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Scalpel, Please! Dissecting the Euro's Effect on Trade*

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Abstract
In order to identify the effect of the euro on trade, we analyze the pattern and dynamics of cross-border trade between the 15 member countries of the European Union from 1995 to 2005. We apply various statistical techniques to examine trade at various levels of disaggregation, including firm-level trade data for Belgium. We find consistent evidence that trade among member countries of the European Monetary Union (EMU) has moderately increased after the introduction of the euro. However, other important features of a bilateral trade relationship such as the number of traded varieties have remained largely unaffected. At the firm level, we find that the euro has increased the propensity of firms to export to EMU. Also, the number of products that exporters ship to EMU member countries has increased after the introduction of the euro. These effects are stronger for small and less productive firms. In combination with results from aggregate product level, our findings suggest that intra-EMU trade has mainly expanded through the extensive margins, i.e. an increase in the number of exporters and products exported by firms.

JEL Code: F13; F14; F15; F33

Keywords: monetary union; common currency; integration

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1. Introduction

1.1 Background

On January 1, 1999, eleven of the (then) fifteen member countries of the European Union (EU) proceeded in economic integration and formed a monetary union. While national currencies remained legal tender in the respective countries for the next three years, their exchange rates were irrevocably fixed to a new multinational currency unit, the euro, so that any volatility between bilateral nominal exchange rates was completely and permanently eliminated. After Greece had joined the European Economic and Monetary Union (EMU) as the twelfth member country on January 1, 2001, the euro was finally introduced as a physical currency (replacing national notes and coins) on January 1, 2002.[1]

Although in principle just another step towards integration, the change in the exchange rate and monetary regime among European countries has attracted much attention from both policymakers and economists. The effects of EMU are of particular interest for at least three reasons. First, there have been only very few experiences of international currency unions before. For instance, in early 1992, when the Maastricht treaty about the establishment of a monetary union was signed, only 32 of the 166 members of the United Nations (UN) were (periphery) member of a currency union, i.e., were not using their own national currency. More importantly, most of the countries involved in a currency union were radically different from a typical non-currency union member. Some currency union members were extremely small in size (such as Palau and Liechtenstein) so that hardly any economic data for these territories were available.[2] Other territories were economically highly dependent on an anchor country (such as Bhutan on India or Namibia on South Africa), and simply have unilaterally adopted this country's currency. Further, almost all pairs of countries in a currency union also shared a common colonial history (such as the former French colonies that formed the CFA franc zone). In any case, none of the existing currency unions was comparable with the EMU.

Second, currency unions have been out of fashion for more than 50 years. Since the end of World War II, not a single currency union had been newly created, and only two

[1] On January 1, 2007, Slovenia became the thirteenth member country of EMU. Cyprus and Malta joined EMU one year later. Slovakia is expected to become the sixteenth member country of EMU effective January 1, 2009.

[2] Only two of the 17 smallest UN member countries (with a population of less than 150,000) have a sovereign currency (Seychelles, Tonga). More generally, Rose and Engel (2002, Table 1) report a mean population size of about 1.8 million for currency union members, more than an order of magnitude smaller than the average population of 23.6 million in non-currency union member countries.

sovereign nations were willing to abandon their independent monies by entering an existing union: Mali and Guinea-Bissau joined the CFA franc zone in 1984. In contrast, many territories rather had a strong preference to have their own national currency. Political separation (e.g., from a former colonizer) was often accompanied by monetary separation so that the number of currencies in the world has sizably increased in the post-war period. As a result, Glick and Rose (2002) find that of the 146 regime transitions into and out of currency unions over the period from 1948 through 1997, 130 switches (~89 percent) in their sample are currency union exits.

Third, recent academic research has argued that the benefits of a common currency may be substantially larger than initially thought. Rose (2000) finds, in an excellent but heavily disputed paper, that a common currency is typically associated with much higher bilateral trade than if two countries use separate currencies; Frankel and Rose (2002) argue, based on these findings, that membership in a currency union may have a sizable positive effect on per capita income. Since it seems generally difficult to establish a robust (negative) empirical relationship between exchange rate volatility and trade (see, for instance, Clark et al. [2004] for a recent survey of the literature and Tenreyro [2007] for recent evidence), this finding was highly surprising and controversial.[3]

Given these uncertainties about the workings of a currency union, the formation of EMU was widely considered to provide a useful "natural experiment" to identify the effects of a common currency. The introduction of a new currency among various large, developed and politically independent nations by free and unforced decision should provide a perfect environment to extract and analyze the effects of this policy change by observing possible changes in economic variables after the adoption of the euro. Not surprisingly, in view of Rose's (2000) results that sharing the same currency may strongly benefit trade, a special focus was given on the effects of EMU on trade.

1.2 The euro and trade

A rough exploration of the pattern and dynamics of European trade provides little conclusive evidence that the introduction of the euro has measurably affected trade. Table 1 shows for each of the 15 EU member countries that were facing the decision on whether or not joining EMU in 1999 some illustrative statistics on the (relative) importance of trade with the EMU; results for the late entrant Greece and for non-EMU

[3] In initial calculations of the effects of EMU such as the European Commission's (1991) study "One Market, One Money", the trade effects of the euro were expected to be small, especially since exchange rate fluctuations among European currencies were already (very) low.

members are presented in bold.[4] The first column reports exports to EMU member countries as a share of a country's total exports to the EU in 1999, i.e., at a time when the EMU was established. As the table indicates, there is no measurable difference in the importance of trade with EMU member countries between EMU and non-EMU countries. Although there is considerable variation in the geographical structure of exports across countries, countries outside the EMU do not trade significantly less with EMU member countries than countries that have decided to participate in the EMU. Also, growth rates of exports to EMU, shown in the next column, do not differ systematically after the introduction of the euro[5]; a similar observation is made for the immediate pre-euro period. Finally, to identify a possible redirection in EU trade, Figure 1 plots the evolution of the share of exports to EMU in total exports, scaled to be 1 in 1999. Again, there is no evidence that the introduction of the euro has measurably changed the pattern of European trade. Most notably, for countries outside the euro the relative importance of exports to the EMU is basically unchanged over the sample period; non-EMU countries are at the center of this fan chart.[6]

Early regression results that control for the effect of other influences on trade, in contrast, appear to provide strong support for Rose's (2000) claim that common currencies benefit trade. Similar to Rose, these studies apply variants of the widely-used gravity model of trade to isolate the effect of the euro on trade—a model that allows to hold constant for a variety of factors, including pre-EMU trade intensity. Studies of this type typically find that intra-EMU trade has increased by about 10 percent in the first three to four years of the EMU's existence. Examples include Micco, Stein and Ordoñez (2003) and Flam and Nordström (2003); the literature is carefully reviewed in Baldwin (2006a, 2006b). Although the estimated trade effect of the euro is considerably smaller in magnitude than Rose's initial estimates suggest, an immediate, economically and statistically significant increase in trade generally confirms Rose's main finding, especially

[4] In the following, EMU is defined – in time-variant fashion – to comprise all member countries of EMU at a given point in time; the term "euro zone (EZ)" is used as a synonym for this group of countries. Since all of our data covers the period only until 2005, EMU refers to the eleven founding members of EMU plus Greece (EMU12). Occasionally, we also present evidence for the founding members only (EMU11).

[5] For almost all countries in the sample exports to EMU have increased by about 20 to 50 percent over the five-year period from 1999 to 2004. However, there are three outliers. Luxembourg's exports have more than doubled, while exports from the United Kingdom and Greece have increased only by about 10 percent.

[6] In similar fashion, Lane (2006, Tables 4 and 5) shows that while international trade as a ratio of GDP has strongly increased for EMU member countries over the last decade, the relative share of trade within the euro area has declined for most member countries.

since Glick and Rose (2002) have shown that it may take decades before the trade effect of a common currency fully shows up.

