Trade with China and Skill Upgrading: Evidence from Belgian Firm Level Data

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Abstract

We use Belgian firm level data over the period 1996-2007 to analyze the impact of imports from China and other low wage countries on firm growth, exit, and skill upgrading. We distinguish the impact of imports into two different channels: industry-level import competition and firm-level outsourcing. We find that imports from China are much more important than imports from other low-wage countries. Industry-level import competition from China reduced firm employment and induced skill upgrading. Import competition from China alone can explain around 30 percent of the total skill upgrading in Belgian manufacturing during 1996-2007. Our IV results confirm the ambiguous role of outsourcing in firm employment growth, but we also find that outsourcing to China will increase the relative employment of non-production workers and is beneficial for firm survival.

Keywords: import competition; outsourcing; China; skill upgrading.

JEL Classification: F11, F14, F16

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1 Introduction

This paper investigates the effects of industry-level import competition and firm-level outsourcing with China and other low-wage countries on firm performances using firm-level data from Belgian manufacturing during the period 1996-2007. While we also study the effect of trade on employment growth and firm exit, the main contribution of our paper is to provide evidence on the effect of trade on within-firm skill upgrading. To the best of our knowledge, we also the first to provide IV estimates of the causal effect of firm-level outsourcing.

Since late 1980s, there has been a rising concern about the deteriorating situations of the low-skilled workers in the developed countries. Both job opportunities and wages for low-skilled workers are decreasing relative to high-skilled workers. Two explanations most often mentioned are: skill-biased technological change (or SBTC) and increased trade with developing countries. In the 1980s and 1990s, the dominant view among labor economists (and also some trade economists) was that technology was more important than trade as a driving force behind changes in the structure of employment.

However, some recent developments in trade theory, outlined in Section 2, have re-shifted the attention to the role of trade. Besides theory some recent phenomena, like the recent rapid growth of countries like India and China, have also contributed to the revival of the trade-based explanation. Compared to the main western countries' trade partners in the 80's, developing countries like India and China are endowed with a much bigger stock of low-skilled labor force at very competitive wages. The dramatically growing trade volumes with such countries may have thus affected low-skilled workers in the developed countries more than ever.

While studies about trade and skill upgrading are already abundant in the literature (see, for example, Feenstra and Hanson [1999] for the US, Hijzen et al. [2005] for the UK, Falk and Koebel [2002] for Germany, etc.), we innovate with respect to previous contributions in several ways.

First, we use both industry-level and firm-level trade data, as well as data on firm-level employment structure, to identify the impact of trade on skill upgrading. Indeed, due to data limitation, most of the research in the literature have been carried out at industry-level (with a few exceptions such as Biscourp and Kramarz, 2007). By contrast, labor economists have provided a sizeable amount of firm-level evidence relating technological change and within firm skill upgrading[1] The failure to use firm-level data leads to at least two drawbacks. One, industry-level studies do not allow to distinguish whether skill upgrading is taking place within firms or between firms. Two,

[1]See, for example, Levy and Murnane (1996), Doms, Dunne and Troske (1997), and Bresnahan, Brynjolfsson, and Hitt (2002).

it is possible to split trade into import competing goods and outsourcing only by looking at the level of the firm. Biscourp and Kramarz (2007), which is arguably the closest related paper to ours, provide a descriptive view of the impact of outsourcing on French manufacturing while our purpose here is to identify the causal relationship of outsourcing (as well as import competition) on skill upgrading by using the IV method.[2]

Second, we distinguish China from other low wage counties. While the distinction between imports from low-wage and non-low-wage countries is made by a few other papers in the skill upgrading literature, the distinction between imports from China and other low-wage countries is made, in the context of trade-induced technological change, only in Bloom et al. (2008). However, as Rodrik (2006) and Schott (2008) show, Chinese exports have different characteristics with respect other other low-wage countries. Chinese exports are in fact more sophisticated and show more overlap with the products of developed countries. Indeed, our results suggest that treating China as a different animal is important.

Third, while most of the previous studies have used data up to the late 1990s, we use much more recent data from 1996 to 2007. This is important since trade with low-wage countries, and especially with China, has dramatically increased during the past decade. Fourth we use workers' education as a measure of skills, which is much more accurate than the crude distinction between production and nonproduction workers used in the literature (Feenstra and Hanson, 1996; Machin and Van Reenen, 1998). However, in order to compare with previous research, we also report findings for production and non-production workers.

Following is a preview of our main findings. First, our results confirm that trade with low-wage countries is important in explaining skill upgrading. According to our IV estimations, imports from China alone can explain around 30 percent of the total skill upgrading in Belgian manufacturing during the period 1996-2007. Second, imports from China is much more important than imports from other low-wage countries, both in explaining skill upgrading and in explaining firm employment growth. Third, firm-level outsourcing to China will also induce skill upgrading and is beneficial for firm survival.

The remainder of this paper is organized as follows. In Section 2, we outline the theoretical background of our research. Section 3 provides a description of the data. Section 4 describes

[2]There exist some firm-level studies relating skill upgrading within multi-national firms, such as Head and Ries (2002) for Japanese multinationals, Hansson (2005) for Swedish multinationals, and Castellani et al. (2008) for Italian multinationals. However, such contributions focus on a special group of firms (multinationals) only and it is thus questionable how to extend results to a larger spectrum of firms. Our paper also relates to some firm-level analysis about developing countries and trade, such as Bustos (2005) for Argentina and Eric Verhoogen (2008) for Mexico.

the econometric models and discusses main results. Finally, Section 5 concludes and points out directions for future research.

