.07)	(0.12)	(0.07)	(0.09)	(0.17)	(0.11)	(0.10)	(0.09)	(0.11)	(0.22)
$\ln \frac{w_{it-1}}{\text{PPI}_{it-1}}$	0.20**	0.35***	0.02	0.13	0.25**	0.26***	0.02	0.05	0.46***	0.09
	(0.10)	(0.11)	(0.08)	(0.14)	(0.10)	(0.10)	(0.13)	(0.10)	(0.15)	(0.13)
Constant	-1.75**	-1.78	-0.47	-1.86*	3.91*	4.24***	2.10*	-2.70***	-2.43**	-5.88**
	(0.76)	(1.34)	(0.72)	(1.04)	(2.06)	(1.29)	(1.15)	(1.01)	(1.07)	(2.47)
MARKUP										
dopenness_	-0.18***	0.01	-0.01	0.11***	-0.05	-0.02	-0.08***	-0.08**	-0.05	0.01
	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)
$\Delta \ln D_{it}$	-0.02	0.01	-0.03	0.02	-0.04*	-0.01	-0.02	0.01	-0.02	-0.00
	(0.02)	(0.01)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
$\ln \mu_{it-1}$	-0.64***	-0.62***	-0.16**	-0.18***	-0.35***	-0.34***	-0.52***	-0.40***	-0.56***	-0.64***
	(0.09)	(0.11)	(0.06)	(0.06)	(0.10)	(0.06)	(0.09)	(0.09)	(0.09)	(0.09)
lopenness_	-0.04***	0.01	0.02	0.02	-0.03	-0.00	-0.02	-0.02	-0.03	0.01
	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)
$\ln L_{it-1}$	-0.02	-0.02	-0.01	-0.02	0.02	-0.06***	-0.03	-0.03	0.01	-0.06***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.06)	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)
Constant	0.32	0.35	0.22	0.33	-0.23	0.80***	0.35	0.37	-0.05	0.82***
	(0.25)	(0.33)	(0.29)	(0.32)	(0.69)	(0.19)	(0.22)	(0.39)	(0.28)	(0.26)
Observations	84	83	80	84	80	84	76	76	73	84
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 8: Baseline estimation based on instrumented gross import penetration ratio

VARIABLES	(1) 1012	(2) 1315	(3) 1618	(4) 2000	(5) 2100	(6) 2223	(7) 2425	(8) 2627	(9) 2800	(10) 2930
PRICE										
$\Delta \ln z_{it}$	-0.10**	-0.44***	0.22**	-0.15**	-0.34***	-0.14***	0.10**	0.08	-0.36***	-0.04
	(0.04)	(0.05)	(0.11)	(0.07)	(0.06)	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)
$\Delta \ln \mu_{it}$	0.19	0.02	0.75***	-0.76***	0.13	0.89***	-0.28	0.24*	0.07	0.52**
	(0.13)	(0.31)	(0.23)	(0.19)	(0.20)	(0.16)	(0.28)	(0.14)	(0.13)	(0.22)
$\ln \frac{\text{PPI}_{it-1}}{\text{PPItot}_{t-1}}$	-0.29***	-0.44***	-0.15	-0.43***	-0.19***	-0.10**	-0.09*	-0.15***	-0.61***	-0.11**
	(0.05)	(0.08)	(0.10)	(0.09)	(0.05)	(0.04)	(0.05)	(0.04)	(0.09)	(0.05)
$\ln z_{t-1}$	-0.06*	-0.19***	0.01	-0.01	-0.13**	0.00	0.01	-0.07**	-0.23***	0.04
	(0.03)	(0.05)	(0.07)	(0.04)	(0.05)	(0.02)	(0.03)	(0.03)	(0.04)	(0.02)
$\ln \mu_{it-1}$	-0.08	0.24	0.03	-0.10	0.08	0.29***	-0.02	0.16*	0.21*	0.34*
	(0.11)	(0.27)	(0.11)	(0.08)	(0.13)	(0.09)	(0.20)	(0.09)	(0.11)	(0.19)
