How do exporters react to changes in cost competitiveness ?

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by Stefaan Decramer, Catherine Fuss and Jozef Konings

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Abstract

Policy-making institutions such as the European Commission, the ECB and the OECD often use unit labor costs as a measure of international competitiveness. The goal of this paper is to examine how well this measure is related to international export performance at the firm level. To this end, we use Belgian firm-level data for the period 1999-2010 to analyze the impact of unit labor costs on exports. We use exports adjusted for their import content. We find a statistically significant negative effect of unit labor costs on export performance of firms with an estimated elasticity of the intensive margin of exports ranging between -0.2 and -0.4. This result is robust to various specifications, including firm, time and sector fixed effects and estimation approaches. We find that this elasticity varies between sectors and between firms, with firms that are more labor-intensive having a higher elasticity of exports with respect to unit labor costs. The micro data also enable us to analyze the impact of unit labor costs on the extensive margin. Our results show that higher unit labor costs reduce the probability of starting to export for non-exporters and increase the probability of exporters stopping. While our results show that unit labor costs have an impact on the intensive margin and extensive margin of firm-level exports, the effect is rather low, suggesting that pass-through of costs into prices is limited or that demand for exported products is not elastic. The latter is consistent with recent trade models emphasizing that not only relative costs, but also demand factors such as quality and taste matter for explaining firm-level exports.

JEL classification: F1, F4, F16.

Keywords: unit labor costs, exports, competitiveness, heterogeneity.

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The views expressed in this paper are those of the author and do not necessarily reflect the views of the National Bank of Belgium or any other institutions to which the author is affiliated. All remaining errors are our own.

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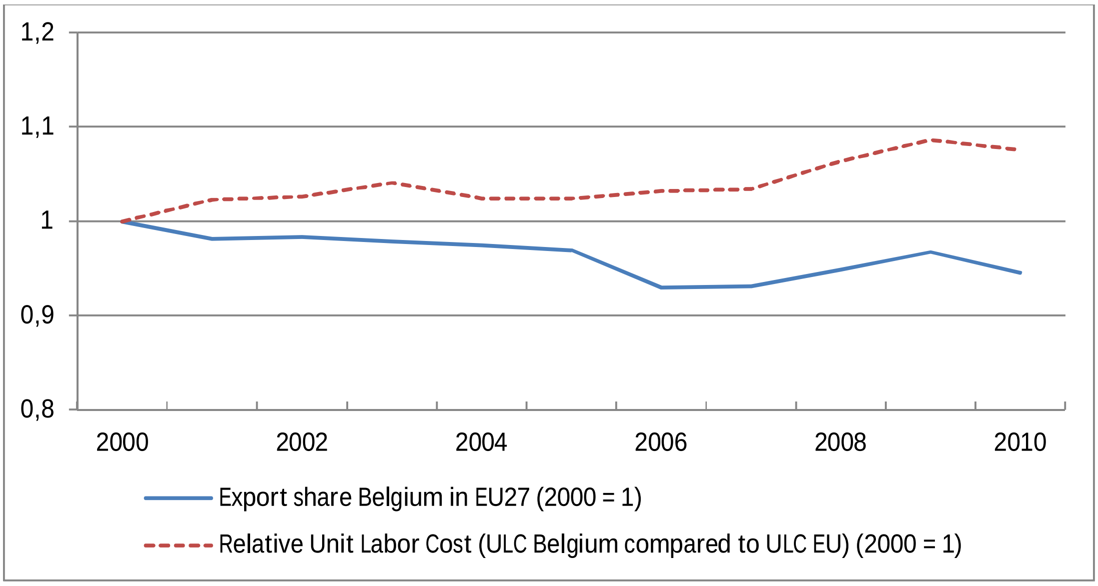
I. Introduction

The growing imbalances in the euro area have triggered a debate about the role of cost competitiveness for growth and how far austerity should go. When competitiveness improves, countries can ‘grow’ out of the crisis and hence austerity measures become less stringent. Globalization and its associated increase in international competition has led to the view that exports have become more sensitive to costs and hence competitiveness is often measured in terms of unit labor costs[1], defined as the labor cost per unit of output. The focus on unit labor costs as a measure for competitiveness is based on the idea that increases in unit labor costs are passed on in the form of higher export prices, resulting in a deterioration in the balance of payments, hampering economic growth and increasing unemployment. The unequal evolution of unit labor costs in the euro area has therefore been a major concern in recent years, or as the ECB puts it in a recent report[2]: *“Cumulative increases in labor costs across euro area countries can be indicative of growing imbalances and losses in competitiveness and, as such, are an important early sign of the need for adjustment. Relative developments in labor costs across the euro area countries, together with other indicators of competitiveness, have therefore to be closely monitored.”*

While there is a clear policy concern about the evolution of unit labor costs in many European countries, stirred by close monitoring by the European Commission, there exists very little conclusive evidence about the impact of unit labor costs on export performance. As early as the seventies, Kaldor (1978) had argued that the growth in unit labor costs to measure international competitiveness is at best too simplified. In particular, he demonstrated that countries with the highest growth rates in GDP tend to have high growth rates in unit labor costs. This is also known as the 'Kaldor paradox'[3]. In Figure 1, we plot the evolution of the aggregate export market share of Belgium and the aggregate relative unit labor costs (relative to the EU27). While we can note a negative correlation, it is clearly not a very strong one. For instance, from 2007 onwards it seems that relative unit labor costs and export market shares have been moving together. The simple correlation coefficient between the growth in RULC and the growth in export market share for the entire period is in fact quite weak, only -0.044.

[1] See for instance the European Competitiveness Report 2012 of the European Commission.
[2] ECB (2008), ‘Monitoring Labor Cost Developments across Euro Area Countries’, ***Monthly Bulletin***
[3] Fagerberg (1988) analyzes this in more detail using macro data on technological competitiveness

Figure 1 (source: Eurostat)



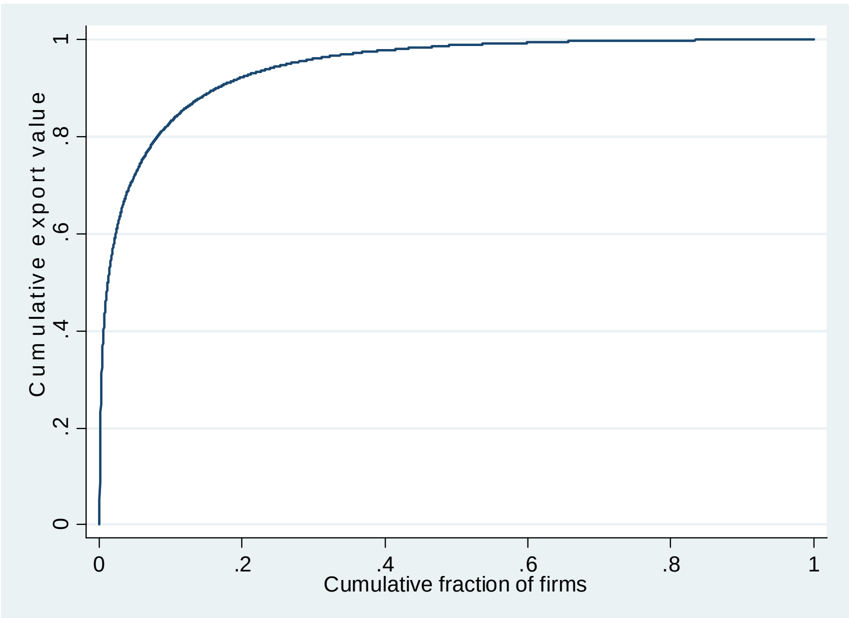
This apparent paradox has also recently been documented for Spain during the great recession where, despite the unfavorable evolution of Spanish relative export prices, only a modest decline in Spanish exports took place (Correa-Lopez and Domenech, 2012). This 'disconnect' between relative costs and exports has also been a widely researched puzzle in international macro analyzing low exchange rate pass-through into export prices. When changes in relative costs (or real exchange rates) only have a limited impact on relative export prices and hence on export quantities, the policy focus on wage moderation and convergence of unit labor costs between countries seems less appropriate. What explains this low aggregate correlation and does it mean that the widely used measure of unit labor costs to measure competitiveness should not be used?

Both the theoretical and empirical work has stressed the importance of taking firm-level heterogeneity into account. The use of micro data helps to understand the different dimensions of trade, such as the extensive and intensive margins. Furthermore, it helps to avoid biases from aggregation (such as “the Spanish paradox”) as explained in Altomonte et al. (2013). Recent work in international trade therefore makes increasing use of detailed disaggregated data to understand the apparent low correlation between a number of macro aggregates. For instance, Amiti et al. (2013) used highly disaggregated firm-product data to show that the largest exporters are also the largest importers. This turns out to be important because when exporters are hit by an exchange rate shock in their destination market, they typically face a compensating movement in their marginal costs if they are importing their intermediate inputs. And since the largest exporters account for most of the exports, they dominate the aggregate picture. In fact, while the largest exporters tend to have an exchange rate pass-through of about 50%, the smallest exporters have a nearly complete pass-through. In this paper, we therefore turn to disaggregated data, at the firm level, to analyze the relationship between changes in unit labor costs and firm export performance. It also enables us to incorporate the heterogeneity of firms in the analysis and to distinguish between the intensive and extensive margin.