2 Theoretical Background

2.1 Trade and Skill Upgrading

As already mentioned, the favorite explanation for the increase in relative demand of skilled workers in developed countries is the 'skill-biased technological change' (SBTC). The main reasons that led economists to favor the SBTC explanation are as follows. First, skill upgrading was found to happen mainly within industries rather than between industries, which contrasts the prediction of traditional Heckscher-Ohlin (HO) theory (Berman, Bound and Griliches, 1994). Second, skill upgrading not only occurred in developed countries but also in developing countries, which is again against the prediction of HO theory. Third, product-price studies found that the prices of labor intensive goods did not decrease significantly relative to skill intensive goods in developed countries. This violates the prediction of the Stolper-Samuelson theorem (Lawrence and Slaughter, 1993, Leamer, 1996, and Baldwin and Cain, 2000). Finally, factor content calculation revealed that trade with developing countries was not important enough to have a major impact on employment structure in developed countries (see, e.g., Krugman, 1995).

However, some recent developments in trade theory have made these critiques questionable. First, trade liberalization may have altered the returns of different available technologies and lead to a skill-biased technological change that has ultimately pushed to a skill upgrading (Wood, 1998, Acemoglu, 2003, Ekholm and Midelfart, 2005, Bloom et al., 2008). This hypothesis makes the trade-based explanation consistent with the technology-based explanation. Second, trade economists have recently extended the traditional HO model and shifted the focus away from trade in goods to trade in tasks, or offshoring (Feenstra and Hanson, 1996, Feenstra and Hanson, 2001, Grossman and Rossi-Hansberg, 2008). This shift in focus makes trade-induced *within* industry skill upgrading possible. Trade in tasks also allows to explain why both developed and developing countries can experience skill upgrading after trade liberalization with the reason being that tasks that are newly offshored to developing countries tend to be more skill intensive than those already performed in developing countries. Moreover, since the production of skill intensive goods can also benefit from trade by outsourcing its most labor intensive stages to developing countries, prices can fall and this make it difficult to argue about any clear pattern in the prices of labor and skill intensive goods. Finally, offshoring (or production fragmentation), as Krugman (2008) pointed out, will also lead the traditional factor content calculation, which led Krugman (1995) to conclude that trade with developing countries was not important, to underestimate the effect of trade on the change of employment structure.

In short, there are reasons to believe that trade is important to explaining employment structure changes in the developed countries. However, we still have to spend few words about the mechanisms through which trade may induce *within firm* skill upgrading, since most of the above mentioned debate has an industry-level focus.

At first glance, although we have reasons to believe that trade with low-wage countries will increase the relative demand for skilled workers in developed countries, it does not necessarily mean that we should observe within firm skill upgrading. If firms are heterogeneous and face difficulties in changing their technology and/or their production process then the bulk of skill upgrading within an industry might happen *across firms*. However, there are at least three possibilities to rationalize within firm skill upgrading. First, trade may induce within firm technology upgrading, which may increase firm's relative employment of skilled workers. Second, multi-product firms may specialize in more skill intensive products when facing competition from low-wage imports, which will also induce within firm skill upgrading. Finally, firms have also the option to outsource the labor intensive stages of the production process to low-wage countries.

2.2 China is Different

There are at least two reasons to consider that with China separately in the analysis. First, Chinese exports are large in volume and increasing very quickly and China has a massive amount of un-skilled labor force which is paid a very competitive wage. All these aspects are worth to be considered. Second, the idea of including Chinese exports separately has a deeper foundation. Schott (2008) shows that China's export similarity with OECD countries, as measured by traded product's overlap, is higher than that of other non-OECD countries. Furthermore, China's similarity with OECD countries is growing faster that with respect to any other country. These findings highlight the fact that firms in developed countries may 'feel' more competitive pressure from Chinese exports than from other low-wage countries' exports.

On the other hand, some researches suggest that export data may overestimate the competitiveness of China in the international market. Van Assche et al. (2008a, 2008b) argue that more than a half of Chinese exports is processing trade of goods for which most of the value added comes from imports (especially imports from other east Asian countries).

Given the ambiguity about the competitiveness of Chinese exports, it will be interesting to find out in our data whether Chinese exports have a different effects on firms in developed countries compared to exports of other low-wage countries. While a lot of studies have been carried out to explain why Chinese exports are special (Branstetter and Lardy, 2006, Rodrik, 2006, and Xu and Lu, 2009), very little is known about whether the effects of Chinese exports in developed countries are also 'special'.

3 Data

3.1 Industry-level Trade and Production Data

The industry-level imports data comes from the ComExt Intra- and Extra-European Trade Data, which is a harmonized and comparable statistical database for EU countries merchandize trade. The database is compiled by Eurostat, using statistics from the member states. We extract data on Belgian manufacturing imports by country of origin and by 4-digit NACE rev.1 industry for the period of 1995-2007. Then we categorize countries into four groups: OECD countries, China, other low-wage countries (BJS), and the rest of the world. The definition for low-wage country is from Table 1 in Bernard et al. (2006), where they define countries with less than 5 percent of U.S. per capita GDP in 1992 as low-wage countries. According to such definition, major labor-abundant countries like China, India and Vietnam are all classified as low-wage. Unlike Bernard et al. (2006), we distinguish China from BJS countries.

We use the variable import share to measure the degree of import competition from different country groups at the four digit NACE code industry level. Let $IMPSHARE_{jt}^c$ denote the import share of country group c of the goods produced by industry j in year t. Import share is defined as following:

$$IMPSHARE_{jt}^c = \frac{M_{jt}^c}{M_{jt} + P_{jt}}$$

where M_{jt}^c and M_{jt} represent (respectively) the value of imports from country group c and all countries. P_{jt} is domestic production of industry j in year t and comes from the Prodcom Production Data also provided by Eurostat.