$\ln L_{it-1}$	0.06**	0.05	-0.07	-0.06	0.09	0.02	0.02	0.08	0.13***	-0.13***
	(0.02)	(0.05)	(0.04)	(0.05)	(0.07)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)
Constant	-0.44**	0.11	0.78	-8.63***	5.31	-0.24	-0.36	-0.73	-0.58	1.46***
	(0.21)	(0.54)	(0.52)	(1.80)	(3.90)	(0.29)	(0.36)	(0.52)	(0.38)	(0.48)
LABOUR PRODUCTIVITY										
dopenness_	-0.07	-0.25	0.02	-0.05	-0.56***	-0.12	0.51***	-0.04	-0.10	-0.28
	(0.14)	(0.20)	(0.11)	(0.16)	(0.18)	(0.17)	(0.11)	(0.13)	(0.14)	(0.23)
$\Delta \ln D_{it}$	0.09*	-0.00	-0.02	0.13	-0.05	0.04	0.18	-0.05	0.02	0.12
	(0.06)	(0.06)	(0.05)	(0.15)	(0.05)	(0.09)	(0.13)	(0.08)	(0.08)	(0.10)
$\ln z_{t-1}$	-0.42***	-0.49***	-0.09	-0.38***	-0.47***	-0.28***	-0.40***	-0.24***	-0.57***	-0.41***
	(0.09)	(0.07)	(0.06)	(0.08)	(0.12)	(0.06)	(0.10)	(0.07)	(0.09)	(0.09)
lopenness_	-0.03	0.03	0.05	0.04	-0.10	-0.11	0.08	0.02	-0.07	-0.16
	(0.04)	(0.05)	(0.07)	(0.07)	(0.08)	(0.08)	(0.09)	(0.10)	(0.06)	(0.12)
$\ln L_{it-1}$	0.22***	0.19	0.07	0.24**	-0.21	-0.27**	-0.03	0.26***	0.24**	0.58***
	(0.07)	(0.13)	(0.07)	(0.09)	(0.18)	(0.12)	(0.10)	(0.09)	(0.11)	(0.22)
$\ln \frac{w_{it-1}}{\text{PPI}_{it-1}}$	0.19*	0.37***	0.02	0.04	0.30***	0.21*	0.02	0.08	0.46***	0.09
	(0.10)	(0.13)	(0.08)	(0.15)	(0.10)	(0.11)	(0.13)	(0.10)	(0.15)	(0.14)
Constant	-1.72**	-1.72	-0.54	-1.38	3.95*	3.84***	2.16*	-2.46**	-2.28**	-5.66**
	(0.76)	(1.47)	(0.73)	(1.07)	(2.14)	(1.38)	(1.21)	(1.02)	(1.07)	(2.47)
MARKUP										
dopenness_	-0.29***	-0.04	-0.02	0.04	-0.07	-0.02	-0.09***	-0.04	-0.11**	0.03
	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.02)	(0.02)	(0.05)	(0.05)	(0.05)
$\Delta \ln D_{it}$	-0.03	0.00	-0.02	0.02	-0.04*	-0.01	-0.02	-0.01	-0.02	0.00
	(0.02)	(0.02)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
$\ln \mu_{it-1}$	-0.71***	-0.64***	-0.16**	-0.19***	-0.35***	-0.34***	-0.52***	-0.40***	-0.56***	-0.64***
	(0.10)	(0.11)	(0.06)	(0.06)	(0.10)	(0.06)	(0.09)	(0.09)	(0.10)	(0.09)
lopenness_	-0.05***	0.00	0.02	0.03	-0.03*	-0.00	-0.02	0.01	-0.04	0.02
	(0.02)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.04)	(0.02)	(0.03)
$\ln L_{it-1}$	-0.03	-0.03	-0.01	-0.04	0.02	-0.06***	-0.03	-0.05	0.00	-0.06***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.06)	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)
Constant	0.43	0.37	0.17	0.49	-0.21	0.79***	0.35	0.66	-0.02	0.82***
	(0.26)	(0.34)	(0.29)	(0.32)	(0.69)	(0.19)	(0.22)	(0.41)	(0.29)	(0.26)
Observations	84	83	80	84	80	84	76	76	73	84