Results derived from the gravity approach, however, are not without criticisms. In an early critique of Rose (2000), Persson (2001) applies a non-parametric matching technique to identify the currency union effect on trade and gets much smaller (though still significantly positive) estimates. Baldwin (2006a, 2006b) emphasizes that most applications of the gravity model lack proper theoretical foundation and are seriously misspecified; this misspecification would lead to considerable overestimation of the common currency effect on trade. Berger and Nitsch (2008) take a historical perspective and argue that the increase in trade between EMU member countries that is observed after the introduction of the euro is simply a continuation of a long-run trend; they show that the intensity of trade between countries that have later adopted the euro has continuously risen since the end of World War II.

Apart from methodological issues (producing contradictory results), there are other sorts of difficulties in identifying the euro's effect on trade. One problem is timing. The gradual shift from national currencies to the euro, which started with the signing of the Maastricht Treaty in February 1992 and includes the selection of founding members of EMU in May 1998, the decision on conversion rates of national currencies to the euro (thereby effectively fixing bilateral exchange rates) in December 1998, the accession of Greece in 2001, and the euro currency changeover in 2002, makes it difficult to choose a particular starting date for EMU. Another problem is possible distortions in official trade statistics. As Baldwin (2006a, 2006b) notes, European trade data have become less reliable (and were possibly inflated artificially) with the creation of the single European market in 1992. Moreover, some of the measures to liberalize intra-European trade were adopted with a considerable delay, thereby potentially overlapping with the effects of the introduction of the euro.[7] Finally, from a welfare perspective, it may not be primarily the value of traded goods but rather the number of traded varieties that is relevant for assessing the gains from trade; see Broda and Weinstein (2004).

1.3 This paper

In view of the widespread (empirical) ambiguity about the euro's effect on trade, this paper aims to provide a new (and hopefully clearer) perspective. In particular, we decompose trade within the EU along various dimensions, analyzing new data and applying new techniques. Dissecting the euro's effect on trade across countries and

[7] See, for instance, http://www.europarl.europa.eu/factsheets/3_1_0_en.htm.

industries, as well as exploring trade activities at the firm level, allows to examine a variety of possible explanations for the observed increase in trade other than a fall in (exchange rate-related) cross-border transaction costs.

Previewing the main results, we find consistent, though statistically fragile, evidence that aggregate trade within the EMU has risen relative to EU trade after the introduction of the euro. Our benchmark estimates imply that actual intra-EMU trade may have increased by about 5-10 percent compared to its share in intra-EU trade in the mid-1990s—an estimate that is roughly in line with other estimates of the euro's effect on trade, such as Micco, Stein, and Ordoñez (2003).

Results are much less conclusive, however, whenever data other than aggregate trade among EMU11 countries are analyzed. For instance, the inclusion of Greece generally weakens estimates of a positive trade effect of the euro, both in quantitative and qualitative terms. Also, results from disaggregated product level rarely indicate that the euro has significantly increased trade. In combination with other results from aggregate data which show, for instance, that the number of traded varieties has not sizably increased, we conclude that the introduction of the euro had only a minor effect on trade. While EMU may have moderately benefited trade among EMU member countries, the adoption of a common currency has not lead to a structural change in intra-European trade patterns.

The firm-level results presented in this paper provide finer details about the channels through which an increase in trade within the euro-area trade may have taken place. Our findings suggest that the euro has raised the probability of being an exporter. Interestingly, the increase is more pronounced for lower and less productive firms. In addition, the single European currencies appear to have increased the average number of products exporters ship to other euro-area countries. These manufactures seem to seem to be characterised by lower unit values. This pattern of results is suggestive of the fact that the euro, lowering the costs associated with trading across borders within the euro-area, has allowed smaller and less productive firms to enter export markets and established exporters to start shipping abroad goods with low unit values, which were previously unprofitable to export.

2. Theory

2.1 Trade models

Fluctuations in exchange rates are, in principle, a barrier to international trade. Firms selling in foreign-currency markets face uncertainty about revenues in national currency. Also, hedging exchange rate risk is costly. As a result, when countries adopt a common currency and thereby (credibly) eliminate exchange rate variability, bilateral trade costs fall.

While lower trade costs should generally benefit international trade, the effects of trade liberalization on the export behaviour of individual producers have become the subject of a growing theoretical literature. In these models, various potential channels of trade growth are highlighted, with Chaney (2008) being a prominent example. More specifically, Chaney (2008) argues that the impact of a reduction of trade barriers on aggregate trade critically depends on the substitutability of goods. When firms differ by productivity (and there are costs of exporting), only a country's most productive firms in a given industry are able to survive in the export market; a fall in trade costs then allows new and less productive firms to start exporting. These new entrants, however, will have little impact on trade when goods are highly substitutable. In markets with fierce competition, firms that supply goods at low productivity capture, at best, only a small market share; instead, the fall in trade costs allows existing exporters to increase the size of their exports. In contrast, when goods are more differentiated and the elasticity of substitution is low, new entrants are sheltered from competition, and their impact on trade growth will be large. As Chaney (2008) shows, trade growth in this model is dominated by new exporters so that aggregate trade is more sensitive to changes in trade barriers for a low elasticity of substitution.

Another potential channel for trade growth after trade liberalization is emphasized in Bernard, Redding and Schott (2006). They start from the observation that firms that export multiple products account for most of a country's export values. Based on this finding, Bernard, Redding and Schott (2006) argue that trade liberalization not only affects the number of exporters and the average size of their exports (as in models with single-product firms), but also the range of products that are produced and exported. In their general equilibrium model, a fall in trade costs (which generates better export opportunities) induces firms to reallocate resources from the production of 'low-expertise' goods which are sold domestically towards the production of 'high-expertise' products which are also shipped abroad. As a result, the range of products that firms produce shrinks (as firms focus on their 'core competencies' and drop their least-productive products), but the share of products exported as well as the firms' export sales per product increase.

Interestingly, these effects are particularly strong in industries where the country already has a comparative advantage.

Bergin and Lin (2008) develop a model in which the reduction in trade barriers associated with exchange rate stability increases trade through completely distinct channels depending on the credibility of the exchange rate arrangement. While exchange rate stability generally lowers the riskiness of foreign sales (thereby resulting in higher exports), firms will pay the fixed cost of entry into new export markets only when the exchange rate link is credible for the longer horizon. Since currency union arrangements are much more durable than simple exchange rate pegs, trade expansion in currency unions is characterized by the entry of new firms or products, while pegs raise trade in existing products.

2.2 A framework for empirics

In order to identify possible sources of changes in bilateral trade, Baldwin (2006a, 2006b) has recently provided a simple and highly intuitive theoretical framework. The framework is based on a standard expenditure equation. More specifically, we start from the notion that the value of exports of a particular good from country i to country j is identical with the share of country j's total expenditures that is spent on the imported good so that:

$$p_{ij}\, x_{ij} \equiv s_{ij}\, E_j$$

where p_{ij} is the price of the good in country j (in terms of the numeraire), x_{ij} is the shipped quantity, s denotes the expenditure share, and E_j is j's total expenditure on tradable goods. How much country j spends on the good from country i depends on the relative price of the good and the intra-temporal elasticity of substitution between goods from various (including home) suppliers (σ) so that:

$$s_{ij} \equiv (p_{ij}/P_j)^{1-\sigma}$$

where P_j is a price index of import-competing goods in country j. Finally, substituting the expenditure share and multiplying both sides of the expenditure equation with the number of varieties that are shipped from i to j (n_{ij}) yields an expression for the total value of country j's expenditure on goods from country i (V_{ij}):

$$V_{ij} = n_{ij}\, (p_{ij}/P_j)^{1-\sigma}\, E_j$$

As a result, any structural change in patterns of trade after the introduction of the euro (i.e., an increase in V_{ij} for EMU member countries) must be coming from an increase in the number of traded varieties and/or a change (i.e., a fall) in relative prices.