3.2 Firm-level data

Manufacturing firms data come from the Central Balance Sheet Office at the National Bank of Belgium (NBB). It collects the annual accounts of all companies registered in Belgium. Most limited liability enterprizes, plus some other firms, have to file their annual accounts and/or consolidated group accounts with the Central Balance Sheet Office every year. Large companies have to file the full-format balance sheet. Small companies may use the abbreviated format.[3] There are some exceptions. Some enterprizes do not have to file any annual accounts.[4] For this study, we selected those companies with their main activity in the manufacturing sector that filed a full-format or abbreviated balance sheet between 1996 and 2007. This provides us with about 15,000 firms per year for which all the relevant information is available. The data coverage, compared with other European firm-level data, is particularly good. For example, despite France has almost 6 times more manufacturing employment than Belgium, the well known French EAE manufacturing firms database contains data on about 'only' 25,000 firms.

Using the information from the balance sheet data, we construct a battery of firms' characteristics. Wage per worker is used as a proxy for skill intensity. Tangible assets per worker is used as measure for capital intensity. Value added per worker and log employment are used as measures for labor productivity and firm size, respectively. As standard in the empirical Industrial Organization literature we also consider firm age. Finally, we use intangible assets per worker to control for technology-related spending within the firm.

As for dependant variables, employment growth is defined as log difference of firm's total employment between year t and year $t+1$. Firm exit is defined as disappearing from the data set for two consecutive years. Share of production workers is defined as the ratio of manual workers to total employment. While most of the papers in the literature only use the share of production workers to measure skill, we are able to do better thanks to a unique feature of the data. In particular, we are able to track, for firm with full-format balance sheets, the education level of workers that enter or exit the workforce of a firm in each year. Using this information, we are able to construct a proxy for the share of skilled workers (see section 4) based on education. We define a skilled worker as a worker having more than secondary school education (ISCED levels 5

[3]Under the Belgian Company Code, a company is regarded as large if: the annual average of its workforce exceeds 100 persons or more than one of the following criteria are exceeded: 1) annual average of workforce: 50; 2) annual turnover (excluding VAT): 7,300,000 euro; 3) balance sheet total: 3,650,000 euro.

[4]These include: sole traders; small companies whose members have unlimited liability: general partnerships, ordinary limited partnerships, cooperative limited liability companies; large companies whose members have unlimited liability, if none of the members is a legal entity; public utilities; agricultural partnerships; hospitals, unless they have taken the form of a trading company with limited liability; health insurance funds, professional associations, schools and higher education institutions.

and 6).

Firm-level import data are also provided by the NBB. More precisely, the information comes from intra-EU (Intrastat) and extra-EU (Extrastat) trade declarations that cover the universe of trade transactions.[5] The two sources of information were merged using the value added tax number, which identifies each firm. Data are extremely rich and comparable in quality to the widely known French Customs data used in Eaton et al (2004) among others. Imports of each firm are recorded each year at the 8-digit CN code level by country of origin. In order to measure outsourcing, following Biscourp and Kramarz (2007), we first divide firm's imports into two categories: imports of finished goods and imports of intermediate goods. Finished goods are defined as CN8 products that correspond to the same 3-digit NACE code of the main activity of the firm.[6] Other imports are defined as imports of intermediate goods. Then outsourcing of finished goods to country group c is defined as:

$$OUTFIN_{it}^{c} = \frac{MF_{it}^{c}}{N_{it}}$$

Where MF_{it}^{c} is imports of finished goods from country group c, N_{it} is total turnover. Outsourcing of intermediate goods from country group c is defined in a similar way.

3.3 Instrumental Variables

In order to solve the potential endogeneity problem of import variables, we use exchange rate and ad valorem tariff data to construct instrumental variables for both industry-level and firm-level imports. Exchange rate data comes from the IFS database, compiled by the IMF. Ad valorem tariff data is from the online customs tariff database, also called the TARIC, provided by European Commission. Such dataset integrates all tariff-like restrictions applying to goods that enter the EU market by country of origin and CN8 code for several years. Although the database contains information about many trade restrictive measures (like quotas, weight-based tariff, etc.) we only use ad valorem tariffs to construct our IVs. The construct a comprehensive trade barrier index that utilizes information on all trade measures is in fact both cumbersome and highly questionable. For this reason we decided to focus on ad valorem tariff data only.

Using country specific exchange rates data we have constructed country-group/industry spe-

[5] For intra-EU trade there are relatively small thresholds above which a legal obligation to declare arises. However, in many cases firms do provide information about their trade even when they are below the threshold. Extra-EU is virtually exhaustive with the legal requirement for declaration being a value of 1,000 euros or more or a weight of 1,000 kg or more.

[6] A precise correspondence Table between CN and NACE codes across time have been provided by the NBB.

cific and country-group/firm specific IVs for industry-level imports and firm-level imports by using trade ratios as weights. We denote by $IVEXCH_{jt}^c$ the exchange rate IV for import share of country group c in industry j on year t, and by $IVEXCHFIN_{it}^c$ the exchange rate IV for outsourcing of finished goods from country group c in firm i on year t (firm-level exchange rate IVs for outsourcing of intermediate goods are constructed in similar way). We construct them as follows:

$$IVEXCH_{jt}^c = \sum_{h \in c} \frac{M_{j0}^h}{M_{j0}} E_t^h$$

$$IVEXCHFIN_{it}^c = \sum_{h \in c} \frac{MF_{i0}^h}{N_{i0}} E_t^h$$

where h denotes country, E denotes exchange rate, 0 denotes the initial value (i.e., value in 1995) of the corresponding variable. We use the initial trade ratio rather than current trade ratio, because current trade ratio may be endogenous. We use turnover rather than total imports as the denominator in the second equation because otherwise the variable would not be defined for non-trading firms.