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Instrumented openness	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 9: Baseline estimation based on value added import penetration ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	1012	1315	1618	2000	2100	2223	2425	2627	2800	2930
PRICE										
$\Delta \ln z_{it}$	-0.44***	-0.35***	0.12	0.06	-0.20**	-0.12***	0.34***	0.01	0.63	-0.03
	(0.10)	(0.05)	(0.12)	(0.14)	(0.09)	(0.04)	(0.08)	(0.07)	(0.39)	(0.05)
$\Delta \ln \mu_{it}$	0.80**	0.45	1.09*	-0.56	0.30	1.01***	0.85*	0.09	-0.27	0.44
	(0.36)	(0.41)	(0.59)	(0.40)	(0.31)	(0.17)	(0.49)	(0.25)	(0.39)	(0.31)
$\ln \frac{\text{PPI}_{it-1}}{\text{PPItot}_{t-1}}$	-0.53***	-0.34***	-0.24**	-0.56***	-0.20***	-0.06	-0.09	-0.10*	0.17	-0.08
	(0.09)	(0.07)	(0.12)	(0.21)	(0.06)	(0.05)	(0.06)	(0.06)	(0.40)	(0.06)
$\ln z_{t-1}$	-0.20***	-0.12***	-0.07	0.06	-0.03	0.01	0.15***	-0.10**	0.23	0.03
	(0.06)	(0.04)	(0.08)	(0.07)	(0.07)	(0.02)	(0.04)	(0.05)	(0.20)	(0.03)
$\ln \mu_{it-1}$	0.45*	0.45	0.20	-0.03	0.16	0.38***	0.30	0.09	-0.18	0.37
	(0.27)	(0.35)	(0.13)	(0.14)	(0.21)	(0.12)	(0.32)	(0.16)	(0.30)	(0.26)
$\ln L_{it-1}$	0.07*	0.01	-0.07*	-0.14**	0.10	0.02	0.13***	0.10	-0.21	-0.13***
	(0.04)	(0.05)	(0.04)	(0.06)	(0.08)	(0.03)	(0.03)	(0.06)	(0.14)	(0.05)
Constant	-0.15	0.33	1.11**	-11.40***	14.46***	-0.38	-2.30***	-0.87	1.57*	1.51***
	(0.38)	(0.58)	(0.51)	(2.49)	(4.76)	(0.32)	(0.49)	(0.62)	(0.89)	(0.50)
LABOUR PRODUCTIVITY										
$\Delta \ln \theta_{VA,it}$	0.04	0.05	0.03	-0.13	0.23	-0.59***	0.78***	-0.19	-0.09	-0.66***
	(0.07)	(0.12)	(0.10)	(0.24)	(0.32)	(0.14)	(0.15)	(0.19)	(0.15)	(0.14)
$\Delta \ln D_{it}$	0.07*	0.00	-0.03	0.00	-0.04	-0.01	0.19*	-0.01	0.10	-0.02
	(0.04)	(0.05)	(0.05)	(0.14)	(0.05)	(0.08)	(0.11)	(0.09)	(0.08)	(0.09)
$\ln z_{t-1}$	-0.42***	-0.43***	-0.12	-0.36***	-0.67***	-0.20***	-0.51***	-0.29***	-0.36***	-0.44***
	(0.09)	(0.09)	(0.08)	(0.08)	(0.13)	(0.06)	(0.11)	(0.09)	(0.08)	(0.08)
$\ln \theta_{VA,it-1}$	-0.03	-0.11*	0.15*	-0.11	0.18	-0.31***	0.22	-0.26	0.01	-0.76***
	(0.03)	(0.06)	(0.08)	(0.11)	(0.17)	(0.10)	(0.15)	(0.16)	(0.10)	(0.15)
$\ln L_{it-1}$	0.23***	0.50***	0.04	0.27**	0.10	-0.41***	-0.08	0.37***	0.39***	0.57***
	(0.08)	(0.15)	(0.07)	(0.12)	(0.24)	(0.11)	(0.11)	(0.12)	(0.10)	(0.20)
$\ln \frac{w_{it-1}}{\text{PPI}_{it-1}}$	0.29***	0.35***	0.05	0.11	0.20	0.12	-0.04	0.22*	0.17	0.06
	(0.09)	(0.11)	(0.09)	(0.17)	(0.14)	(0.08)	(0.14)	(0.13)	(0.13)	(0.13)