While the number of traded varieties is (roughly) observable from official statistics, it seems useful to briefly discuss the relative price channel in more detail. As noted above, a good becomes relatively cheaper when either its price in the destination market falls or the prices of all competing varieties increase. Since the price of a good from country i in country j is, by definition, the product of three terms: the (common) marginal production costs in country i (mc_i), the destination-specific trade costs to ship the good from i to j (τ_{ij}), and the destination-specific mark-up that producers charge in country j (μ_{ij}), price changes that affect only a group of countries could result from a change in bilateral transaction costs and/or a change in mark-ups. For the introduction of the euro, both channels appear a priori reasonable. Using the same currency should lower bilateral transaction costs and should also increase price transparency across markets. Still, it is an open empirical issue to what extent the euro has changed the pricing behaviour of European firms. Alternatively, relative prices fall when country j's price index of competing goods increases. Indeed, for EMU member countries, the sharp depreciation of the euro against other major currencies in the first two years of the euro's existence may have made goods from the same currency area more (price-)attractive. As Baldwin (2006a, 2006b) notes, however, controlling for exchange rate changes has had little effect on the estimation results of the euro's effect on trade.

2.3 Empirical implementation, part one: gravity models

In previous work, following Rose (2000), variants of the gravity model have been widely used to identify the euro's effect on trade. The main idea is to control for the standard determinants of bilateral trade in order to quantify the extent (if any) to which trade between EMU member countries deviates from trade between non-members. In the actual implementation of this framework, however, studies differ enormously. While most studies analyze panels of data, the time period that is chosen as well as the country sample, the dependent variable, the set of explanatory variables, and the use of panel estimators differ. This diversity is particularly unfortunate since it is well known, at least since Anderson and van Wincoop (2003), that the exact specification of the gravity regression matters for the estimation results.

For a long time, economists have applied a very simple and naïve version of the gravity framework in which the bilateral volume of trade between two territories is basically explained by their economic sizes and the geographic distance between them. Other explanatory variables are then added to the regression on an "as-needed" basis. For instance, speaking the same language or having a common land border is typically found to

increase trade so that respective controls have become a standard ingredient in gravity equations.

This ad hoc approach to the gravity framework became increasingly popular for a number of reasons. First, the model works extremely well empirically. The estimated coefficients on the key variables (such as GDP and distance) consistently take on the expected sign and are statistically highly significant; the adjusted R^2 is typically above 0.6. Second, the model has firm theoretical foundations. In particular, Deardorff (1998) has shown that a gravity-type equation can be derived from almost any standard trade model. Finally, and most importantly, the results of interest were typically extremely robust across various regression specifications. Since modifications of the regression set-up often had no measurable effect on the estimation results, the exact specification of the gravity equation became of less relevance.[8]

For Rose's (2000) analysis of the currency union effect on trade, however, it turns out that, given the specific features of his data, a theoretically sound specification of the gravity model is critically important. In fact, in an extremely detailed and insightful discussion, Baldwin (2006a, 2006b) lists a number of mistakes that are commonly made in the estimation of the common currency effect on trade and have the potential to severely bias the results upwards. Classic mistakes include deflating nominal GDP's by local GDP price indices, wrong log averaging of trade data, and inappropriately deflating nominal trade values by the U.S. aggregate price index.

In addition to these problems of data handling, a frequent difficulty in the design of the gravity estimation equation is how to consider a country pair's relative distance to all other markets which may have a potentially large effect on bilateral trade. Anderson and van Wincoop (2003), who have recently (again) emphasized the importance of correcting for this effect, estimate this term directly. Since their estimation technique is highly demanding, however, others have simply proxied for these factors by including country(-pair)-specific fixed effects; see, for example, Robert Feenstra (2004). This approach, however, ignores that the country effects are varying over time.[9]

In the baseline implementation of the gravity approach, we will therefore use a specification of the gravity model that aims to avoid (many of) these problems. In

[8] Rose (2000) is a good point in case. Rose reports dozens of parameter estimates of the currency union effect on trade, varying sample size, estimation techniques and explanatory variables. The key finding, however, proves to be robust to these perturbations (though the point estimate of the variable of interest varies somewhat in magnitude). As a result, Rose often labels the other regressors in the gravity equation as nuisance variables.

[9] Feenstra (2004) demonstrates the effectiveness of the fixed-effects estimator based on a sample of only a single year.

particular, we analyze direction-specific trade (instead of aggregate two-way bilateral trade); this approach is similar to Flam and Nordström (2003). Also, we consistently use nominal values.

In practice, we apply a theory-inspired ad hoc approach to describe the pattern and dynamics of EU trade after the formation of the EMU in gravity fashion. As shown above, the gravity model is essentially an expenditure equation which relates country j's expenditure on goods from country i (V_{ij}) to the two countries' total expenditures (E_i, E_j), bilateral trade costs (τ_{ij}), the two countries' alternative trading opportunities (as measured by prices P_i and P_j) and the intra-temporal elasticity of substitution between goods from various (including home) suppliers (σ). More specifically, theory yields the following specification:

$$V_{ij} = (\tau_{ij}/P_iP_j)^{1-\sigma} E_iE_j/E_{world} \text{ with } P_i = (\Sigma_k (\beta_k p_k \tau_{ki})^{1-\sigma})^{1/(1-\sigma)}$$

where β_k is the share of country k output in world output. For a detailed exposition of the underlying theoretical framework, see Baldwin (2006a, 2006b).

Instead of using a structural approach to estimate the individual parameters in this equation, we follow a more minimalist approach. More specifically, we control for all country-specific determinants of bilateral trade (such as GDP, exchange rates, multilateral resistance) with an (exhaustive) set of year-specific exporter and importer fixed effects, while time-invariant pair-wise fixed effects capture the effects of bilateral trade costs (such as geographic distance, common border, common language) on trade. The inclusion of a binary dummy variable for common membership in the EMU then allows identifying the effect of the euro on trade. In sum, we estimate equations of the form:

$$\ln(VX_{ijt}) = \alpha + \beta \text{ EMU} + \Sigma_{it} \chi_{it} X_{it} + \Sigma_{jt} \delta_{jt} M_{jt} + \Sigma_{it} \phi_{ij} \text{Pair}_{ij} + \varepsilon_{ijt}$$

In our view, this is the 'cleanest' possible (panel) version of the gravity model; it is also easily tractable. Still, as Berger and Nitsch (2008) have argued, even with a theory-consistent gravity approach, the coefficient estimate of the euro's effect on trade is hard to interpret since the increase in trade among EMU member countries after the introduction of the euro could be just a continuation of a long-term trend.

2.4 Empirical implementation, part two: trade decomposition

Apart from these minor (though important) modifications in standard procedures, we extend previous work along other dimensions. More specifically, exploiting highly disaggregated trade data, we are able to decompose a country's total value of exports in a given year (VX_t) into trade in an already existing bilateral trade relationship (typically labelled as intensive margin) and trade that is due to the market entry of new exporters or

new products (extensive margin). As already shown above, theory suggests that these margins may be affected differently by a change in trade costs; Broda and Weinstein (2006) argue that changes along these margins have different welfare implications.[10]

Formally, we note that:

$$VX_t = E_t \times I_t = N_t \times Z_t \times G_t \times I_t \ ,$$

where *E* is the number of a country's destination-variety combinations (extensive margin) and *I* is the average value of exports at destination-variety level (intensive margin). The extensive margin can then be further decomposed into sub-margins concerning the number of exporting firms (*N*), the average number of products exported by firms (*Z*) and the average number of destinations for each product-firm combination, i.e. variety (*G*). Taking logs and calculating the difference between any two years allows decomposing exports growth along different margins.