Similarly, denoting $IVDUTY_{jt}^c$ as tariff IV for import share of country group c in industry j on year t, and $IVDUTYFIN_{it}^c$ as tariff IV for outsourcing of finished goods from country group c in firm i on year t (IVs for outsourcing of intermediate goods are constructed similarly), we construct IVs using tariff data as follows (where D denotes ad valorem tariff, p denotes an 8-digit CN product code , and f denotes finished goods):

$$IVDUTY_{jt}^c = \sum_{h \in c, p \in j} \frac{M_{p0}^h}{M_{j0}} D_{pt}^h$$

$$IVDUTYFIN_{it}^c = \sum_{h \in c, p \in f} \frac{MF_{pi0}^h}{N_{i0}} D_{pt}^h$$

4 Results

We look at the impact of import competition and outsourcing on four firm adjustment margins: employment growth, share of blue collar workers, share of skilled (highly educated) workers and firm exit. The explanatory variables are similar in all equations, i.e., firm-level controls, industry-level imports and firm-level imports.

$$\Delta \ln emp_i^{t:t+1} = c + V_{it}^{'}\alpha + T_{jt}^{'}\beta_1 + T_{it}^{'}\beta_2 + \delta_t + \delta_i + \varepsilon_{it} \tag{1}$$

Equation 1 is based on Bernard et al. (2006). The dependant variable is the log difference of firm i employment between year t and year $t+1$. V_{it} is a vector of firm characteristics, including firm size (log employment), age, labor productivity, capital intensity, skill intensity and intangible capital intensity (which is used as control for technology). T_{jt} is a vector of industry-level trade variables which measure import competition from different country groups. T_{it} is a vector of firm-level trade variables including variables that measure imports of intermediate or finished goods from different country groups. δ_t is time fixed effect and δ_i is firm fixed effect.

$$S_{it} = c + V_{it}^{'}\alpha + T_{jt}^{'}\beta_1 + T_{it}^{'}\beta_2 + \delta_t + \delta_i + \varepsilon_{it} \tag{2}$$

Equation 2 is similar as Equation 1, but the dependant variable now becomes the skill structure of firm employment. We use two measures for S_{it}. One is the share of production workers and the other is the share of skilled workers (workers with higher than secondary school education). The share of production workers can be calculated directly from the data, but share of skilled workers is not directly available. We have the educational level of workers entering and quitting a firm in each year that we use to construct a proxy for S_{it} based on the following decomposition:

$$S_{it} = \frac{skill_{it}}{emp_{it}} = \frac{skill_{i0}}{emp_{it}} + \frac{skill\_net\_flow_i^{0:t}}{emp_{it}}$$

where $skill$ is the number of skilled workers, emp is the total employment, and $skill\_net\_flow_i^{0:t}$ is the net inflow (i.e., inflow minus outflow) of skilled workers between year 0 and year t for firm i. The only thing on the righthand side of the equation that is unobservable in our data is $skill_{i0}$, which is the initial number of skilled workers in firm i. We used the initial number of non-production workers as a proxy for $skill_{i0}$.

Finally, we estimate a linear probability model for firm exit:

$$Exit_{it} = c + V_{it}^{'}\alpha + T_{jt}^{'}\beta_1 + T_{it}^{'}\beta_2 + \delta_t + \delta_i + \varepsilon_{it} \tag{3}$$

Where $Death_{it}$ is a dummy indicating firm exit. We defined a firm as exiting in t if it disappears from the data set for at least two consecutive years (t and $t+1$).

For all the three equations above, we used exchange rate and ad valorem tariff data to construct IV's for industry-level and firm-level trade. The estimation results are shown in Tables 1 to 4.

Table 1 shows the results for equation 1. Tables 2 and 3 show the results for equation 2, while Table 4 contains the results for equation 3. In each Table, the first two columns are the results of 'within' estimations. Column 3 and 4 instruments industry-level trade. In column 3 we use only tariffs and exchanges rates as instruments while in column 4 we also included lagged trade as an additional instruments. Column 5 and 6 instrument both industry-level and firm-level trade, with column 6 including both tariff/exchange rates and lagged industry-level trade as instruments. For firm-level trade in columns 5 and 6 we only instrument imports from China and BJS countries because instruments for imports from OECD and other countries are weak. Firm-level outsourcing is always instrumented with both tariff/exchange rates and its lag.

We use robust standard errors and statistics. At the bottom of each Table we report the under-identification (Kleibergen-Paap LM), weak identification (Kleibergen-Paap Wald F), and over-identification (Hansen J) statistics and p-vales. The number of first stage regressions and those among them with an F-test significant the the 5% confidence level are also indicated along with the number of observations, firms, and the R^2. Results indicates that our instruments for industry-level trade are strong but there might be an issue of weak instrumentation for firm-level trade in some specifications. At the same time, the Hansen J statistic sometimes rejects the null of over-identification suggesting that more than a single set of estimates one should evaluate the broad picture emerging from all different estimations.