Constant	-2.01***	-5.28***	-0.73	-1.56	0.45	6.99***	2.51**	-3.00***	-3.92***	-1.75
	(0.75)	(1.57)	(0.71)	(1.16)	(3.09)	(1.73)	(1.07)	(1.03)	(0.95)	(2.17)
MARKUP										
$\Delta \ln \theta_{VA,it}$	-0.12***	-0.07***	-0.03	0.00	-0.12	-0.07***	-0.14***	-0.19***	-0.19***	-0.03
	(0.03)	(0.02)	(0.04)	(0.07)	(0.09)	(0.02)	(0.03)	(0.07)	(0.05)	(0.03)
$\Delta \ln D_{it}$	0.00	-0.00	-0.02	0.01	-0.02	-0.01	-0.02	-0.02	0.02	-0.00
	(0.02)	(0.01)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
$\ln \mu_{it-1}$	-0.56***	-0.81***	-0.20**	-0.20**	-0.51***	-0.33***	-0.46***	-0.43***	-0.52***	-0.65***
	(0.10)	(0.11)	(0.08)	(0.08)	(0.12)	(0.07)	(0.10)	(0.10)	(0.10)	(0.09)
$\ln \theta_{VA,it-1}$	-0.03*	-0.04***	0.01	0.02	0.03	-0.02*	-0.03	-0.03	-0.10**	0.02
	(0.02)	(0.01)	(0.03)	(0.04)	(0.04)	(0.01)	(0.03)	(0.06)	(0.04)	(0.03)
$\ln L_{it-1}$	0.00	0.04*	-0.01	-0.05	-0.08*	-0.07***	-0.03	-0.05	0.03	-0.08***
	(0.03)	(0.02)	(0.02)	(0.04)	(0.05)	(0.01)	(0.02)	(0.04)	(0.03)	(0.02)
Constant	0.16	-0.26	0.08	0.60	0.98**	0.96***	0.57***	0.75**	0.06	0.95***
	(0.27)	(0.23)	(0.26)	(0.39)	(0.48)	(0.19)	(0.20)	(0.37)	(0.29)	(0.23)
Observations	74	73	70	74	70	74	66	66	63	74
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 10: Baseline estimation based on instrumented value added import penetration ratio

VARIABLES	(1) 1012	(2) 1315	(3) 1618	(4) 2000	(5) 2100	(6) 2223	(7) 2425	(8) 2627	(9) 2800	(10) 2930
PRICE										
$\Delta \ln z_{it}$	-0.38***	-0.35***	0.03	-0.06	-0.30***	-0.10***	0.03	0.06	0.16**	-0.02
	(0.06)	(0.04)	(0.09)	(0.07)	(0.06)	(0.04)	(0.03)	(0.04)	(0.07)	(0.04)
$\Delta \ln \mu_{it}$	0.81***	0.66**	0.25	-0.43**	-0.12	0.88***	-0.67***	0.20*	0.10	0.73***
	(0.23)	(0.31)	(0.20)	(0.22)	(0.22)	(0.15)	(0.21)	(0.11)	(0.10)	(0.26)
$\ln \frac{\text{PPI}_{it-1}}{\text{PPItot}_{t-1}}$	-0.51***	-0.36***	-0.30***	-0.55***	-0.19***	-0.06	-0.13***	-0.08*	-0.13	-0.09
	(0.08)	(0.07)	(0.10)	(0.13)	(0.06)	(0.05)	(0.05)	(0.05)	(0.10)	(0.06)
$\ln z_{t-1}$	-0.17***	-0.13***	-0.12*	0.02	-0.10*	0.01	0.01	-0.08**	0.03	0.05*
	(0.05)	(0.04)	(0.06)	(0.04)	(0.06)	(0.02)	(0.03)	(0.03)	(0.04)	(0.03)
$\ln \mu_{it-1}$	0.41**	0.64**	0.10	0.00	-0.08	0.38***	-0.53***	0.12	0.08	0.59***
	(0.19)	(0.29)	(0.11)	(0.10)	(0.17)	(0.11)	(0.16)	(0.09)	(0.10)	(0.22)
$\ln L_{it-1}$	0.06*	0.03	-0.06	-0.11**	0.12	0.02	0.06**	0.09*	-0.06	-0.15***
	(0.03)	(0.05)	(0.04)	(0.05)	(0.08)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)
Constant	-0.13	0.15	1.20***	-11.09***	10.37**	-0.31	-0.73**	-0.74	0.54	1.56***