Similar decompositions can be performed for trade between any pair of countries. Consider the value of a country's exports to destination j (VX_d); following Mayer and Ottaviano (2007), it is possible to write:

$$VX_j = N_j^f \times \overline{VX}_j^f$$

where N_j^f and $\overline{VX}_j^f$ are the number of exporting firms and the firm-level average value of exports to country j. Further, using information about the total number of exported products, $\overline{VX}_j^f$ can be decomposed:

$$\overline{VX}_j^f = N_j^p \times \overline{VX}_j^{f,p}$$

where N_j^p and $\overline{VX}_j^{f,p}$ are respectively the number of products exported and the firm-product level average value of exports to country j. Finally, information about exported quantities (in tons) allows decomposing $\overline{VX}_j^{f,p}$ into the firm-product level average quantity ($\overline{QX}_j^{f,p}$) and firm-product level average unit value ($\overline{P}_j^{f,p}$) of exports to j:

$$\overline{VX}_j^{f,p} = \overline{QX}_j^{f,p} \times \overline{P}_j^{f,p} .$$

[10] Recent empirical evidence suggests that most of the variation in exports takes place along the extensive margin (i.e., with changes in the number of exporting firms); see Eaton, Kortum and Kramarz (2004) for evidence from France and Mayer and Ottaviano (2007) for results from a sample of European countries. For the trade effects of the euro, Baldwin (2006a, 2006b) argues that the observed increase in trade may be mainly due to trade of new goods; Baldwin and DiNino (2006) and Flam and Nordström (2006) provide supporting evidence.

All of these are multiplicative margins. Therefore, combining them and taking logs yields:

$$\ln VXj = \ln N_j^f + \ln \overline{VX}_j^f$$
$$= \ln N_j^f + \ln N_j^p + \ln \overline{VX}_j^{f,p}$$
$$= \ln N_j^f + \ln N_j^p + \ln \overline{QX}_j^{f,p} + \ln \overline{P}_j^{f,p}$$

The different export margins can also be used as dependent variables in gravity equations; this allows identifying possible determinants of trade margins (including the role of the euro).

Analogously, at an even more detailed level, it is possible to decompose an individual firm's exports to any given country j (VX_{fj}) into different extensive and intensive margins. Considering the number of products a firm exports to destination j (N_{fj}), we can write:

$$VX_{fj} = N_{fj} \times \overline{VX}_{fj}$$

where $\overline{VX}_{fj}$ denotes the firm's product-level average value of exports to j. Similarly, using information about exported quantities, it is possible to obtain:

$$\overline{VX}_{fj} = \overline{QX}_{fj} \times \overline{P}_{fj}$$

where $\overline{QX}_{fj}$ and $\overline{P}_{fj}$ are respectively the product-level average quantity and unit value of exports by firm and destination.

3. Product-level evidence

We begin our empirical analysis by applying gravity techniques on standard data sets of aggregate (and product-level) trade. We extend previous work along various lines, using a theory-consistent specification of the gravity model and decomposing trade along various dimensions.

3.1 Data

Before we start, we discuss a number of noteworthy features of the data set in more detail. First, we analyze exclusively data on trade between the fifteen countries that have been a member of the EU at the end of 2003. This restriction of the sample helps to minimize the effect of possible distortions on trade, perhaps arising from factors such as political frictions, large fluctuations in exchange rates or changes in the institutional setting of integration.[11,12] In principle, this set-up also implies that the time period to be analyzed

[11] Other studies, such as Micco, Stein and Ordoñez (2003), also seek to keep their country sample homogeneous, e.g., by including only industrial countries. It is then hoped that the

should be restricted from 1995 to 2004 to keep the country sample unchanged.[13] However, for completeness and comparability, we often tabulate results for the period until 2005.

Second, we focus on import values. Analyzing one-directional trade offers, in principle, the choice between using the recorded figures of exports from i to j (i.e, shipments), or applying the (hopefully) complementary statistics on imports of j from i (i.e., arrivals).[14] For both series, there are good arguments to use this particular data in the empirical implementation. For instance, import data are widely considered to be more reliable in international trade, since import values are the basis for tariff payments and therefore are often recorded more correctly by customs officers. With the launch of the single European market, however, trade is no longer checked at the border, but recorded by self-reporting of firms. Apart from making cross-border shipments easier, this procedure also lowers the accuracy of the statistical data and may even offer opportunities for fraud. As a result, Baldwin (2006a, 2006b) argues that for intra-European trade, export data may seem to be more reliable, since exporters get reimbursed for the VAT they pay at home and therefore have an incentive to correctly report shipments. Criminal activity, however, is not restricted to imports (being underreported); similarly, it may be profitable to overstate exports (as it is the case in carousel fraud[15]). In practice, it turns out that there are more non-zero trade observations for imports than for exports in our sample. More importantly, import values come in c.i.f. format, and therefore also include costs for transportation—a figure that appears to reflect more properly the demand of customers; see Jacques Melitz (2006).

Finally, we examine highly disaggregated sectoral trade data. Since our principal aim is to decompose the recent evolution of intra-European trade, we also analyze trade data at the most detailed level of product classification in European trade statistics, the 8-digit Combined Nomenclature (CN) level. According to the European Commission, the

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set of control variables properly captures any remaining differences across country pairs. Here, these differences are already reduced to a minimum by focusing exclusively on a set of countries that face(d) the choice of adopting the euro.

[12] On the impact of political frictions on trade, Larry Chavis and Phillip Leslie (2006) have recently examined the effect of French opposition to the war in Iraq on the sales of French wine in the U.S.. They find significantly lower sales as a result of the consumer boycott.

[13] On January 1, 1995, Austria, Finland and Sweden joined the EU. On May 1, 2004, EU was further enlarged by another ten new countries: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic, and Slovenia.

[14] Another alternative is to use the average of export and import figures. In fact, many studies on two-way trade compute total bilateral trade as the average of the four possibly recorded trade values—an approach that successfully reduces the number of observations with zero trade.

[15] See Baldwin (2006a, box 2) for a detailed description.

CN is comprised of the (widely used and often better known) Harmonized System (HS) nomenclature, which is run by the World Customs Organization, with further Community subdivisions.[16] With about 13,000 product codes, however, the CN-8 classification covers a smaller number of products than the 10-digit HS scheme which is used to classify U.S. trade.

The main source of data is the statistical office of the European Union, Eurostat. Eurostat provides detailed trade data in values (current euros) and volumes (quantities in 100 kilograms); the data have been downloaded from their website at http://fd.comext.eurostat.cec.eu.int/xtweb. In total, then, our sample covers trade between 210 country pairs (=15*14 countries) for a period of 11 years (1995-2005). At the 8-digits level, there are data for 13,882 product categories so that the maximum number of observations in our sample is 32,067,420 (=210*11*13,882).

A large share of these observations is zero, partly also due to the deletion of codes and the introduction of new codes. In fact, it turns out that changes in product classification affect on average about 4 percent of the sample in each year. As shown in the upper panel of Figure 2, about 200 new products are added to the statistics each year, while about the same number of product codes becomes obsolete, with large differences across years. Overall, the number of deleted product codes marginally exceeds the number of newly created codes so that the total number of product codes at the 8-digit CN level slightly decreases over time from about 10,500 in 1995 to about 10,100 codes at the end of the sample period. While product reclassifications appear to caution against the use of product-level data, pooling across years helps to reduce any possible statistical distortion.[17] In sum, there are 9,044,382 observations (~28.2%) with positive trade values for imports (while the figure for exports is lower at 8,776,212).

A notable (and potentially problematic) feature of the data set is that Eurostat reports no separate trade data for Luxembourg before 1999.[18] Instead trade is reported jointly for the union of Belgium-Luxembourg. To deal with this break in the data, which occurs exactly at the time of the introduction of the euro, we aggregate the trade figures for Belgium and Luxembourg after 1999, thereby reducing the number of countries in the

[16] See http://ec.europa.eu/taxation_customs/customs/customs_duties/tariff_aspects/combined_nomenclature/index_en.htm.

[17] In principle, Eurostat allows to track changes in product codes. Unfortunately, however, it is not possible to identify, based on this data, a continuous, uninterrupted trade relationship (and the respective trade values). For a description of changes in product codes, see Eurostat's Update of CN codes.

[18] As a result, the total number of possible trade observations is effectively only 30,512,636 (=14*13*4*13,882+15*14*7*13,882).

sample to 14. Occasionally, we also report results when Luxembourg is dropped from the sample.[19]

Table 2 presents a description of the raw data on trade within the European Union for the sample period that we analyze. Three indicators are tabulated, separately for the 15 EU member countries as a whole and for the subgroup of countries that have later become members of the EMU (as well as for trade involving non-EMU members by the direction of trade). The last column reports EMU12 trade as a percentage of total intra-EU trade, while the bottom part of the table shows percentage changes between the two (pre- and post-EMU) sample periods.