More specifically, we use a confidential Belgian firm-level dataset with detailed information on costs, productivity and exports for the period 1999-2010. These data are provided by the National Bank of Belgium, which collects the annual accounts of firms and merges them based on a unique company identifier (VAT number) to the trade data that originate from the Customs for non-EU trade and a compulsory survey on trade activity for EU trade (see data appendix). Furthermore, we supplement these data with confidential sales data from the VAT registry as small firms are not required to report sales in their company accounts.

By using disaggregated data, we are able to better take into account the heterogeneity between firms that export. This is illustrated clearly from the highly skewed export distribution that characterizes exporting firms in Figure 2, where we show the Lorenz curve for exports. It shows the relation between the cumulative fraction of exports and the cumulative fraction of the number of firms accounting for these exports. In other words, we can see that 20 percent of Belgian exporters account for almost 90 percent of all exports. Thus exports are concentrated in the hands of a small group of large exporters, which will dominate the aggregate exports, a stylized fact that has also been documented by Muuls and Pisu (2009) for Belgium and for other countries, e.g. by Bernard et al. (2007) using similar firm-level data to ours.

Figure 2: Lorenz curve of exports (source: NBB and own calculations for the year 2004)



But, typically, these large exporters also tend to be the largest importers of intermediate inputs, as pointed out by Amiti et al. (2013). Having access to imported intermediate inputs is not only a channel that firms can use as a hedging tool, but it can also encourage firms to start innovating and exporting. Goldberg et al. (2012) show how firms having access to imported inputs start to innovate more in India, while Amiti and Konings (2007) and Halpern et al. (2011) show how having access to imported inputs enhance productivity growth. This reflects the growing role of international supply chains, which suggests an alternative approach to analyzing competitiveness. In fact, a recent report by the OECD (2013) makes this precise point, showing that the rise of global value chains implies that the production process is dispersed across different countries. Exports therefore contain a large component of intermediate imported inputs. In small open economies especially, the import content of exports reaches more than 40% of total exports on average. Ignoring the import content of exports in analyzing competitiveness may result in wrongly attributing gains in export performance of firms to improved cost competitiveness. High export growth may just reflect the fact that some firms import products to re-export them. Or when firms only add limited value to imported inputs, exports reflect mainly the value of the intermediate inputs. We therefore analyze net exports to capture firm-level competitiveness, although we also report results based on gross export numbers as a robustness check.

Earlier work using mostly aggregate data found a weak or even positive relationship between relative costs or prices and exports. Only a limited number of research papers examine the link between unit labor costs and export competitiveness. Fagerberg (1988) uses macro data for Japan, the US and the UK and finds that relative unit labor costs still matter, but competition in technology and the ability to compete on delivery turn out to be more important. In contrast, Carlin et al. (2001), using disaggregated sector-level data for 15 OECD countries, find a robust relationship between relative costs and exports, with an elasticity of export market share with respect to relative unit labor costs of -0.26. However, they fail to find any strong evidence of factors going beyond relative costs, such as the role of R&D spending. Correa-Lopez and Domenech (2012) emphasize that the relatively modest decline in Spanish export markets despite the unfavorable evolution of Spanish relative export prices is largely due to firms' strategic decisions, such as investment in human capital, quality upgrading and on market and financial strategies. Altomonte et al. (2012) use firm-level survey data (EFIGE) to show how unit labor costs affect the probability of being an exporter.

In this paper, we investigate the relationship between unit labor costs and export performance for a small open economy, Belgium. Taking a microeconomic perspective, we are able to consider various dimensions often ignored by the earlier literature. More precisely, we consider both the intensive margin (export performance of continuing exporters) and extensive margin (entry and exit of firms into export) of exports. Furthermore, we allow for heterogeneous effects of unit labor costs on export performance according to firm and sector characteristics. We also evaluate the role of wages versus productivity in the impact of unit labor costs on exports.

The paper is structured as follows. In Section II, we provide theoretical background, starting with a description of how the Melitz (2003) model illustrates the relationship between unit labor costs and firm-level export performance. Section III describes the data. Section IV reports the results. We conclude in Section V.

II. Theoretical Background

Earlier work on international trade and competitiveness focuses on the relationship between between unit labor costs and export performance at the country level. E.g. Farenberg (1988) presents a general equilibrium model where country-level prices are determined by unit labor costs and a fixed mark-up. In this model, lower unit labor costs increase the country's GDP, boost exports and reduce imports.

However, recent work in international trade emphasizes the importance of firm heterogeneity. We use the seminal paper by Melitz (2003) as a framework to illustrate the relationship between cost competitiveness and export performance at the firm level. We focus on the main components that are relevant in this context, and for further details we refer to the Melitz (2003) paper itself. In this model, labor is treated as a homogeneous factor of production and the wage per worker is equal across all firms. Therefore labor productivity drives export performance. To align the Melitz model with the concept of unit labor costs, we slightly modify it to allow for different wages across firms. Wages can be different for a number of reasons, which we do not explicitly model.

We follow Melitz (2003) and model demand as a representative consumer with C.E.S. preferences over a continuum of goods, index-linked by ω:

$$U = \left[\int_{\omega\in\Omega} q(\omega)^{\rho} d\omega\right]^{1/\rho}.$$

with U the utility of the representative consumer, Ω the set of available goods. Because these goods are substitutes, ρ is between 0 and 1. The corresponding sales of each good ω depend on the total demand in the market, R, the aggregate price level, P, and the price level of the firm $p(\omega)$:

$$r(\omega) = R\left[\frac{p(\omega)}{P}\right]^{1-\sigma},$$

with σ the elasticity of substitution between goods, and $\sigma>1$.

On the supply side, firms produce a single variety ω and have labor as the only input in the production process. Labor can be expressed as a linear function of output: $l = f + q/\varphi$. Firms face the same fixed cost of production f, but the marginal cost depends on the productivity level of the firm φ. Firms with a high φ are able to produce more units q with the same use of labor l.

Without modeling the details of the labor market, we assume that firms can differ in the wage per worker w they face, in addition to differences in productivity. Profit maximization implies the following price-setting rule at the firm level, setting a fixed mark-up $1/\rho = \sigma/(\sigma - 1)$ over marginal cost:

$$p(\varphi) = \frac{w}{\rho\varphi} \quad .$$

In this setting, w/φ represents the labor cost per unit of output, or unit labor costs. Total revenue of the firm therefore becomes:

$$\mathrm{r}(\varphi, w) = \mathrm{R}\left[\frac{\varphi}{\mathrm{w}} P\rho\right]^{\sigma-1} = R(P\rho)^{\sigma-1} \cdot ulc^{1-\sigma}, \qquad \text{(T1)}$$

with R the total sales across all products and P the price index. The firm's revenue depends on various factors, but there is an inverse relation between unit labor costs and the revenues of the firm. This depends on the elasticity of substitution σ on the market.

Considering an open economy implies taking into account variable and fixed trade costs. Omitting further details of the model, we simply state that, under variable iceberg trade costs, revenue on the foreign market (which equals export by definition) is proportional to revenue as in the expression in equation (T1). So, expression (T1) guides our analysis for investigating the intensive margin.

Taking the natural logarithm of (T1), we see that the elasticity of exports compared to unit labor costs is 1- σ according to this model. This provides us with a benchmark for the elasticities we find in the empirical section. More specifically, we expect an elasticity of exports to unit labor costs of 0 when the elasticity of substitution between varieties is perfectly inelastic (σ=1), and an elasticity of exports to unit labor costs of minus infinity when the elasticity of substitution between varieties is perfectly elastic (σ=∞). To analyze the extensive margin within this framework, we follow the standard Melitz (2003) assumption that exporters face a fixed export entry cost. The assumption is needed because of the demand structure. If there are no fixed costs of exporting, every active firm will export given the CES utility (this is not the case in more general approaches using quadratic utility as in Di Comite et al., 2014, for instance). If we assume a fixed cost f_x per period of being active in the export markets, only the more productive firms will find it profitable to export, that is, only firms where the following holds:

$$\pi_x(ulc) = \frac{r_x(ulc)}{\sigma} - f_x \geq 0,$$

with π_x profits on the export markets and r_x revenue on the export market. Only the cost-efficient firms, measured by unit labor costs, will be able to enter and stay active on the export market.