4.1 Employment Growth

Table 1 reports the relationship between firm employment growth and imports from different country groups both at the industry- (import competition) and firm- (outsourcing of intermediate and finished goods) level. The first two columns report within estimates while the remaining four columns report IV estimates. Both sets of regressions include year and firm fixed effects to control for aggregate trends in manufacturing employment growth and unobserved (time-invariant) firm characteristics.

Within estimation results reveal that employment growth is negatively affected by import competition from both China and BJS countries. Estimates for firm-level trade in column 2 indicate that outsourcing of finished (intermediate) goods from OECD (BJS and other countries) positively affect firm growth. Other trade variables, at either industry- or firm- level, are not significant.

IV estimates in column 3 to 6 show that, at the industry level, only import competition from China has a robust significant negative effect on employment growth. Imports from BJS countries have significant effect only when the lagged value of industry-level trade is included as an additional instrument (column 4 and 6). Including lagged value as instruments may (as suggested by the Hansen J statistics) exacerbate endogeneity problem and we consider column 3 and 5 as our preferred specifications. The different impact of imports from China with respect to BJS countries is consistent with Schott (2006) argument. Chinese exported products are more sophisticated than those of BJS countries products and are thus more likely to compete with Belgian products.

As for outsourcing, IV estimates in columns 5 and 6 show that outsourcing from OECD and BJS countries is no longer significant and only imports of intermediate goods from other countries still have significant positive effect on employment growth (although this latter is not instrumented). The ambiguous effect of outsourcing on employment is in line with previous industry-level findings in the literature (Amiti and Shang-Jin Wei, 2005). Meanwhile, the literature suggests that outsourcing might have a clearer impact on the workforce composition. In particular, it can increase the relative share of high-skilled jobs (Crino, 2008). This composition effect is consistent with the results shown in the next Section.

4.2 Skill upgrading

Tables 2 and 3 summarize the relationship between import competition, outsourcing and firm's relative demand for skilled workers. The first two columns of each table report the within estimator coefficients while the remaining columns report IV results In all the regressions, we include year and firm fixed effects to control for aggregate trends in firm's demand for skilled workers and unobserved (time-invariant) firm characteristics.

From the first two columns in Tables 2 and 3, one can see that only import competition from China has a positive and significant effect on both measures of 'skill upgrading' within the firm. The coefficient is in fact negative for the share of blue-collar workers and positive for the share of skilled (i.e. having more than a secondary education) workers. As for firm-level imports by country groups, estimates indicate that outsourcing generally induce within-firm skill upgrading by reducing the share of production workers. Results for the share of skilled workers are by contrast not significant.

From the IV estimates, we get broadly similar results. For industry-level trade, we again find that only Chinese imports have a significant effect on the workforce composition leading to upgrading, both in terms of occupation and education. If we consider the point estimate from column 5 of Table 3, imports from China alone can explain around 30% of the total skill upgrading in Belgian manufacturing industries during the period 1996-2007. For firm-level trade, we find evidence that outsourcing of intermediate goods from China decreases the share of production workers. China is again different as outsourcing from BJS is never significant. On the other hand outsourcing of finished (intermediate) goods from OECD countries induces occupational upgrading (downgrading), which suggest that China is also different from OECD countries. However, for this last set of results caution is need as firm outsourcing with this country group is not instrumented. Finally, outsourcing seems to have no effect on the share of skilled workers.

Together with the results in Section 4.1, we can deduce that import competition from China reduces firm employment but leads firms to upgrade their workforce both in terms of occupation types and education. Meanwhile, firm-level outsourcing to China will only change the occupational composition of firm employment, but not the level of employment.

4.3 Firm exit

Table 4 shows the relationship between trade and firm exit. Within estimates in columns 1 and 2 show that import competition from China and BJS countries are not correlated with firm exit. However, industry-level imports from OECD and other countries are positively and significantly correlated with firm exit. For firm-level trade, one can see that outsourcing is (whenever significant) negatively related to firm exit. Outsourcing of finished goods from both China and OECD decreases the likelihood of exit. The same applies to outsourcing of intermediate goods from other countries. The IV estimates somewhat destroy this picture with only a weakly significant effect of outsourcing from China and other countries on firm exit remaining alive.

When combined with the results from the previous two sections, the finding that import competition from China has no effect on firm exit can be somewhat surprising. One possible interpretation is that, even though import competition from China reduces firm employment, it also pushes firms to upgrade their employment structure which may ultimately make them no more likely to die. Overall, we see our results as consistent with the 'moving up the quality ladder' story by Schott (2008): manufacturing firms in developed countries can manage to survive to the extent that they are able to specialize in the production of high quality goods.

5 Conclusion

Imports from low-wage countries, and especially China, have been the fastest growing component of Belgian trade during the last decade. This paper considers separately the role of imports from China and other low-wage countries in Belgian manufacturing firms outcomes. Unlike most previous research, we consider two different channels for the impact of imports: industry-level import competition and firm-level outsourcing. We further innovate by providing IV results for both import types.

We find that trade with low-wage countries is important in explaining within firm employment structure change in Belgian manufacturing, with imports from China playing a much more important role than that from other low-wage countries. We find that industry-level import competition from China reduces firm employment but pushes firms to upgrade their workforce both in terms of occupation and in terms of education. According to our estimations, import competition from China alone can explain around 30% of the total skill upgrading in Belgian manufacturing during the period 1996-2007. Meanwhile, outsourcing from China leads firms to upgrade their occupational structure without affecting employment growth. Interestingly, import competition from both China and other low-wage countries does not affect firm exit while there is some evidence that outsourcing from China actually increases a firm chances to survive. Overall, we see our results as consistent with the 'moving up the quality ladder' story of Schott (2008).