The first column reports figures for total EU trade. As shown in the first line, trade within the EU has risen by about 60 bn. euros (in nominal terms), or 58 percent, over the period from 1995-97 through 2002-04. Not surprisingly, given the economic weight of these countries, the majority of this increase, about 72 percent, comes from higher trade between member countries of the EMU. Trade between these countries has risen by about 43 bn. euros so that their share in total EU trade has marginally increased from about 67 percent in 1995-97 to 69 percent in 2002-04.

The next line reports the number of non-zero trade observations at the 8-digits CN level. Again, the numbers generally confirm intuition. With about 60 percent, the share of trade observations from EMU countries in total EU trade is lower than for aggregate trade values, implying that EMU countries report on average larger trade values. Also, most of the increase in EU trade has been on the intensive margin (i.e., in existing trade relationships or trade relationships that have replace others); the total number of observations with positive trade values has increased by only 3.8 percent.

Finally, it is evident from the third line that EMU member countries trade in almost all product categories for which Eurostat reports positive values for intra-EU trade. While we do not intend to interpret the absolute number of product categories too literally, given frequent changes in classification, the fraction of intra-EMU trade is stable at 99.7 percent.

In the following, we aim to (further) decompose the increase in intra-EU trade. We analyze data for different sub-groups of countries, use trade data at various levels of disaggregation, and apply several statistical and econometric techniques.

3.2 Results

[19] With a value of about 4.4 bn. euros in 1999 (6.5 bn. Euros in 2004), trade between Belgium and Luxembourg is minuscule in relation to both total EU trade and total EMU trade.

Table 3 presents the benchmark gravity estimates for aggregate trade. The first two columns show estimation results for our theory-consistent specification of the standard gravity model; the remaining columns present analogous estimates for other panel estimators that have been frequently used in the literature. It should be noted that, by design, there are several differences in the specification to many existing estimates of the euro's effect on trade: the dependent variable is imports (not total trade); we use Eurostat (instead of IMF or UN comtrade) data; and we include time-varying exporter and importer fixed effects, as required by theory (instead of time-invariant fixed effects).

Reassuringly, despite all those modifications, the estimated coefficient on the parameter of interest, the EMU11 (EMU12) dummy variable which captures the extent to which trade between countries sharing the euro deviates from trade between countries using separate currencies, takes a positive sign and appears to be of reasonable magnitude. The point estimate of 0.09 on the EMU11 dummy indicates an increase in imports among the founding members of EMU by about 9 percent (=exp(0.09)-1) after the introduction of the euro, holding other things constant. Thereby, our results imply that the trade effect of the euro is somewhat smaller in magnitude than most previous estimates suggest. Micco, Stein and Ordoñez (2003), for instance, estimate (in their preferred specification) a trade effect between 8 and 16 percent. Also, with a p-value of 0.082, the estimated coefficient is only of borderline significance statistically. More importantly, the coefficient decreases in magnitude and becomes statistically indifferent from zero when Greece is (correctly) coded as a member country of EMU (from 2001 onwards). Taken at face value, the coefficient of 0.07 implies a trade effect of the euro of about 7 percent (=exp(0.07)-1); this estimate is clearly on the low end of the range of existing estimates on the trade effects of the euro.

In the remaining columns of Table 3, we present estimation results for other specifications. At least two observations are particularly noteworthy. First, when structural variables replace (or augment) the sets of fixed effects in our benchmark specification, the standard gravity variables take on the expected sign, are of reasonable magnitude and are statistically highly significant; the only exception is the point estimate on the common border dummy which is insignificant (and actually negative), possibly due to its collinearity with the common language dummy in the European sample. Second, for all other specifications, the estimated coefficient on the EMU11 dummy variable increases in size and significance. For some specifications (specifically the plain pooled OLS estimation), the estimated trade effect of the euro even increases by factor three. Since all

these specifications of the gravity model are basically inconsistent with theory, the estimation results appear to be seriously biased.

Table 4 explores the evolution of the euro effect over time. Instead of entering a single EMU dummy variable, the regression includes year-specific dummy variables. In line with most previous findings, the estimated coefficients gradually increase over time. The point estimates almost triple in magnitude, from 0.04 in 1999 to 0.13 in 2005, though almost none of the coefficients is statistically different from zero. More importantly, as Berger and Nitsch (2008) have argued, there has been a continuous increase in intra-EMU trade intensity over the post-World War II period so that a continuation of this long-term trend is not necessarily evidence of a positive trade effect of the euro.

Table 5 makes use of the product level detail in the data set. In order to stick to our theory-consistent specification of the gravity model as closely as possible, we proceed step-wise. Analyzing trade at the 8-digits CN level (instead of aggregate bilateral trade) increases the number of observations from 2,002 to several millions. In combination with (then required) industry-specific time-varying exporter and importer fixed effects, the estimation model is no longer computationally tractable. Also, on product level, observations with zero trade become a potentially serious problem, since most products are traded only between a small set of countries (e.g., for product varieties where there is a major exporter that dominates the European market). Therefore, we begin analyzing trade that is disaggregated according to the first digit in the CN classification. With this extension, the estimated coefficients on the EMU dummy slightly decrease in magnitude (and, in the case of EMU11, lose statistical significance). In column 4, we include (theory-consistent) time-varying industry-specific exporter and importer fixed effects instead of simple industry controls, without much effect. The last two columns of Table 5 further increase the level of industry detail, presenting results by section and chapter in the CN tariff classification. Again, the point estimates are slightly smaller in magnitude than the results for aggregate trade, but basically confirm the previous finding of a moderate increase in intra-EMU trade after the introduction of the euro.

In Table 6, we list estimation results for each of the 21 sections in the tariff classification. Not surprisingly, there is considerable variation in the estimated coefficients. The point estimates range from -0.352 (for mineral products) to 0.430 (for optical instruments); most of the coefficients are positive, but statistically indifferent from zero at conventional levels of significance. In fact, only for two tariff sections, we estimate a statistically significant trade effect of the euro: optical instruments, and beverages and

tobacco.[20] These results broadly confirm the sectoral findings in Baldwin, Skudelny and Taglioni (2005).

In order to identify a possible explanation for this heterogeneity, we compare the estimated trade effects of the euro to the sectoral elasticity of substitution. Following Koenig (2005), we use the number of divisions inside a tariff chapter (i.e. a two digits category) as a measure of product differentiation, assuming that differentiated goods are divided into more (tariff) categories than homogenous goods. Not surprisingly, given that most of our sectoral estimates are statistically indifferent from zero, we find hardly any association between product differentiation and the trade effect of the euro. Figure 3 provides an illustration.[21]

Finally, we present results for two decomposition exercises. In a first experiment, we decompose the total value of bilateral trade into the number of traded products for a country pair (according to the 8-digits CN classification) and the average trade value per product; more details on this decomposition procedure are described below. The results are presented in Table 7. There is consistent evidence that the total number of traded products is largely unaffected by the introduction of the euro. As a result, since the two columns on the right of the table combine to make up aggregate imports (and, therefore, the sums of the coefficients equal those for the aggregate value of imports), the average trade value per product (that is, the intensive margin) has increased.

In another experiment, we decompose bilateral trade flows by trade duration.[22] More specifically, we distinguish between product categories (at the 8-digits level) that are traded between a pair of countries over the full sample period (of eleven years) and product categories for which at least one year of trade is missing. Following Flam and Nordstrom (2006), we interpret changes in trade for products with continuous trade observations as changes along the intensive margin, while changes in trade for occasionally traded products mainly reflect changes along the extensive margin of trade. Table 8 presents the estimation results. Similar to our previous results, there is evidence (at least for trade among EMU founding members) that the estimated euro effect on trade is due to changes in trade along the intensive margin.

[20] In the appendix, we present estimates by chapter.
[21] We also followed Koenig (2005) in using information from the Rauch (1999) classification of goods with similar results.
[22] Nitsch (2008) examines trade duration at the 8-digits level for German import trade. He finds that the fraction of bilateral trade relationships rapidly decreases over time, but a sizable share of trade pairs survives for the full sample period.