More recent papers have shown that demand factors are important too, especially in explaining the intensive margin. Baldwin and Harrigan (2011), for example, introduce quality differentiation in a Melitz-type model to get predictions that give a closer fit with the data. Di Comite et al. (2014) argue that, next to quality, taste is an important demand factor to consider in explaining the differences of within-firm-product exports across different destinations. They introduce both vertical and horizontal differentiation in a Melitz-Ottaviano (2008)-type model but without imposing any relationship between cost, taste and quality. Against this backdrop, theoretical predictions are less clear cut on the extent to which relative unit labor costs are able to explain differences in relative export performance. In this respect, more empirical guidance is needed. We therefore seek to estimate first the relationship between unit labor costs and firm export performance. Next, we analyze to what extent factors going beyond cost competitiveness matter. Finally, we also analyze the role of unit labor costs in explaining the extensive margin. More specifically, we investigate the correlation of unit labor costs with entry into and exit from export markets, and with the "within-firm" extensive margin i.e. adding and dropping export products or destinations.

III. Data and summary statistics

Our main data source is the National Bank of Belgium balance sheet database, providing a comprehensive panel of Belgian firms' income statements, with detailed financial and operational information, for the period 1999-2010. Belgian firms are legally required to submit full or abbreviated company accounts, which implies that our data cover most active firms[4]. Since small firms are not required to report their sales, we supplement these data with confidential data from the VAT register on sales, in order to increase the number of observations in our sample. We focus on manufacturing firms as most exports and imports would take place by these firms. Some exporting is by firms active in the wholesale sector (distribution). They are typically intermediaries in trade, which we do not consider in our analysis as they do not actually produce the goods themselves, so that their cost competitiveness is less relevant to explaining export performance. We merge these firm-level company accounts with data on exports and imports at the individual firm level.

The trade data are collected through a compulsory survey for intra-EU trade and by customs for extra-EU trade. These data include all firms that engage in international trade above a minimum threshold. For extra-EU trade, this threshold is an import or export value of at least 1,000 euro, while for intra-EU trade the threshold is higher, total imports or exports have to be at least 250,000 euro in a year. Since 2006, this threshold has gone up to 1,000,000 euro for exports and 400,000 euro for imports per year. While the trade data report exports and imports at the firm-product-destination level, we aggregate them up at the firm level since we observe unit

[4] The self-employed have a simple way of reporting financial information and are not included in the data.

labor costs not at the firm-product level, but just at the firm level. By adding the product or destination dimension, we would just inflate the dimension of the dataset, duplicating observations on unit labor costs of the same firm, which does not add additional insights.

We follow the OECD and Eurostat in defining unit labor cost (ULC) as the total cost of labor per unit of output, but computed at the level of the individual firm:

$$ULC_{it} = \frac{W_{it}}{Q_{it}} \qquad (5)$$

where W_{it} is the total nominal employee compensation, including social security contributions, for firm i at time t, and Q_{it} is the deflated value added of the firm, which we use as a proxy for real output[5]. This measure of unit labor costs is equivalent to marginal costs when only one factor of production, labor, is used in production and the production process displays constant returns to scale. They are linked to export performance if increases in unit labor costs are passed on into higher prices, and consequently exports decline.

To test for heterogeneity in firm export performance in response to changes in unit labor costs, we experiment with a number of indicators, such as the firm-level capital-labor ratio, the destination GDP per capita and a crisis dummy. We also make a distinction between high-tech and low-tech sectors to capture the degree of non-price competition. This measure is based on the Eurostat classification of high-tech/low-tech manufacturing sectors[6].

Table 1 shows summary statistics for the exporting firms in our sample and we compare them with manufacturing firms that never export, pooled over all years. In our analysis, we have over 6,000 firms that export and for which we have information on labor costs, employment and value added[7]. The average manufacturing exporter employs 91 workers compared to only 9 employees in firms that never export. Exporters have also higher labor costs, but this is compensated by higher labor productivity compared to non-exporters, so that they still have slightly lower unit labor costs. The fact that exporters are larger, more productive and pay higher wages confirms one of the stylized facts that has been documented in similar firm-level data for other countries. The average exporting firm exports 18 million euro worth and, when importing, imports 13.9 million euro. About 80% of the firms in our sample that export are also importers. Furthermore, exports and imports are highly correlated with a correlation coefficient of 0.66. This demonstrates that most exporters rely on imports of intermediate inputs in their production process or that exporters simply re-export imported products, as shown by Damijan et al. (2013). Hence, ignoring the import content of exports may lead to wrongly concluding that firms and sectors are highly competitive when they have strong export growth, while this may merely

[5] We use a 2-digit value added deflator from Belgian national accounts.
[6] We aggregate Eurostat's definition of high technology and medium-high technology to one category, high-tech sectors.
[7] Only for firms that report full annual accounts we have complete information, smaller firms are not required to report all accounting information.

reflect high import growth. This suggests that measuring export competiveness as net exports, i.e. the difference between exports and imports, is a more sensible approach, which is what we will do in our analysis. The average net exporter firm has net exports which are about half of gross exports (not shown in table) and the growth in gross exports (0.05 when considering only net exporters) is higher than the growth in net exports (0.007, see table) on average.

Table 1: summary statistics

	exporter	**non-exporter**
# Firms	6,161	16,981
Employment	91 (308)	9.0 (25.1)
Labor cost per worker in euro	40,979 (15,565)	32,407 (12683)
Real value added per worker	83,571 (730,342)	70,886 (224,943)
Tangible fixed assets per worker (K/L) in euro	71,976 (1,004,659)	93,951 (547,496)
Unit labor cost	0.70 (1.91)	0.73 (9.71)
Exports (X million euro)	18.0 (119)	0
Importer (= 1 if imports >0)	0.80 (0.40)	0.15 (0.35)
Imports (X million euro, importers only)	13.9 (108)	0.8 (3.4)
Net exporter (=1 if net exports > 0)	0.55 (0.50)	0
Net exports (X million euro, net exporters only)	15.4 (72.8)	-
Growth in labor cost per worker	0.03 (0.11)	0.03 (0.17)
Growth in real value added per worker	0.007 (0.27)	0.004 (0.32)
Growth in unit labor costs	0.024 (0.26)	0.029 (0.31)
Growth in exports	-0.03 (0.81)	-
Growth in net exports	0.007 (0.60)	-
EU orientation (=1 if EU exports in total exports>0.70)	0.64 (0.37)	-

Note: Standard deviations in brackets. Averages are taken across all time periods.

To further illustrate the cross-sectional differences between exporters and non-exporters, we turn to a formal econometric analysis. More specifically, we run the following regression:

$$\log(y_{it}) = \rho\, D_{ex} + \log(emp_{it}) + \mu_s + \mu_t + \varepsilon_{it},$$

where D_{ex} stands for a dummy taking the value '1' when the firm is an exporter, $\log(emp)$ is the natural logarithm of employment, which we include to control for size[8], and μ_s and μ_t are respectively sector and time dummies. The dependent variable $\log(y_{it})$ stands for the natural logarithm of the variable of interest, i.e. employment, capital-labor ratio, labor productivity, average wage and unit labor cost. The results are shown in table 2. We see that exporters are much larger in terms of employment (column 1), and conditional on employment, they have a higher capital-labor ratio (column 2), a higher labor productivity (column 3), a higher average wage (column 4) and a lower unit labor cost (column 5).

[8] The importance ofcontrolling for firm size, and more specifically employment size, is explained in detail in the appendix.

Table 2: differences between exporters and non-exporters

	(1) Emp	(2) K/L	(3) Q/L	(4) W/L	(5) ULC
D_{ex}	1.694**	0.373**	0.280**	0.104**	-0.221**
	(0.0195)	(0.0179)	(0.00698)	(0.00374)	(0.00638)
Size control	No	Yes	Yes	Yes	Yes
Observations	163385	158673	163240	163251	164754
R^2	0.305	0.097	0.162	0.343	0.209

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

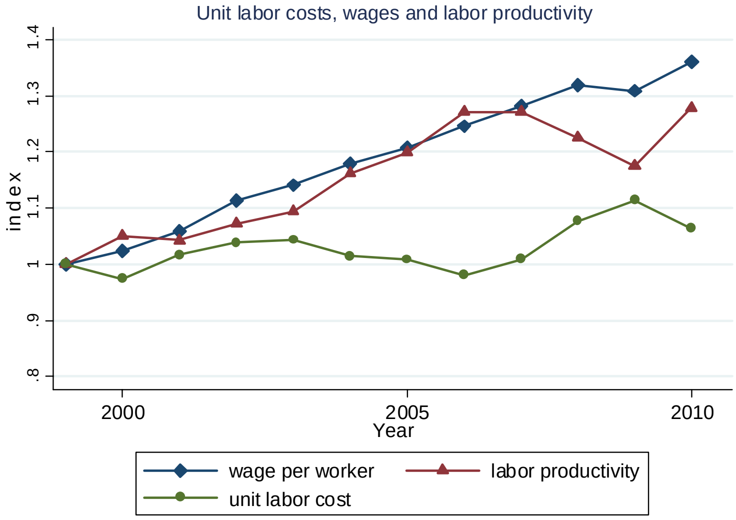
While unit labor costs may be high and increasing, suggesting a deterioration in firm-level competitiveness, it may be triggered by either excessive nominal wage growth or insufficient labor productivity growth, or a combination of both. To illustrate this, we decompose unit labor costs into its sub-components, the nominal labor cost per worker (i.e. the total wage bill per worker) and output per worker or labor productivity:

$$ULC_{it} = \frac{W_{it}}{Q_{it}} = \frac{W_{it}/L_{it}}{Q_{it}/L_{it}}. \quad (6)$$