	(0.31)	(0.53)	(0.46)	(2.19)	(4.30)	(0.30)	(0.34)	(0.47)	(0.33)	(0.47)
LABOUR PRODUCTIVITY										
$\Delta \ln \theta_{VA,it}$	0.14	-0.04	0.09	0.27	0.42	-1.18***	0.92***	-0.06	-0.15	-0.57**
	(0.11)	(0.28)	(0.13)	(0.56)	(0.53)	(0.33)	(0.17)	(0.23)	(0.27)	(0.27)
$\Delta \ln D_{it}$	0.09*	-0.00	-0.04	0.03	-0.04	0.02	0.14	-0.02	0.16*	-0.02
	(0.05)	(0.06)	(0.06)	(0.15)	(0.05)	(0.09)	(0.12)	(0.09)	(0.08)	(0.09)
$\ln z_{t-1}$	-0.36***	-0.45***	-0.12	-0.36***	-0.68***	-0.20***	-0.46***	-0.27***	-0.43***	-0.44***
	(0.09)	(0.10)	(0.08)	(0.09)	(0.14)	(0.07)	(0.11)	(0.09)	(0.09)	(0.08)
$\ln \theta_{VA,it-1}$	-0.02	-0.13*	0.17**	-0.08	0.19	-0.59***	0.17	-0.18	-0.01	-0.73***
	(0.04)	(0.07)	(0.08)	(0.12)	(0.20)	(0.17)	(0.16)	(0.17)	(0.11)	(0.17)
$\ln L_{it-1}$	0.22***	0.54***	0.06	0.30**	0.18	-0.67***	-0.05	0.34***	0.34***	0.57***
	(0.08)	(0.16)	(0.08)	(0.13)	(0.30)	(0.18)	(0.12)	(0.12)	(0.11)	(0.20)
$\ln \frac{w_{it-1}}{\text{PPI}_{it-1}}$	0.22**	0.36***	0.02	-0.01	0.21	0.16	-0.10	0.19	0.34**	0.05
	(0.10)	(0.14)	(0.09)	(0.21)	(0.13)	(0.10)	(0.15)	(0.13)	(0.16)	(0.14)
Constant	-1.97**	-5.60***	-0.93	-1.69	-0.54	11.27***	2.35**	-2.98***	-3.53***	-1.97
	(0.78)	(1.62)	(0.74)	(1.21)	(3.82)	(2.89)	(1.10)	(1.04)	(0.99)	(2.32)
MARKUP										
$\Delta \ln \theta_{VA,it}$	-0.18***	-0.14***	-0.08*	-0.05	-0.18	-0.09***	-0.15***	-0.18**	-0.22***	0.04
	(0.04)	(0.04)	(0.05)	(0.14)	(0.12)	(0.03)	(0.03)	(0.07)	(0.06)	(0.05)
$\Delta \ln D_{it}$	-0.00	-0.00	-0.01	0.01	-0.02	-0.01	-0.03	-0.03	0.02	-0.00
	(0.02)	(0.01)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
$\ln \mu_{it-1}$	-0.57***	-0.81***	-0.22***	-0.20**	-0.52***	-0.33***	-0.48***	-0.43***	-0.49***	-0.67***
	(0.10)	(0.12)	(0.08)	(0.08)	(0.12)	(0.07)	(0.10)	(0.10)	(0.10)	(0.09)
$\ln \theta_{VA,it-1}$	-0.03*	-0.04***	0.00	0.02	0.02	-0.03*	-0.05	-0.01	-0.09**	0.04
	(0.02)	(0.01)	(0.04)	(0.04)	(0.04)	(0.01)	(0.03)	(0.06)	(0.05)	(0.03)
$\ln L_{it-1}$	-0.00	0.04*	-0.01	-0.06	-0.08*	-0.07***	-0.03	-0.06	0.03	-0.08***
	(0.03)	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
Constant	0.21	-0.24	0.13	0.67*	1.03**	0.95***	0.60***	0.79**	0.13	0.88***
	(0.28)	(0.24)	(0.26)	(0.39)	(0.49)	(0.19)	(0.20)	(0.37)	(0.29)	(0.23)
Observations	74	73	70	74	70	74	66	66	63	74
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Instrumented openness	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

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