Overall, the findings in this section show that the introduction of the European single currency may have increased intra-euro area trade moderately. Our estimates are lower than those reported in the recent literature on this topic. This is arguably because of the comparison group used in this study, which include only countries in the EU that had the possibility of adopting the euro but did not, and because we properly control for unobserved partner-specific time-varying effects. This setting is likely to produce lower bound estimates of the impact of the euro for two reasons. Firstly, as underlined by Baldwin (2006a, 2006b), the euro may have acted like a unilateral trade liberalisation. As a result the exports from these countries to euro-countries have also increased, although to a lower extent than trade within the euro-area.[23] In addition, using this control group it may become difficult to disentangle the effect of the euro from the wider European integration process.[24]

4. Firm-level evidence

Thus far we have analyzed the effect of the euro on aggregate trade. In this section we investigate in further detail the effect of the euro on trade exploiting Belgian firm-level data. This exercise provides additional insights on the channels through which the euro has affected trade. Furthermore, consistent with the recent international trade literature at the level of the firm, we are able to study how firms with different firm characteristics have reacted to the introduction of the euro.

4.1 Data

Foreign trade data. Data on individual trade transactions are collected separately at company level for intra-EU (Intrastat) and extra-EU (Extrastat) trade. As before, products are recorded at 8-digit level of the Combined Nomenclature. Companies report Intrastat transactions monthly; they are only liable for Intrastat declarations if their annual trade flows (receipts or shipments) exceed the threshold of 250,000 euro per year.

There are two kinds of trade declarations, the standard and the extended one. Both declarations must include for each transaction the product code, the type of transaction, and the destination or origin of the goods, the value, the net mass and units.[25] In addition to

[23] Baldwin (2006a, 2006b) states that these countries are free-riding on the euro.
[24] Berger and Nitsch (2008) have shown, using a broad set of countries, that the impact of the euro on trade actually disappears when one controls for the increase in trade among EU members with a time trend.
[25] Companies which exceed the threshold of 25,000,000 euro for their annual receipts or shipments must fill up the extended declaration. They must file an extended declaration

the same common variables of the standard declaration, the means of transport and the conditions of delivery must be included in the extended declaration.

Extrastat contains the same information as Intrastat for trade transactions with countries outside the European Union. The data is collected by customs agents and centralized at the National Bank of Belgium (NBB). The Extrastat data cover a larger share of the total trade transactions than Intrastat data, because *all* flows are recorded, unless their value is smaller than 1,000 euro or their weight smaller than one ton.

In 1998, the minimum threshold beyond which firms are obliged to declare their exports (and imports) to EU member countries (Intrastat declaration) was increased from 100,000 to 250,000 euro per year. This change in reporting requirements created a break in the series with an evident drop of the number of exporters in 1998. To circumvent this problem, we decided to apply the 250,000 euro limit to all years in our sample, thereby allowing proper comparisons of the number of trading firms and the value of exports over the whole sample period.[26]

The loss of information associated with this trimming procedure is summarized in Table 9. As shown, the exclusion of firms with annual exports to EU countries of less than 250,000 euro results in a negligible loss of total exports. However, the decline in the number of exporters is more substantial, being in the order of about 20 percent in 1997 and 1996. These firms are arguably small exporters that did not contribute much to total exports.[27]

In the raw trade data different types of international trade transactions are reported. To classify firms as exporters, we consider only firms with trade transactions that involve a change in ownership.[28] As shown in Table 9, dropping other transactions has little effect

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for the flow of goods which exceeds this threshold. The extended declaration was introduced in 2002.

[26] Note that the threshold of 250,000 Euro per year was imposed to exports to the EU only.

[27] Note that also from 1998 onwards the percentage of total exports covered in our sample is below 100 since some firms reported their exports also when they exported less then 250,000 euro per year (and, therefore, were actually not required to do so).

[28] Records of international trade transactions also have to register movements of goods across borders which do not involve any change of ownership. These concern movements of stock, or goods sent or received for further processing, or for repair (after the repair has been executed). Furthermore, international trade transactions have to register the return of merchandise and other special movements of goods. For more details, see also Institut des comptes nationaux (2006). In order to give more information, recorded international trade transactions regard only goods that have actually transited the country. This therefore excludes the so-called triangular trade, whereby two firms in two different countries (for instance A and C) exchange goods through an intermediary operating in a third country (B). The intermediary buys the goods from the seller in country A and sells them to the buyer in country C. However, the goods are shipped by the original seller (in country A) to

on the results. Exports still cover more than 84 percent of total raw figure; the number of exporting firms is even less affected by this procedure.

For reasons explained below, we eliminate trade observations related to exports to Greece and Luxemburg. We also eliminate observations for which the partner country or the value or weight is missing. As shown in column 4 of Table 9, after these two additional steps, we are left with about 80 percent of the original value of exports and more than 90 percent of the initial number of exporting firms.

Firm-level accounts. The Central Balance Sheet Office at the NBB collects the annual accounts of all companies registered in Belgium. Most limited liability enterprises, plus some other firms, have to file their annual accounts and/or consolidated 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.[29] However, there are some exceptions: the data set does not cover firms in the financial sector; also, some non-financial enterprises do not have to file any annual accounts.[30]

For this study, we selected the companies that filed a full-format or abbreviated balance sheet between 1996 and 2005 To avoid double counting, we did not select firms filing consolidated balance sheets, either. Balance sheets that cover more than one year or report data from two different calendar years were annualized to match the customs data.

Merger of balance sheet and customs data. The Belgian Balance Sheet Transaction Trade Dataset (BBSTTD) results from the merging of the balance sheet data and the customs data at the level of the firm through the value added tax (VAT) number. This is a unique code identifying each firm in the statistics. As reported in column 5 of Table 9, the merge with the balance sheet data sizably reduces the available trade data and the number of exporters in our sample. The loss of information is mainly due to legal entities that have

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the final buyer (in country C), without transit through country B. Official figures suggest that this kind of trade is a non-negligible phenomenon in Belgium, but it will be recorded among imports or exports of services and not of goods.

[29] Under the Belgian Code of Companies, 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.

[30] 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.

a VAT number, but do not file any accounts with the Central Balance Sheet Office.[31] More information about these unmatched firms is given in Muuls and Pisu (2007). Nearly 60 percent of trade conducted by unmatched firms in 2004 can be attributed to foreign affiliates with no actual production site in Belgium. These are trading entities with a VAT representative. Most probably, they are trading platforms of other European firms using Belgium as their port of entry or exit. About 20 percent of the unmatched imports and exports can be attributed to foreign firms producing in Belgium. Their annual accounts are not available, probably because they are part of a larger group of firms filing consolidated accounts.

Geographical coverage. For aggregate product-level trade, we examined trade among a fairly homogeneous group of countries, the 15 member countries of the EU at the time of the introduction of the euro. For firm-level trade, in contrast, our sample comprises, in principle, all external trade of Belgian firms, disaggregated by partner country. Therefore, to identify the impact of the introduction of the euro on the intensive and extensive margins of exports, we examine Belgian trade with the following groups of countries; see also Berthou and Fontagné (2008):

- EMU11 (which comprises the eleven founding members of EMU except Luxembourg: France Germany, Ireland, Spain, France, Italy, the Netherlands, Austria, Portugal, Finland);
- NonEMU3 (which comprises the three non-members of EMU from the EU15: Denmark, Great Britain, Sweden);
- NonEMUeurope (which covers all other European countries including the 12 EU enlargement countries as well as Switzerland and Norway);
- NonEMUworld (which covers all countries from the rest of the world).

Slovenia is in the nonEMUeurope group since it adopted the European single currency only in 2006. We exclude Luxemburg from the analysis since even before the introduction of the euro it shared a common currency with Belgium. Besides, the two countries presented a single export and import declaration up to 1998. We also drop Greece from the data set since it joined EMU only in 2001.