Figure 3 shows the aggregate evolution of ULC for our dataset, and the evolution of its two components. The aggregation is done by simply dividing the total wage bill summed across all firms by the total value added summed across all firms in our dataset for each year. We used the value for the year 1999 as the reference to construct the index. The labor cost per worker is rising almost linearly, with an increase of about 36% between 1999 to 2010. As can be noted from table 1, the growth in nominal labor costs in the average firm is also 3 percent per year, which reflects the aggregate evolution in nominal labor costs. In figure 3, we can see that aggregate labor productivity also rose, but not at the same pace as aggregate labor costs. Up to 2004, growth in labor productivity was below growth in nominal labor costs, but it reversed between 2005 and 2007. Since the crisis years, labor productivity growth has been lower again than growth in labor costs, and it was in fact negative for 2008 and 2009. As a result, aggregate unit labor costs in our sample have been relatively stable apart from the crisis years. However, the aggregate picture in figure 3 hides a substantial amount of heterogeneity between firms.

Figure 3: Aggregate evolution of unit labor cost, labor productivity and wages per worker

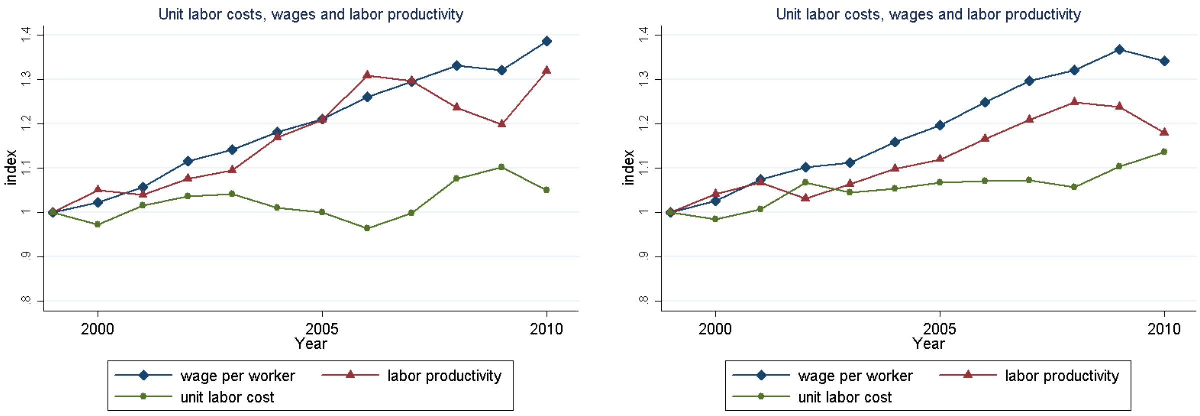
Source: own calculations based on NBB data



To illustrate this, figure 4 distinguishes between non-exporters (left) and exporters (right) when calculating the aggregate evolution of unit labor costs, wage per worker and labor productivity. We see that the pattern is quite different for labor productivity, while the average wage evolution is roughly similar, although there is some difference during the last two years. Also the evolution of unit labor costs is different, with non-exporters experiencing a rise in the first years, then a relatively stable pattern until the rise in the crisis years 2009 and 2010, while exporters experience a rise, but then a decline from 2004 to 2006, and then again a substantial rise in 2008 and 2009 to go down again in 2010. The distinction between non-exporters and exporters is relevant for the analysis, as the changes in non-exporters' unit labor costs will not have an impact on the intensive margin of continuing exporters, but could have an indirect effect on the export performance of sectors or Belgium as a whole through the extensive margin of entering and exiting the export markets. Therefore we study the extensive margin as well in our results section.

Figure 4: Aggregate evolution of unit labor cost, labor productivity and wages per worker, distinguishing between non-exporters (left) and exports (right)

Source: own calculations based on NBB data



IV. Results

In this section, we start by analyzing the baseline relationship between the intensive margin of net exports and unit labor costs at the firm level, using various estimation approaches. Next, we exploit differences between sectors and the role of firm heterogeneity and finally we tune in on the relationship between the extensive margin of exports and unit labor costs.

IV.1 Baseline results

Following the discussion in section II, we start by estimating a simple relationship between firm-level (net) export values and unit labor costs. The basic export equation we seek to estimate is derived from equation (T1) and given by:

$$\Delta x_{it} = \beta \cdot \Delta ulc_{it} + \mu_{st} + \varepsilon_{it} \qquad (7)$$

where all variables are in logs. We use a first-differenced model to control for unobserved firm-fixed effects. The variable x_{it} represents the log of net exports in euros of firm *i* at time *t*, and ulc_{it} represents the log unit labor costs of firm *i* at time *t*. To control for sector specific business cycles and shocks, we include sector-year fixed effects μ_{st}. Finally, ε_{it} is a white noise error term. We start by estimating this basic equation using OLS in table 3, while in table 4 we report the same estimates, but using system GMM to account for potential endogeneity of unit labor costs. We consistently cluster the standard errors at the firm level throughout the paper, but our results are robust to alternative clustering, such as clustering at the sector level or at the sector-year level[9].

In the first column of table 3, we estimate equation (1) including a full set of sector times year effects, while in the second column we do the same but include sector and year effects separately. Both specifications yield very similar results with an estimated elasticity of net exports with respect to unit labor costs of close to -0.3. In the third column, we include as an additional control variable the change in capital stock, taking into account the fact that capital investment may drive exports and at the same time boost the capital input share, which would cause a drop in unit labor costs. This may take place when firms decide to substitute labor for capital when labor costs are rising. But we can note that the estimated elasticity remains statistically significant with a very similar point estimate of -0.28.

To assess whether it is mainly nominal wage costs or changes in productivity that drive the results, we decompose in the third and fourth column unit labor costs in the nominal wage cost per worker and output per worker. The results in column (3) show that firms that are more productive in terms of output per worker export more (an elasticity of 0.30), while the estimated coefficient on nominal wages per worker is negative, but small and not statistically significant different from zero. This suggests that the variation in unit labor costs firms face is mainly driven by changes in labor productivity. As shown in table 1, there is actuallymuch more variation in labor productivity than in wages. Given that the wage formation process in Belgium is centralized and a large part of the variation in wages is driven by institutional factors, such as collective agreements at sector level[10] or automatic wage indexation, the variation of wage costs at the firm level is most likely going to be small.

A concern with the results based on OLS in table 3 is potential endogeneity of unit labor costs and in particular of labor productivity. Our specifications control for firm-unobserved effects (by taking first differences) and for sector-specific business cycles and demand shocks by including sector-time fixed effects. However, one could still argue that there is an endogeneity issue to the extent that wages and output are jointly determined by the firm. Rent-sharing between the firm and the workers would create a downward bias (in absolute value) of the elasticity we are estimating if exports are positively correlated with profits. There could also simply be reverse causality when there is 'learning from exporting', albeit in advanced countries like Belgium, it is less likely that this is going to be a dominant factor[11]. If there is an impact of

[9] Taking for example the baseline specification presented in the third column in table 2, we find a standard error for *ΔULC* of 0.0208 when clustering at the firm level, 0.0260 when clustering at the sector (NACE 2-digit) level and 0.0220 when clustering at the sector-year level. This might suggest that the standard errors are larger when clustering at the sector level, but this is not the case for all specifications. We also checked the robustness for the long differences (table 4) and the heterogeneity table (table 8, presented further on in this paper), and find that all coefficients keep their significance level when clustering at the sector level instead of the firm level. When clustering at the sector-year level, standard errors are consistently lower across the different specifications.

[10] E.g., see Lopez and Sissoko (2013).

[11] Pisu (2008) finds no support for the learning-by-exporting hypothesis for Belgium.

exporting on productivity we would expect this is also reflected in nominal wages and hence unit labor costs (that is, nominal wages adjusted for real labor productivity) should be unaffected. By contrast, if wages and labor are rigid and reacting less to changes in output, this could lead to an upward bias (in absolute value) of the elasticity.