Finally, we propose two directions for future research. First, we acknowledge that is extremely difficulty to instrument firm-level trade. Although we provide for the first time IV results for firm outsourcing, results are certainly not fully satisfactory in terms of instruments' strength. Second, while we have explored the impact of trade with low-wage countries on several aspects of firm outcomes, there are other margins of adjustment that firms can use when facing import competition, such as product line switching, quality upgrading and technology upgrading. Evidence on these margins is still limited, especially when we take into account the special role played by Chinese trade.

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Table 1: Employment growth

Dep. Var: Empl. growth VARIABLES	(1) FE i	(2) FE if	(3) IV i nolag	(4) IV i lag	(5) IV if nolag	(6) IV if lag
wpw	0.0057	0.0116^{c}	0.0057	0.0148^{b}	0.0190^{a}	0.0191^{a}
	(0.0063)	(0.0066)	(0.0060)	(0.0068)	(0.0069)	(0.0069)
kpw	0.0337^{a}	0.0334^{a}	0.0341^{a}	0.0332^{a}	0.0330^{a}	0.0326^{a}
	(0.0023)	(0.0022)	(0.0021)	(0.0021)	(0.0021)	(0.0021)
vapw	0.0949^{a}	0.1004^{a}	0.0944^{a}	0.1035^{a}	0.1048^{a}	0.1071^{a}
	(0.0051)	(0.0052)	(0.0047)	(0.0052)	(0.0053)	(0.0054)
size	-0.2953^{a}	-0.2941^{a}	-0.2983^{a}	-0.3139^{a}	-0.3120^{a}	-0.3105^{a}
	(0.0141)	(0.0136)	(0.0161)	(0.0149)	(0.0147)	(0.0149)
age	-0.0055^{a}	-0.0057^{a}	-0.0046	-0.0048	-0.0035	-0.0047
	(0.0006)	(0.0006)	(0.0043)	(0.0044)	(0.0044)	(0.0044)
Tech	0.0235^{c}	0.0246^{c}	0.0228	0.0070	0.0055	0.0068
	(0.0133)	(0.0127)	(0.0152)	(0.0138)	(0.0136)	(0.0139)
BE_imp_share_OECD	0.0043	0.0034	0.1958	-0.0195	0.2202^{c}	-0.0228
	(0.0238)	(0.0237)	(0.1193)	(0.0325)	(0.1264)	(0.0324)
BE_imp_share_LW	-0.4221^{b}	-0.4117^{b}	-0.0928	-0.5894^{a}	0.0087	-0.5367^{b}
	(0.1704)	(0.1711)	(0.3741)	(0.2075)	(0.3902)	(0.2089)
BE_imp_share_China	-0.5032^{a}	-0.5001^{a}	-0.9555^{a}	-0.5555^{a}	-1.0474^{a}	-0.5614^{a}
	(0.0869)	(0.0873)	(0.2523)	(0.1023)	(0.2640)	(0.1025)
BE_imp_share_other	0.0377	0.0345	0.1835	0.0008	-0.0263	-0.0630
	(0.0753)	(0.0766)	(0.3779)	(0.1171)	(0.4182)	(0.1209)
imp_finished_OECD		0.0000^{a}			-0.0190	-0.0132
		(0.0000)			(0.0186)	(0.0186)
imp_intermediate_OECD		0.0065			0.0074	0.0066
		(0.0063)			(0.0062)	(0.0063)
imp_finished_BJS		-0.0073			-0.1369	-0.0217
		(0.0124)			(0.1827)	(0.0663)
imp_intermediate_BJS		0.4910^{c}			0.8162	0.6589
		(0.2513)			(0.5119)	(0.5267)
imp_finished_China		-0.0471			-0.1979	-0.2624
		(0.0294)			(0.2182)	(0.2109)
imp_intermediate_China		0.0832			-0.1248	-0.1630
		(0.2084)			(0.3021)	(0.2988)
imp_finished_Other		0.0626			0.2216	0.3156
		(0.0601)			(0.2694)	(0.2733)
imp_intermediate_Other		0.0039^{a}			0.0038^{a}	0.0038^{a}
		(0.0004)			(0.0004)	(0.0003)
Underidentification			307.6	3684.7	19.9	15.1
			(0.0000)	(0.0000)	(0.0968)	(0.5852)
Weak identification			47.4	668.2	1.0	0.5
Hansen J			54.1	69.6	59.0	76.9
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
N. first-stage reg.			4	4	8	8
N. first-stage p<0.05			4	4	7	7
Observations	118769	117941	116519	110651	110997	109702
R-squared	0.1976	0.2009	0.1964	0.2029	0.1979	0.2010
Number of firms	17961	17832	15929	15178	15233	15052

Robust standard errors in parentheses
^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1