[31] These entities can well be firms that are part of a larger group filing consolidated accounts. We do not use consolidated accounts. But even with consolidated accounts, it would be extremely difficult to disentangle the data related to those firms trading internationally but not filing accounts from the information concerning other firms in the group.

4.2 Descriptive analysis

For the groups of countries defined above, it is possible to decompose total exports into extensive and intensive margins. For this purpose, for all pairs of countries, we define a firm-product combination as a variety. Having a data set with detailed information about trading firms, traded products and partner countries, we are able to distinguish between different dimensions of the extensive margin of exports, namely the number of exporting firms, the number of products exported and the number of destinations to which a variety is shipped.

Table 10 provides a rough description of our firm-level trade data, based on the sample described in column 4 of Table 9. As shown, the total value of exports increased steadily over time. Also, confirming findings for other countries, exports are highly concentrated among relatively few firms: the 10 percent largest exporters account for more than 90 percent of total exports. The concentration level appears to have moderately increased over time whereas the number of exporters has gradually fallen. At exporter level, both the average number of products and the average value of exports by firm have increased from 1996 to 2005. The same pattern holds for the average value by variety, i.e. by product-firm combination. Along with the decreasing number of exporting firms, these observations are consistent with evidence that foreign sales are becoming more concentrated among few large exporters.

Table 11 reports analogous summary statistics for each group of destination countries. Unsurprisingly, most of Belgian exports are destined to EMU11 countries. However, the share of these countries appears to have gradually fallen over time, from about two-thirds of total exports at the beginning of the sample period to about one-half in 2005. Exporter concentration is high for all destinations; the market share of the top 10 percent exporters is often (sizably) above 80 percent, with lowest values for exports to EMU11 countries. This is likely due to the fact that EMU11 markets are easily accessible because of their geographical, cultural and institutional proximity to Belgium. Therefore, more exporters have the ability to ship goods there. The opposite is true for countries in the nonEMUworld group: only a minority of firms find it profitable to export there and as a result exports to these countries are more concentrated.

Concerning the number of exporters to each destination, what is most interesting is their dynamics over time. Whereas the number of enterprises exporting to EMU11 and nonEMU3 increased from 1996 to 2005, that to nonEMUeurope and nonEMUworld decreased. The average number of products by exporter exhibits a different behaviour. It

increased, but only slightly, for EMU11 and nonEMU3 and, more robustly, for nonEMUeurope, although mostly in the last years.

Figure 4 explores the contribution of the extensive ($E = G*Z*N$) and intensive margins (I), as defined in section 2.4, to the change in total exports from 1996 to 2005.[32] The most striking feature of this graph is the different behaviour of the two margins in the nonEMUworld export destinations when compared to other country groups. More specifically, the extensive margin explains most of the growth of exports towards EMU11 or nonEMU3 or nonEMUeurope countries. On the contrary, the intensive margin dominated the growth of exports towards nonEMUworld countries. An important message of this figure is that the role of the extensive and intensive margins changes according to the destination group. The relative importance of the former for exports to nonEMUworld countries suggests that sunk costs of exports to this destination group, whether at product, firms or country level, are so high that most of the changes in exports take place along the intensive margin. This is because any shock will induce exporters to change their export sales in these countries, but very few firms will enter or exit these markets as results. The opposite is true for exports to European countries in the EMU11, nonEMU3 or nonEMUeurope groups.[33]

Figure 4 also explores the contribution of the different components of the extensive margins to the change in exports from 1996 to 2005. As it is possible to see, for the EMU11 group, the number of destinations per variety and the number of exporters played a significant role in the change in total exports. The number of products per firm increased as well, but at a less extent. The contribution of the former to the growth of exports to nonEMU3 countries was larger, whereas those of the number of destinations per variety lower.

Figure 5Figure exhibits the behaviour of these three extensive margins differs over time and across destinations. Those of EMU11 and nonEMU3 all increased steady over time. Also, from this figure it is evident that there was a large increase in the number of products per firm and number of destinations per variety of nonEMUeuope in 2004 and 2005. These two margins of exports to EMU11 and nonEMUeurope increased smoothly, but less than the number of firms.

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[32] It is worth reminding that E number of destination-variety combinations and I the average value of exports at destination-variety level; N is the number of exporters, Z the average number of products exported by firm, G the average number of destinations at product-firm (variety) level.

[33] Note the same types of graphs in **Error! Reference source not found.** were created also for the 1997-2004 and 1998-2003 periods. They produce the same results.

This simple analysis has shown that the behaviour of the different margins change according to the country group we consider. However, there does not appear to be any noticeable change in their behaviour in the period around the introduction of the euro. This could be as results of the effect of other important trade determinants, such as GDP of export destinations, which followed different paths in euro-area and non-euro-area countries. To investigate more thoroughly the behaviour of different export margins taking into other potentially important factors we now turn to regression analysis.

4.3 Results

We are interested in estimating the effect of the introduction of the euro on firm-level exports to different destinations. In our dataset firm-destination couples identify panels: for each firm we have the export to all countries by year. To estimate the effect on exports one need model empirically both the decision to export and the volume. Empirical researchers have often used the Heckman (1979) selection process in such cases. However, this methodology has proved to be both unfeasible and inappropriate in this context. It is inappropriate because of different issues. Firstly, the Heckman procedure does not take into account unobserved idiosyncratic firm- and destination-level shocks. This is a potentially important source of bias because of pervasive firm-level heterogeneity. Secondly, as pointed out by Johnston and DiNardo (1997) the identification on the parameters of the Heckman selection process relies on some variables affecting the decision to export, but not how much.[34] Without at least one of these variables the identification of the model relies totally on the assumption of normality of the error term, which we feel is rather strong. It is not clear which trade determinant should affect the decision whether to export or not, but not exports sales. Thirdly, Manning, Duan and Rogers (1987) have shown that a two-part model, where the two decisions are estimated separately, is an attractive alternative when the selection problem arises because of taking logarithm of zero values. Lastly, the Heckman procedure is unfeasible because of the large number of observations in our data set. This, coupled with the large set of industry dummies necessary to control for industry shocks, will render the convergence of the maximum likelihood difficult.

For all these reasons, in this study we have estimated the decisions to export and how much to do so separately. We control for unobserved heterogeneity at firm- and destination-level. The two models have the same set of explanatory variables. This

[34] This avoids collinearity problems between the inverse Mill's ratio and the other controls in the value of exports regression.

comprises factors the gravity equation literature has found to be important trade determinants, such as GDP, common language and sharing a border. In addition, it includes firm-level characteristics, namely total factor productivity (TFP) and employment that the more recent empirical and theoretical literature at the level of the firm has shown to be important causes of firms' export decision.[35] [36]

The trading partners we consider in this regression exercise are those in the EMU11 and nonEMU3 groups defined above. As underlined above, we deem the latter to be a better control group than larger sets of jurisdictions including countries outside the EU. This is because the countries in nonEMU3, have been part of the broad EU's economic integration process of which the introduction of the euro has been one of many steps.

Before running firm-level regressions it is worth to compare the results that are possible to obtain using the Belgian data to those using the aggregate trade flows employed in Section 2. To this end, Table 12 shows the results of country-level gravity type equation obtained aggregating the Belgian firm-level export data at destination-level.

In column 1 of Table 12, it is possible to see that that the euro had not any significant impact on total value of exports. The point estimates are 0.034 and 0.04 for the random and fixed effects specification respectively. These are admittedly low and below the 5 to 20 percent range that Baldwin (2006) has suggested to be as the most plausible estimate of the euro on trade. Besides, the decomposition of trade into different margins, from column 2 to 7, does not yield any statistical significant results concerning the euro. One should not hastily conclude from these results that the euro had not any impact on Belgian trade because of the low number of observations of these regressions. However, taking these estimates and the results at aggregate level presented in the previous section we may infer that the impact of the euro on total exports has been modest, at best. To further investigate

[35] Bernard and Jensen (1995, 1999) were the first to note for the US that the most productive and largest firms self-select into export markets. Many other studies using datasets from different countries have corroborated this finding. Greenaway and Kneller (2007) and Wagner (2007) have recently reviewed this large empirical literature. Melitz (2003) and Bernard, Jensen, Eaton and Kortum (2003) have provided theoretical foundations of this finding in a general equilibrium setting.