Table 3: OLS results, dependent variable Δ *Net export value*

	(1)	(2)	(3)	(4)	(5)
Δ ULC	-0.292**	-0.281**	-0.283**	-	-
	(0.0210)	(0.0206)	(0.0208)		
Δ K	-	-	0.0920**	0.0922**	0.0911**
	-	-	(0.0134)	(0.0134)	(0.0134)
Δ Q/L	-	-		0.313**	0.301**
				(0.0213)	(0.0208)
Δ W/L	-	-	-	-0.0348	-0.0155
				(0.0512)	(0.0515)
Sector × year effects	Yes	No	No	Yes	No
Year effects	No	Yes	Yes	No	Yes
Sector effects	No	Yes	Yes	No	Yes
Observations	23207	23207	23009	22987	22987
R^2	0.039	0.023	0.026	0.044	0.029

Standard errors clustered at the firm level in parentheses. All variables are in logs.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

We attempt to mitigate the potential endogeneity issues in a number of ways, apart from controlling for fixed effects. First, we estimate the relation described in equation in levels, i.e.

$$x_{it} = \alpha_i + \beta \cdot ulc_{it} + \mu_{st} + \varepsilon_{it} \quad (8)$$

with System GMM, using lags 2 and 3 of unit labor cost as instruments in the difference equation and the first lag of Δulc in the level equation[12]. The results are shown in table 4, where we show various specifications, starting in column (1) with just including year fixed effects, in column (2) we include a full set of sector times year effects, columns (3) – (4) further include the capital stock as an extra control. For the first columns, the Hansen p test and the second order correlation test do not reject the model, which suggests the model is well specified. Note that the number of observations reported for the System GMM specification cannot be directly compared to the number of observations in our OLS first-difference baseline specification in table 3.[13]

[12] These are the standard instruments for endogenous regressors, see Roodman (2009). For additional background on Difference and System GMM, see also Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998).

[13] The fact that the number of observations in table 4 is different from the number of observations in table 3 is not driven by the use of different samples. The sample used in both estimations is the same. However, we follow the reporting standard for System GMM, which is reporting the total number of observations available in levels. The

The results in table 4 show a point estimate of the elasticity of exports with respect to unit labor costs of approximately -0.40. When we also control for the change in capital stock, assumed exogenous, the elasticity remains very similar, with a point estimate ranging between -0.43 and -0.53 in columns (3) and (4). When we compare the point estimates of the OLS specifications in table 3 and the GMM system specifications, we can see that on average the latter yields a point estimate of the unit labor cost elasticity that is 10 to 25 percentage point above that obtained from the OLS specification, but this difference is limited taking into account the standard errors. We will therefore use OLS in the remainder of our analysis.

Table 4: System GMM Estimation, dependent variable: *Net export value*

	(1)	(2)	(3)	(4)
ULC	-0.401**	-0.434**	-0.434**	-0.536**
	(0.150)	(0.144)	(0.123)	(0.119)
K	-	-	0.737**	0.748**
			(0.012)	(0.0128)
Year effects	Yes	Yes	Yes	Yes
Sector effects	No	Yes	No	Yes
Hansen J test p-value	0.478	0.297	0.149	0.087
AR 2 p-value	0.265	0.281	0.038	0.05
Observations	29,965	29,965	29,965	29,965

Standard errors clustered at the firm level in parentheses. All variables are in logs. Instruments for ULC include lagged values of the ULC from t-2 to t-3 (difference equation) and the difference between t-2 and t-1 (level equation). $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

So far, our estimates have been based on one-year differences. Of course, firms may need time to adjust and short-run rigidities may result in biased estimates of the long-run elasticity of net exports with respect to unit labor costs. We therefore report the same set of results using five-year-long differences instead of one-year differences. The results are shown in table 5. Not surprisingly, the elasticity increases and falls in between -0.35 and -0.40. In column (5), we lag unit labor costs with one period as an additional robustness check, but the results hardly change.

number of observations actually used is substantially lower, as the instruments are not available for all observations. The number of observations in our first-difference OLS specification in table 3 is lower than the number of observations in levels because differencing leads to a reduction of the sample size.

Table 5: Dependent variable Δ_5 *Net export value* - long differences (5 years).

	(1)	(2)	(3)	(4)	(5)
Δ_5 *ULC*	-0.391**	-0.402**	-0.381**	-0.356**	-0.353**
	(0.0364)	(0.038)	(0.0369)	(0.0346)	(0.0409)
Δ_5 *K*				0.205**	0.210**
				(0.0178)	(0.0192)
Sector × year	No	Yes	No	No	No
Sector effects	No	No	Yes	Yes	Yes
Year effects	No	No	Yes	Yes	Yes
Observations	11,744	11,744	11,744	11,625	9,411
R^2	0.023	0.06	0.049	0.074	0.079

Standard errors clustered at the firm level in parentheses. All variables are in logs. Specification (5) uses unit labor costs lagged once. $^{+}$ *p < 0.10,* * *p < 0.05,* ** *p < 0.01*

Finally, we check whether the sensitivity of exports with respect to unit labor costs is different when other export measures are used. First, we check the results when gross exports are used, rather than net exports, as the dependent variable; i.e. using exports without subtracting imports. The results are reported in table 6a, where we give both one-year and five-year differences. It is worth noting that we still obtain a negative and statistically significant effect of unit labor costs on export performance, however, the point estimates are about 10 percentage points lower compared to the specifications in which we use net exports.

Table 6a: Dependent variable $\Delta_{(5)}$ *Gross export value*

	(1)	(2)	(3)	(4)
Δ *ULC*	-0.201**	-0.206**	-	-
	(0.0183)	(0.0183)		
Δ *K*		0.0985**	-	-
		(0.0117)		
Δ_5 *ULC*	-	-	-0.285**	-0.272**
			(0.0345)	(0.0336)
Δ_5 *K*	-	-		0.264**
				(0.019)
Sector × Year effects	yes	yes	yes	yes
Observations	43,589	43,111	22,395	22,125
R^2	0.029	0.032	0.042	0.064

Standard errors clustered at the firm level in parentheses. All variables are in logs. $^{+}$ *p < 0.10,* * *p < 0.05,* ** *p < 0.01*

As a second robustness check, we use value-added exports as the dependent variable, see table 6b. Gross exports will not exhibit a strong link with unit labor costs if the cost of the exporting firm is small relative to the total cost of the exported product. This is the case if the firm makes heavy use of intermediate inputs. Using net exports as the dependent variable, defined as the difference of exports and imports, only mitigates this to the extent that the intermediate inputs are imported by the firm. If the firm sources its intermediate inputs on the domestic market, there might still be a weak link between a value-added-based measure such as unit labor costs. Therefore, we go one step further and use value-added exports as a dependent variable, which proxies exports net of the intermediate inputs used to produce the exported products. An approximation of the value-added exports is obtained by subtracting the share of exports in intermediate inputs[14] from the gross exports. We again report both one-year and five-year differences. As before, we still obtain a negative and statistically significant effect of unit labor costs on export performance. The point estimates are 10 to 15 points higher in absolute value than the original specification with net exports.

Moreover, going from the main specification to the robustness checks, the coefficients change in a way that makes sense intuitively. If we take gross exports as an independent variable, the estimated coefficient becomes lower in absolute value. A part of the gross exports of a firm potentially rely heavily, or even entirely as shown in Damijan et al. (2013), on imports. An increase in unit labor costs will not have any impact on this part of gross exports, but only the part in which the firm uses its workers. Therefore, we expect the elasticity of gross exports to be lower than for net exports. Turning to value-added exports, we see that the coefficient increases in absolute value compared to using net exports as the independent variable. Net exports are potentially partly driven by domestically-sourced inputs, and can therefore be expected to suffer less from firm-level increases in unit labor costs than value-added exports. So, a higher elasticity (in absolute value) for value-added exports is in line with our expectations.

Table 6b: Dependent variable $\Delta_{(5)}$ *Value-added export value*

	(1)	(2)	(3)	(4)
Δ ULC	-0.430**	-0.437**	-	-
	(0.0249)	(0.0249)		
Δ K		0.120**	-	-
		(0.0142)		
Δ_5 *ULC*	-	-	-0.454**	-0.444**
			(0.0464)	(0.0438)
Δ_5 *K*	-	-		0.269**
				(0.0214)
Sector × year effects				
Observations	34520	34237	17605	17448
R^2	0.026	0.028	0.048	0.071

Standard errors clustered at the firm level in parentheses. All variables are in logs. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

[14] Value-added exports are thus defined as gross exports minus the intermediate inputs used for these exports. We only observe inputs at the firm level and hence do not observe the inputs corresponding to the exports. Therefore, we approximate the input share of exports by the share of exports in sales multiplied by the total intermediate inputs.

The analysis shows that unit labor costs have an appreciable impact on export performance, but the elasticity is still rather low. Linking it with the Melitz (2003)- based theoretical model presented in section II, an elasticity of exports with regards to unit labor costs of -0.2 to -0.4 implies an elasticity of substitution σ between varieties of 1.2 to 1.4, which is not that far from a perfectly inelastic elasticity of substitution (σ=1).