Table 2: Share of production workers

Dep. Var: Share P VARIABLES	(1) FE i	(2) FE if	(3) IV i nolag	(4) IV i lag	(5) IV if nolag	(6) IV if lag
wpw	0.0340[a]	0.0394[a]	0.0340[a]	0.0412[a]	0.0431[a]	0.0433[a]
	(0.0029)	(0.0030)	(0.0022)	(0.0025)	(0.0025)	(0.0026)
kpw	0.0019[b]	0.0015	0.0019[a]	0.0017[b]	0.0015[b]	0.0016[b]
	(0.0009)	(0.0009)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
vapw	0.0071[a]	0.0099[a]	0.0070[a]	0.0113[a]	0.0126[a]	0.0126[a]
	(0.0020)	(0.0020)	(0.0016)	(0.0017)	(0.0017)	(0.0017)
size	-0.0476[a]	-0.0460[a]	-0.0479[a]	-0.0439[a]	-0.0435[a]	-0.0434[a]
	(0.0062)	(0.0062)	(0.0037)	(0.0038)	(0.0037)	(0.0038)
age	-0.0046[a]	-0.0047[a]	-0.0000	-0.0009	-0.0000	-0.0006
	(0.0002)	(0.0002)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Tech	-0.0094	-0.0099[c]	-0.0093[a]	-0.0099[a]	-0.0107[a]	-0.0105[a]
	(0.0058)	(0.0058)	(0.0034)	(0.0035)	(0.0034)	(0.0035)
BE_imp_share_OECD	-0.0074	-0.0069	-0.0368	0.0035	-0.0709	0.0038
	(0.0093)	(0.0093)	(0.0497)	(0.0126)	(0.0529)	(0.0126)
BE_imp_share_LW	-0.1011	-0.0990	0.3393[a]	-0.0172	0.2750[b]	-0.0286
	(0.0735)	(0.0734)	(0.1269)	(0.0732)	(0.1386)	(0.0763)
BE_imp_share_China	-0.1225[a]	-0.1228[a]	-0.3765[a]	-0.1888[a]	-0.3244[a]	-0.1967[a]
	(0.0396)	(0.0396)	(0.0943)	(0.0382)	(0.1018)	(0.0390)
BE_imp_share_other	0.0813[b]	0.0795[b]	0.1451	0.0210	0.2378	0.0243
	(0.0322)	(0.0325)	(0.1334)	(0.0405)	(0.1619)	(0.0445)
imp_finished_OECD		-0.0423[a]			-0.0437[a]	-0.0454[a]
		(0.0120)			(0.0109)	(0.0107)
imp_intermediate_OECD		0.0082[a]			0.0088[a]	0.0086[a]
		(0.0023)			(0.0023)	(0.0021)
imp_finished_BJS		-0.0027			0.0606	0.0462
		(0.0034)			(0.0757)	(0.0585)
imp_intermediate_BJS		-0.1585			-0.1208	-0.0982
		(0.1049)			(0.1841)	(0.1908)
imp_finished_China		-0.0060			0.3443	0.1854
		(0.0140)			(0.3302)	(0.2578)
imp_intermediate_China		-0.1212[c]			-0.2807[a]	-0.2938[a]
		(0.0666)			(0.1072)	(0.1074)
imp_finished_Other		-0.0040			-0.3815	-0.2111
		(0.0314)			(0.3213)	(0.2675)
imp_intermediate_Other		-0.0716[b]			-0.0606[b]	-0.0711[a]
		(0.0334)			(0.0241)	(0.0237)
Underidentification			240.6	3680.3	9.5	12.4
			(0.0000)	(0.0000)	(0.7355)	(0.7755)
Weak identification			41.0	707.3	0.6	0.6
Hansen J			2.1	28.2	17.8	40.4
			(0.7265)	(0.0004)	(0.1216)	(0.0007)
N. first-stage reg.			4	4	8	8
N. first-stage p<0.05			4	4	6	6
Observations	121453	120789	119476	113244	113893	112435
R-squared	0.0519	0.0553	0.0503	0.0546	0.0447	0.0535
Number of firms	17342	17268	15573	14734	14880	14638

Robust standard errors in parentheses
[a] $p<0.01$, [b] $p<0.05$, [c] $p<0.1$

Table 3: Share of skilled workers

Dep. Var: Share S VARIABLES	(1) FE i	(2) FE if	(3) IV i nolag	(4) IV i lag	(5) IV fi nolag	(6) IV fi lag
kpw	0.0458^c	0.0446^c	0.0453^c	0.0465^c	0.0430^c	0.0446^c
	(0.0270)	(0.0268)	(0.0247)	(0.0251)	(0.0246)	(0.0251)
vapw	-0.0280	-0.0273	-0.0272	-0.0294	-0.0239	-0.0278
	(0.0377)	(0.0383)	(0.0304)	(0.0318)	(0.0311)	(0.0325)
size	0.2896^a	0.2900^a	0.2931^a	0.2951^a	0.2975^a	0.2972^a
	(0.0714)	(0.0728)	(0.0547)	(0.0558)	(0.0560)	(0.0569)
age	-0.0007	-0.0008	-0.0093	-0.0102	-0.0124	-0.0107
	(0.0019)	(0.0019)	(0.0234)	(0.0242)	(0.0234)	(0.0240)
Tech	0.0154	0.0152	0.0164	0.0161	0.0175	0.0163
	(0.0250)	(0.0249)	(0.0234)	(0.0243)	(0.0232)	(0.0243)
BE_imp_share_OECD	0.0463	0.0428	-0.1095	0.0527	-0.3413^c	0.0449
	(0.0405)	(0.0405)	(0.2107)	(0.0500)	(0.1999)	(0.0500)
BE_imp_share_LW	-0.0842	-0.0850	-0.7461	-0.4409	-0.2927	-0.3587
	(0.3306)	(0.3346)	(0.4616)	(0.3134)	(0.5098)	(0.3116)
BE_imp_share_China	0.9750^b	0.9788^b	1.8790^a	1.5223^a	1.9240^a	1.5282^a
	(0.3985)	(0.3948)	(0.4848)	(0.3319)	(0.5170)	(0.3354)
BE_imp_share_other	-0.0930	-0.0753	0.0968	-0.1303	-0.4305	-0.1912
	(0.1366)	(0.1460)	(0.4778)	(0.1797)	(0.5533)	(0.2056)
imp_finished_OECD		0.0318			0.0483	0.0346
		(0.0328)			(0.0343)	(0.0312)
imp_intermediate_OECD		-0.0053			-0.0093	-0.0057
		(0.0070)			(0.0063)	(0.0058)
imp_finished_BJS		0.0102			0.0774	-0.0246
		(0.0110)			(0.1165)	(0.0648)
imp_intermediate_BJS		0.1109			1.5795^c	1.4662
		(0.5733)			(0.9162)	(0.9294)
imp_finished_China		0.0634			-0.1162	0.0096
		(0.0517)			(0.3697)	(0.3558)
imp_intermediate_China		0.1276			-0.5336	-0.4552
		(0.2885)			(0.5309)	(0.5060)
imp_finished_Other		-0.1227			0.2352	-0.0193
		(0.1259)			(0.7278)	(0.7018)
imp_intermediate_Other		0.0686			0.0100	-0.0235
		(0.0892)			(0.2750)	(0.2816)
Underidentification			154.5	704.0	32.9	22.7
			(0.0000)	(0.0000)	(0,0018)	(0,1581)
Weak identification			24.3	114.7	1.6	1.2
Hansen J			18.2	21.5	28.8	36.5
			(0.0012)	(0.0058)	(0.0042)	(0.0024)
N. first-stage reg.			4	4	8	8
N. first-stage p<0.05			4	4	7	6
Observations	26913	26842	18843	18408	18811	18377
R-squared	0.2465	0.2520	0.2446	0.2471	0.2450	0.2523
Number of firms	10377	10323	2339	2276	2338	2275