IV.2 Heterogeneity in the sensitivity of exports with respect to unit labor costs

While the above results focus on the average effect of unit labor costs on net exports, there may be quite a lot of heterogeneity in the responsiveness of firms with respect to changes in unit labor costs, depending on the product market or sector they operate in. As discussed in section II, recent models in international trade emphasize that, apart from relative costs, demand factors, such as quality and taste differences, may also be important in explaining the export performance of firms. Hence, sectors that are more R&D-intense may generate a different response to increases in unit labor costs as their product demand depends more on the degree of innovation and quality. We therefore estimate the elasticity of net exports with respect to unit labor costs for each two-digit NACE sector separately, shown in table 7. The elasticity of net exports with respect to unit labor costs is estimated to be negative in all sectors, but its magnitude ranges between -0.084 (and not statistically significant) in 'electrical equipment' and-0.742 in 'paper and paper products'. It is not surprising to find differences across sectors and we would expect these to be related to differences in the capital labor ratio, the type of technology used or the export orientation of the sector, which reflects different demand patterns (e.g. high- versus low-income countries). Similarly, we may expect some sectors tobe more vulnerable to demand shocks than others. With the financial and economic crisis, export markets collapsed and in some product areas more so than in others.

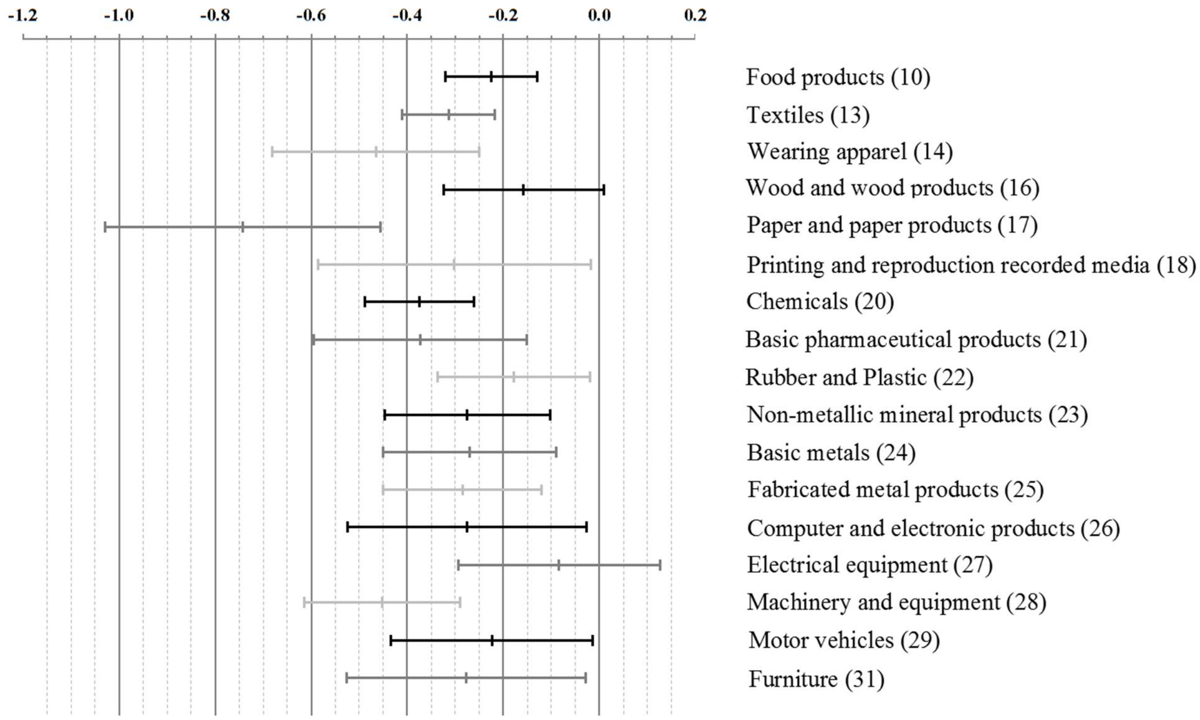
Table 7: Elasticity of net exports with regards to unit labor costs, according to specification (1), at the sector level.

Sector (NACE2-digit code)	*Δulc*	*s.e.*	*Obs*
Food products (10)	-0.225**	0.049	3,385
Textiles (13)	-0.313**	0.049	2,548
Wearing apparel (14)	-0.465**	0.110	658
Wood and wood products (16)	-0.158+	0.085	653
Paper and paper products (17)	-0.742**	0.146	601
Printing and reproduction recorded media (18)	-0.302**	0.145	667
Chemicals (20)	-0.374**	0.058	1,980
Basic pharmaceutical products (21)	-0.373**	0.113	324
Rubber and Plastic (22)	-0.178**	0.081	1,907
Non-metallic mineral products (23)	-0.275**	0.088	1,154
Basic metals (24)	-0.270**	0.092	679
Fabricated metal products (25)	-0.285**	0.084	2,498
Computer and electronic products (26)	-0.276**	0.127	831
Electrical equipment (27)	-0.084	0.107	693
Machinery and equipment (28)	-0.452**	0.083	2,221
Motor vehicles (29)	-0.224**	0.107	561
Furniture (31)	-0.278**	0.127	910

Standard errors clustered at the firm level in parentheses. All regressions include time fixed effects and have Δ K as control variable. The sectors beverages (11) tobacco products (12), leather products (15), coke and refined products (19) and other transport equipment (30), are not displayed because of the low number of observations for these sectors. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$

To illustrate to which extent the elasticities in table 7 are statistically significantly different from each other, we show a graphical representation of the point estimates with the corresponding 95% confidence interval in figure 5. The overlap of the confidence intervals gives an indication of whether the point estimates are significantly different from each other.For example, food products (10) and textiles (13) have confidence intervals that overlap substantially. The difference in elasticities is 0.088 in absolute value with a standard error of 0.069 and thus not statistically significant at the conventional significance levels (with a p-value of approximately 20%). The difference in elasticity between the sectors wearing apparel (14) and wood and wood products (16) is statistically significant: the difference is 0.307 with a standard error of 0.139 and a p-value of 2.8%. The graph shows that the confidence intervals of the coefficients of these sectors only have limited overlap.

Figure 5: Illustration of the 95% confidence intervals for the elasticities in table 7.



To further explore the heterogeneity, we carry out additional analysis to see to what extent the export elasticity with respect to unit labor costs varies over time and across a number of firm and sector characteristics that capture different demand and supply shocks. The results are presented in table 8. We focus on the specification using one-year differences, but the results for five-year differences are qualitatively the same. The first column of table 8 interacts unit labor costs with a crisis dummy equal to 1 for the years 2009 and 2010[15]. We include year-fixed effects and sector-fixed effects separately. Note that the interaction between unit labor costs and this crisis dummy is positive, but statistically not different from zero. In other words, the crisis did not have an effect on the sensitivity of (net) exports to changes in unit labor costs. In contrast, the direct impact of the crisis on net exports for the average firm has been strong and negative. The cumulative direct impact of the years 2009 and 2010 was estimated at -0.23 (not reported in the table), which means that exports dropped by 23% for the average firm in 2009 and 2010. In the second column, we check whether firms that export to high-income countries have a different elasticity. To this end, we define the firm-level destination GDP per capita as a gross-export-weighted average of the GDP per capita of its different destination countries and interact it with the change in unit labor costs. Arguably, if firms export to high-income countries, cost competiveness may be less important, as other aspects related to non-price competition,

[15] We also experimented with defining this dummy from 2008 onwards, but the results remained the same.

such as quality and reliability, may matter more[16]. We find the expected positive coefficient, but it is not statistically significant.

In column (3), we explore to what extent non-price competition is relevant in high tech sectors, that typically would be able to innovate more. High-tech sectors are defined on the basis of the Eurostat classification of R&D-intensive manufacturing sectors. We consider sectors as high-tech when they are ranked according to Eurostat as either high-tech and medium-high tech[17]. However, we find no statistically significant effect of high-tech sectors. This is somewhat surprising as we would expect them to be able to innovate more and because non-price competition is more relevant in these sectors. Nonetheless, a similar result for R&D-intensive sectors was found in Carlin et al. (2001) using OECD sector-level data. Of course, R&D intensity is measured in a rather crude way at the 2-digit NACE level, while typically R&D tends to be concentrated among a few large firms. Firm-level data on R&D and innovation would be required, which we do not have at our disposal.

In column (4), we test whether labor-intensive firms are more sensitive to changes in unit labor costs by interacting unit labor costs with the capital-labor ratio. We find that labor-intensive sectors have a much higher elasticity of net exports with respect to unit labor costs relative to capital-intensive firms.