Robust standard errors in parentheses

^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1

Table 4: Firm exit

Dep. Var: Firm exit 2	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FE i	FE if	IV i nolag	IV i lag	IV if nolag	IV if lag
wpw	0.0084^a	0.0048^b	0.0086^a	0.0008	-0.0009	-0.0007
	(0.0020)	(0.0020)	(0.0018)	(0.0019)	(0.0020)	(0.0020)
kpw	-0.0044^a	-0.0039^a	-0.0044^a	-0.0033^a	-0.0032^a	-0.0031^a
	(0.0009)	(0.0009)	(0.0009)	(0.0008)	(0.0008)	(0.0009)
vapw	-0.0234^a	-0.0264^a	-0.0236^a	-0.0312^a	-0.0327^a	-0.0332^a
	(0.0022)	(0.0023)	(0.0020)	(0.0022)	(0.0022)	(0.0022)
size	-0.0113^b	-0.0126^b	-0.0120^a	-0.0176^a	-0.0185^a	-0.0186^a
	(0.0049)	(0.0049)	(0.0044)	(0.0045)	(0.0045)	(0.0045)
age	0.0064^a	0.0066^a	0.0023	0.0018	0.0015	0.0018
	(0.0003)	(0.0003)	(0.0019)	(0.0018)	(0.0019)	(0.0018)
Tech	0.0063	0.0069	0.0056	0.0044	0.0049	0.0049
	(0.0046)	(0.0046)	(0.0041)	(0.0041)	(0.0041)	(0.0042)
BE_imp_share_OECD	0.0284^a	0.0272^a	0.0850	0.0258	0.0516	0.0270
	(0.0103)	(0.0103)	(0.0609)	(0.0174)	(0.0586)	(0.0175)
BE_imp_share_LW	0.0370	0.0313	0.4489^b	0.1548	0.3505	0.1691
	(0.0787)	(0.0785)	(0.2242)	(0.1068)	(0.2224)	(0.1082)
BE_imp_share_China	0.0304	0.0314	-0.1539	-0.0678	-0.0977	-0.0741
	(0.0412)	(0.0413)	(0.1406)	(0.0504)	(0.1353)	(0.0510)
BE_imp_share_other	0.0736^b	0.0744^b	-0.6016^a	0.0025	-0.4275^b	0.0050
	(0.0352)	(0.0356)	(0.2139)	(0.0594)	(0.2129)	(0.0603)
imp_finished_OECD		-0.0000^a			0.0061	0.0017
		(0.0000)			(0.0100)	(0.0084)
imp_intermediate_OECD		-0.0019			-0.0031	-0.0009
		(0.0018)			(0.0032)	(0.0017)
imp_finished_BJS		-0.0008			0.0143	-0.0500
		(0.0012)			(0.0259)	(0.0781)
imp_intermediate_BJS		0.0070			-0.0814	-0.0820
		(0.0793)			(0.1508)	(0.1550)
imp_finished_China		-0.1486^a			-0.1407^b	-0.0993
		(0.0523)			(0.0693)	(0.0624)
imp_intermediate_China		-0.0337			0.2662	0.2761
		(0.0622)			(0.1715)	(0.1682)
imp_finished_Other		-0.0502			-0.0368	-0.0476
		(0.0333)			(0.0323)	(0.0332)
imp_intermediate_Other		-0.0004^a			-0.0004^b	-0.0004^b
		(0.0001)			(0.0002)	(0.0002)
Underidentification			353.2	3103.9	24.8	18.2
			(0.0000)	(0.0000)	(0.0248)	(0.3761)
Weak identification			51.6	646.3	1.4	0.7
Hansen J			6.7	24.6	26.1	37.2
			(0.1506)	(0.0018)	(0.0104)	(0.0020)
N. first-stage reg.			4	4	8	8
N. first-stage p<0.05			4	4	7	8
Observations	118267	117377	116227	109735	109938	108708
R-squared	0.0216	0.0227	0.0173	0.0251	0.0231	0.0254
Number of firms	18691	18572	16811	15929	15941	15779

Robust standard errors in parentheses
^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1