Finally, in column (5), we put all specifications together to check whether all these effects still hold, which is the case. It is clear from the results in tables 6 and 7 that an average estimate of the elasticity of net exports with respect to unit labor costs is not reflecting the full dimensions of firm responses to shocks and that, depending on a number of firm and sector characteristics, firm exports react differently to changes in unit labor costs, giving support to recent models covering both cost heterogeneity and demand heterogeneity as in Melitz and Ottaviano (2008) and Di Comite et al. (2014).

We also experimented with other sources of heterogeneity not reported here. We analyzed to what extent the export sensitivity with respect to unit labor cost depends on whether exports go to the EU (Internal Market effect) or not. To check if multinational groups behave differently, we included an interaction with the firm’s multinational status, but also did not find any statistically robust relationship. We also interacted the change in unit labor costs with firm size (proxied by log sales or employment). However, no statistically robust relationship was found. These results are presented in appendix 3.

[16] On a related issue, Martin and Mayneris (2014) study high-end variety exporters, defined as firms selling expensive varieties of a product, these varieties having specific attributes such as reputation, branding or quality that make them appealing despite their higher price. They find that French high-end exports are more sensitive to the average income of the destination country, but less sensitive to distance. This suggests that quality is more important relative to price (or costs) for high income countries.

[17] If we just restrict it to the very high-tech sectors, the results remain the same.

Table 8: Heterogeneity of elasticity of net exports with regards to unit labor costs over time and across firm and sector characteristics

	(1)	(2)	(3)	(4)	(5)
$\Delta\ ULC_{it}$	-0.291**	-0.849^{+}	-0.271**	-0.758**	-1.280*
	(0.0229)	(0.480)	(0.0245)	(0.199)	(0.517)
$\Delta\ ULC_{it} \times crisis_t$	0.0394				0.0423
	(0.0506)				(0.0548)
$\Delta\ ULC_{it} \times \ln$ *GDP per capita*$_{it\text{-}1}$		0.0538			0.0505
		(0.0467)			(0.0481)
$\Delta\ ULC_{it} \times$ *High-Tech*$_s$			-0.0338		-0.0257
			(0.0452)		(0.0472)
$\Delta\ ULC_{it} \times \ln$ *capital-labor ratio*$_{it\text{-}1}$				0.0433*	0.0438*
				(0.0186)	(0.0186)
$\Delta\ K_{it}$	0.0918**	0.0973**	0.0923**	0.105**	0.105**
	(0.0134)	(0.0135)	(0.0134)	(0.0136)	(0.0135)
Year & sector dummies	Yes	Yes	Yes	Yes	Yes
Observations	23009	22484	23009	22393	22380
R^2	0.026	0.029	0.026	0.029	0.030

Standard errors clustered at the firm level in parentheses. All variables that are interacted with unit labor costs are also included separately in the regressions, but not reported. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

IV.3 Extensive margin

So far, we have only focused on the intensive margin of exports, i.e. how export sales increase or decrease with changing unit labor costs. But when the fixed costs of entering export markets are high, unit labor costs, reflecting in part productivity, may be even more important for starting to export. As theoretically shown by Melitz (2003), firms self-select into export markets when they are more productive. So, we would expect that firms with higher unit labor costs will be less likely to start exporting if they are not yet exporting and more likely to stop exporting when already exporting. We analyze the relationship between entry into export markets and unit labor costs by identifying all firms that start to export in a particular year, while not exporting the year before. Our control group consists of all other manufacturing firms that never export. The first three columns in table 9 reports various specifications of a probit model for entry into export markets. Note that we report the marginal effect evaluated at the means of the regressors rather than the probit coefficients as the latter do not have an economic interpretation. In the first column, we simply include lagged unit labor costs, and the standard year and sector control dummies. Contrary to our expectations, we find a statistically significant positive relation between unit labor costs and firm entry into export markets. However, when controlling for firm size, through log employment[18], we find the expected negative coefficient (see the second column). The estimated effects are quite low: a decline in the ULC from the 75th percentile in

[18] The importance ofcontrolling for firm size, and more specifically employment size, is explained in detail in the appendix.

our sample to the 25th percentile, increases the probability of becoming an exporter with approximately 1.7 percentage points. When going from the 10th to the 90th percentile, the increase is 3.7 percentage points. In the third column, we report a specification where we separately include nominal wages and labor productivity as is done in a number of papers that analyze the extensive margin (e.g. Bernard et al., 2006). They indicate that firms entering export markets have both a higher level of labor productivity and higher nominal wages. This is consistent with findings in the literature. For instance, Bernard et al. (2006) report a positive coefficient on both the wage and on labor productivity. The positive coefficient on labor productivity reflects better firms self-selecting into export markets. The positive coefficient on the wage is usually interpreted as an indicator of labor force quality, reflected by higher nominal wages paid to workers with high human capital. The last three columns of table 9 show the results for firms that exit the export markets. We compare firms that withdraw from the export markets, while still exporting the year before, with firms that keep on exporting as a control group. Column (4) shows a statistically insignificant positive relation between unit labor costs and exit. This coefficient becomes much larger and statistically significant when controlling for employment, as shown in column (5). The magnitude is larger than for the entry analysis, but still somewhat low: an increase of unit labor costs from the 25th to the 75th percentile raises the probability of exit by 4 percentage points, from the 10th to the 90th percentile of 8.1 percentage points. The final column shows that this is mainly driven by lower labor productivity and that the coefficient on wage is not statistically significant.

Table 9: Extensive margin – exit and entry of firms

	(1) Entry	(2) Entry	(3) Entry	(4) Exit	(5) Exit	(6) Exit
ln ULC	0.00967**	-0.0305**		0.00231	0. 0680**	
	(0.0175)	(0.00273)		(0.006545)	(0.00771)	
ln Employment		0.0351**	0.0319**		-0.0707**	-0.0635**
		(0.00130)	(0.00125)		(0.00231)	(0.00231)
ln Labor prod.			0.0305**			-0.0666**
			(0.00279)			(0.00744)
ln Av. Wage			0.0137**			-0.0101
			(0.00484)			(0.0118)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	60989	59306	59888	29942	29892	29892
Pseudo R^2	0.044	0.118	0.125	0.066	0.254	0.264
Log likelihood	-13551	-12203	-12247	-10875	-8645	-8535

Standard errors clustered at the firm level in parentheses. The dependent variable is a dummy that indicates whether the firm started exporting. All regressors are lagged with one period. All specifications are probit estimations. We report the marginal effect evaluated at the means of the regressors rather than the probit estimation coefficients. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

The disaggregated data enable us to study the 'within-firm extensive margin' as well, i.e. the impact of unit labor costs on adding or dropping products, destinations and product-destination combinations. We present the results in table 10. In the first column, we run a probit regression on a dummy taking on the value '1' if a firm increases its number of export destinations compared to the previous year, and zero otherwise. In column 2, we use the reverse: the dependent variable dummy for destinations dropped takes on the value '1' if the firm reduces its number of export destinations, and zero otherwise. We find that firms with higher unit labor costs are less likely to expand the number of export destinations (column 1) and more likely to reduce the number of export destinations (column 2). The next two columns show the same analysis for exported products: firms with higher unit labor costs are less likely to increase the number of exported products (column 3), and more likely to cut the number of exported products (column 4). The last two columns show the results for unique export destination-product combinations. In line with the previous results, we see that firms with higher unit labor costs are less likely to boost the number of export destination-product combinations (column (5)), and more likely to reduce the number of export destination-product combinations (column (6)).

So, we can summarize the results for the extensive margin as follows: a higher unit labor cost reduces the probability of entering the export markets and increases the probability of exit from the export markets when controlling for firm size. Also, firms with higher unit labor costs are less likely to add export destinations, export products and destination-product combinations. The effects are statistically significant but rather small.

Table 10: Extensive margin – adding/dropping of destinations, products and destination-product combinations

	(1) Dest. added	(2) Dest. dropped	(3) Prod. added	(4) Prod. dropped	(5) D-P added	(6) D-P dropped
ln ULC	-0.0627**	0.0303**	-0.0306**	0.0150*	-0.0628**	0.0380**
	(0.00721)	(0.00714)	(0.00716)	(0.00649)	(0.00741)	(0.00682)
ln Employment	0.0392**	0.0266**	0.0360**	0.0251**	0.0341**	0.0147**
	(0.00199)	(0.00179)	(0.00191)	(0.00181)	(0.00204)	(0.00189)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	34048	34048	34048	34048	34048	34048
Pseudo R^2	0.017	0.011	0.013	0.007	0.013	0.006
Log likelihood	-22322	-21634	-22493	-22500	-23130	-22970

Standard errors clustered at the firm level in parentheses. The dependent variable is a dummy that indicates whether the firm started exporting. All regressors are lagged with one period. All specifications are probit estimations. We report the marginal effect evaluated at the means of the regressors rather than the probit estimation coefficients. $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$

V. Conclusion

Unit labor costs have been a widely used measure for assessing the competitiveness of countries. Rising unit labor costs are usually seen as a threat to export market performance. However, very little empirical work has looked into the impact of unit labor costs on export performance. This paper has tried to fill this gap by analyzing the relationship between unit labor costs and exports at the firm level.

We argue first that using micro data is more appropriate as there is a lot of heterogeneity between firms not only in terms of productivity and hence unit labor costs, but also in terms of their export market performance. Furthermore, we analyze net exports of firms, i.e. exports adjusted for their import content, for which firm-level data seem more appropriate.

We find that the elasticity of exports with regard to unit labor costs varies between -0.29 and -0.40. But this elasticity varies between sectors and firms. In particular, we find that more labor-intensive firms are more sensitive to changes in unit labor costs than firms that use more capital and export mainly to the EU market. The financial and economic crisis affected exports, but the elasticity of exports with respect to unit labor costs did not change. Finally, we show that changes in unit labor costs also have only a statistically significant impact on the extensive margin of exports.

Our results are relevant for policy-makers in understanding the role of cost competitiveness in export performance. The paper helps to evaluate the use of unit labor costs as a competitiveness indicator. While our results show that unit labor costs have an impact on the intensive and extensive margin of firm-level exports, the impact is rather low. This suggests that pass-through of costs into prices is low or that demand is fairly inelastic with regard to prices. The latter finding indicates that other factors such as taste and quality may be just as important to incorporate into indicators of competitiveness, as suggested by recent trade models focusing on quality and taste parameters. A major challenge for constructing indicators of competitiveness is therefore to identify proper measures for quality and taste. Also, the finding that the elasticity of exports with regard to unit labor costs is larger for labor intensive firms suggests that cost competitiveness is more important for these firms.

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Appendix 1: Data description

Reporting trade data

Extra-EU data are taken from the customs data and intra-state survey data available at the NBB. Trade data are collected of all transactions with a value higher than 1,000 euro or a weight over 1,000 kg. Following a broader use of electronic reporting producers from 2006 onwards, very small transactions are now reported while this was not the case before.

The thresholds are more binding for intra-EU trade. From 1998 to 2005, firms had to report their export and import flows if these were more than 250,000 euro per year. From 2006 onwards, the threshold was raised to 1,000,000 euro for exports and 400,000 euros for imports.

Firm data

The trade data are merged with the company accounts of firms using a VAT number. All incorporated firms in Belgium are required to submit full or abbreviated annual accounts to the National Bank of Belgium. Since small firms are not required to report sales, we supplement the firm-level data with confidential data on sales from the VAT registry.

Data-cleaning

The changes in unit labor costs, exports, net exports, capital, average wage, labor productivity and materials over sales ratio that are smaller than the first percentile of the distribution or larger than the 99th percentile of the distribution are dropped. For the differences between exporters and non-exporters in table 2, we also dropped the observations in levels that were lower than the first percentile or higher than the 99th percentile of the dependent variable.

Appendix 2: Measurement of employment for micro firms

When analyzing the differences between exporters and non-exporters, it is important to control for the fact that micro-firms seem to be exceptional. This is illustrated in table 11. We regress different variables of interest, i.e. labor productivity, average wage, unit labor costs and capital-labor ratio on five size dummies $D^{FTE=k}$, taking the value of one when the number of FTEs is respectively one or lower, strictly larger than one but smaller than or equal to two, …, strictly larger than four but smaller than or equal to five. The smallest firms are more productive, have a lower wage, lower unit labor costs and a higher capital-labor ratio. This is remarkable, as the literature generally finds that productivity and capital intensity *increase* with firm size. We find the contrary, as again confirmed in table 12 where we regress the four dependent variables on log employment. However, interestingly, the relation returns to “normal” when we exclude the firms with strictly more than five FTEs. This is shown in table 13. For this sub-set of firms, productivity, wages and capital intensity do in fact increase with firm size.

The main explanation we see is that the owner of the firm is not always reported as an employee of the firm for micro firms, even if active in the firm[19]. This would explain why labor productivity and the capital labor ratio is so high for these small firms. An alternative explanation for the high labor productivity is that the marginal product of an extra employee diminishes with an increasing number of employees. Irrespective of the reason why micro firms are more productive, this is potentially problematic when comparing exporters and non-exporters, as the non-exporters are on average much smaller and contain a much higher fraction of these micro firms. Hence, we need to control for this in our analysis. Therefore, we include log employment as a control to take this into account when analyzing the differences between exporters and non-exporters and for our extensive margin analysis. Adding more detailed controls, e.g. employment dummies for the smallest firms, yields qualitatively the same results.

Table 11: Premia for micro firms

	(1) Q/L	(2) W/L	(3) ULC	(4) K/L
$D^{FTE=1}$	0.302**	-0.227**	-0.840**	0.812**
	(0.00951)	(0.00528)	(0.0116)	(0.0235)
$D^{FTE=2}$	0.0269**	-0.215**	-0.266**	0.377**
	(0.00874)	(0.00509)	(0.00756)	(0.0235)
$D^{FTE=3}$	-0.0586**	-0.198**	-0.149**	0.196**
	(0.00860)	(0.00513)	(0.00715)	(0.0233)
$D^{FTE=4}$	-0.0783**	-0.177**	-0.102**	0.132**
	(0.00860)	(0.00516)	(0.00669)	(0.0231)
$D^{FTE=5}$	-0.0826**	-0.149**	-0.0747**	0.0761**
	(0.00871)	(0.00515)	(0.00702)	(0.0241)
Observations	163240	163251	168379	158673
R^2	0.160	0.277	0.252	0.100

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

[19] The owner is at least partly paid through the profits of the firm. Some owners choose to be an employee of their firm, e.g. for tax reasons (if they pay themselves a low wage, the tax rate on their wage is lower than the corporate taxes), but not all owners do this. We see for instance many firms reporting zero employment in their accounting statements.

Table 12: Relation with firm size

	(1) Q/L	(2) W/L	(3) ULC	(4) K/L
Log employment	-0.0168**	0.0811**	0.126**	-0.130**
	(0.00225)	(0.00104)	(0.00224)	(0.00510)
Observations	163240	163251	164754	158673
R^2	0.124	0.330	0.184	0.085

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 13: Relation with firm size for firms with more than five FTEs

	(1) Q/L	(2) W/L	(3) ULC	(4) K/L
Log employment	0.0787**	0.0963**	0.0197**	0.0235**
	(0.00339)	(0.00177)	(0.00257)	(0.00812)
Observations	92272	91849	92374	90678
R^2	0.240	0.420	0.111	0.111

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Appendix 3: Additional heterogeneity results

In this section, we present the additional heterogeneity results mentioned in section IV.2. The results are shown in table 14. The first column shows the interaction with the EU-orientation dummy defined as in the summary statistics, taking the value one if the export value of the firm's exports to EU destinations exceeds 70% of the total exports and zero otherwise. The effect is positive and statistically significant. However, this effect is not robust. The coefficient is not statistically significant when defining the EU-orientation dummy slightly differently, e.g. using a threshold of 60% (coefficient drops to 0.073 with a p-value of 18%) or 80% (coefficient drops to 0.047 with a p-value of 29%). In addition, when using gross exports as dependent variable, the coefficient even switches sign. So we do not find a robust effect for the interaction with EU orientation. The second column shows the result for an interaction with a multinational dummy, taking the value one if the firm is a MNE and zero otherwise. The coefficient is close to zero and not statistically significant. Columns 3 and 4 show firm size interaction, with respectively employment and sales as a proxy for firm size. Here too, we do not find any effect.

Table 14: Heterogeneity of elasticity of net exports with regards to unit labor costs – additional results

	(1)	(2)	(3)	(4)
$\Delta\ ULC_{it}$	-0.366**	-0.284**	-0.280**	-0.546*
	(0.0427)	(0.0238)	(0.0521)	(0.217)
$\Delta\ ULC_{it} \times EU_{it-1}$	0.0961*			
	(0.0488)			
$\Delta\ ULC_{it} \times MNE_{it-1}$		0.0119		
		(0.0460)		
$\Delta\ ULC_{it} \times \log Emp_{it-1}$			-0.00599	
			(0.0130)	
$\Delta\ ULC_{it} \times \log Sales_{it-1}$				0.0154
				(0.0132)
$\Delta\ K_{it}$	0.0976**	0.0913**	0.0964**	0.0971**
	(0.0135)	(0.0134)	(0.0135)	(0.0135)
Observations	22497	22927	22482	22491
R^2	0.029	0.026	0.029	0.029

Standard errors clustered at the firm level in parentheses. All variables that are interacted with unit labor costs are also included separately in the regressions, but not reported. $^{+}\ p < 0.10$, $^{*}\ p < 0.05$, $^{**}\ p < 0.01$

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