[36] TFP has been computed using the Levinsohn and Petrin (2003) methodology for each two-digit Nace industry separately. Recently Ackerberg, Caves Frazer (2006) have criticised this approach and argued in favour of the Olley and Pakes (1996) method. However, this turned out infeasible because of the lack of a reliable investment measure (this is because we are using accounting data). Yet the, the results doe not seem to be sensible to this particular productivity measure. Many of the regressions results presented in the following tables were also estimated using value added per worker and capital per employee instead of TFP. They were qualitatively similar to those reported in the paper. These results are available upon request.

the impact of the introduction of the euro on exports, we next exploit the data at the level of the firm. This allows us to test whether or not the European common currency had any effect of firm-level exports, the channels through which this has taken place and which companies were mostly affected.

The first results concerning the choice of whether to export or not are in Table 13. This model estimates the effects of different factors on the probability of exports. From its estimates, it is possible to infer how these determinants have affected the firm extensive margin of exports. The results in Table 13 come from a pooled logit model where the effect of idiosyncratic firm-destination shocks is completely ignored.[37] Standard errors are clustered at firm-destination level to control for potential serial correlation of the error term within each cluster. The results in column 1 suggest that, rather unsurprisingly, the probability of exports is higher the larger the GDP of export destinations. Besides, cultural and geographical proximity have the expected sign too: distance is negative whereas border and common language are positive. All these results are highly significant and they seem to be relatively stable as we control for additional variable from column 2 to 4.

Column 2 adds the euro dummy. Its effect is positive and significant. This may be taken as evidence of the fact the euro may have lowered the sunk and/or variable costs of exports firms face, thereby increasing their propensity to exports. Thus, one way through which the new European currency may have raised exports is through the entry into foreign markets of additional firms. This result appears to robust to the inclusion firm-level characteristics whose effects are, as expected, positive and highly significant. Larger and more productive firms are more likely to export. However, adding the interaction terms between these variables and the euro makes the effect of the latter negative and significant. This is odd and could be generated by the unobserved heterogeneity at the level of the firm and destination the logit model do not control for.

To get around this problem, Table 14 shows the results obtained using the fixed effect logit model.[38] Variable that do not change over time can not be estimated so distance,

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[37] We have used a logit rather than a probit model since maximum likelihood of the former converges more easily. As underlined by Greene (2000, pp. 817) the difference in the marginal effects between the two methodologies is usually low. Even with the logit we could not use three-digit industry dummies, as in the rest of the paper, so we were forced to use two-digit fixed effects.

[38] The fixed effect logit model dates back to Chamberlain (1980). His idea was to maximise the likelihood function conditional on the number of ones (i.e. export cases in this study) in each panel. Doing this removes the idiosyncratic term, analogously to what the first difference or within transformation do in linear models. The drawback is that the fixed effect logit uses only those firms that change export status at least one. As underlined by Wooldridge (1960), unlike in linear models using the first difference or

common language and border drop out. From column 1 it appears that the euro had a positive and significant effect the probability of export market entry. In addition, the effects of TFP and size are positive and significant whereas their interaction terms with emu11 are negative and significant. This lends support to the idea that the euro may have increased the probability of exports of small firms more than that of large companies. Column 2 shows that the positive impact of the european currency on the probability of export market entry was not a one off case, but sustained over time.

Thus far we have shown coefficient estimates only. One important question concerns the economic significance of these effects, that is their marginal effects. Unfortunately, although the fixed logit model provides consistent estimates of the parameter of interest, it does not enable to compute marginal effects. To get an idea of how much the euro has affected firm's propensity to export we have computed the predicted probability of selling into foreign markets under different policy scenarios.

Figure 6 shows the percentage increase in the probability of exports, in 1999, towards eurozone countries due to the introduction the euro in the same year.[39] More specifically, we have predicted the probability of exports towards countries in the euro area in 1999 and compared it with the probability computed assuming the euro had not been introduced. This is easily done setting the emu11 dummy to zero when it is one. This can be considered an estimate of the probability of exports had the euro not been introduced. Figure 6 Figure also graphs the polynomial fit between the predicted probability and TFP along with TFP's kernel density.

Overall it appears, given our parameter estimates, that there is a clear negative relationship between the percent increment in the probability of exports and TFP. For the companies in the right tail of the productivity distribution the increase is around zero whereas for those at the opposite end it is much larger, around 30 percent. Thus only the predicted export probability of very lowly productive firms was significantly affected by the introduction of the euro in a positive fashion. For the majority of firms the rise seems to have been very small.

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within transformations the parameter estimates of the fixed effect logit model are not conditional on the unobserved effects in the sample. Rather, they are conditional on the part of the data set used in the estimation. For further details on the fixed effect logit model, see Wooldridge (2003, pp. 492) and Greene (2000, pp. 840).

[39] The predicted probability in this figure are based on parameters in Table 14 column 1 were used. Given the very similar estimates in column 2, it is possible to obtain similar graphs for the other years. Also, the predicted probabilities were computed considering only the observations in the estimation sample To enhance clarity, we have excluded the one percent tails of the TFP distribution.

To estimate the effect of the introduction of the euro on firm-level exports we run gravity-type equation at the level of the firm. The data set is such that for each firm we know the destination countries, the number of products it exports therein and their quantity. We control for firm-destination effects estimating fixed and random effects models. Standard errors are clustered by firm-destination couple to recognize for the fact that the error terms may be correlated within each cluster.

Table 15 shows the random effects estimates of total firm-level trade by destination. The list of regressors also includes a set of year and three-digit industry dummies. Column 1 shows the specification with the basic gravity equation variables: GDP of export destinations and distance along with border and common language dummies. All their coefficient estimates have the expected sign and are significant at more than one percent level. Moreover, as it possible to see from column 2 to 4, they appear to be relatively stable as other variables are progressively added to the regression. From the point estimates it is possible to infer that a one percent increase in the GDP of destination countries raises firm-level export by around 0.4 percent. The effect of distance is around -0.35 percent. Common language appears to have a much larger effect than sharing a border, the former being more than 100 percent and the latter between 25 and 30 percent.

Column 2 adds the euro dummy. The point estimate is surprisingly negative, although not very large in absolute value, and significant at five percent level. However, this result is not robust as we add additional variables. In column 3 adding TFP and the log of employment the EMU11 dummy becomes significant at just the 10 percent level. On the contrary the two firm-level variables have, rather unsurprisingly, a positive and highly significant effect on the value of exports. Their estimates are similar and suggest that a one percent increase in productivity or employment relates to around a 0.4 percent rise in exports. The last column of Table 15 shows the final specification with the firm-level variables interacted with the euro dummy. What is interesting here is that the interaction term between the log of employment and the common currency dummy is negative and significant at 5 percent level. As the estimates on the probability of exports, this results suggests that the euro has had probably different effects on firms of different size **[Here we need more explanation as one referee ha requested. I cannot think of anything]**.

Table 16 shows the results obtained with a random effect model using as dependent variables the different export margins. For ease of comparison, column 1 reports the same estimates of the last column of Table 15. The following two columns exhibit the results on the decomposition of the total value of exports by firm and destination into its extensive, i.e. number of product exported, and intensive, i.e. average value of exports, margins. The

first thing to notice is that the euro had a positive and significant effect on the latter, but an insignificant one on the former. It is worth emphasising that the positive effect of the euro on the number of products firms export is not necessarily inconsistent with the insignificant impact on the number of trade varieties at aggregate level as reported in Table 8. This is because the additional products established exporters started selling abroad after the introduction of the euro could have been already part of the set of exported varieties at country level. Thus, a positive effect on the product extensive margin at the level of the firm may well translate into a positive effect on the intensive margin at aggregate level.

The positive effect on the number of products exported by firms can be taken then as supportive evidence of a variant of the new good hypothesis put forward by Baldwin (2006a, 2006b). He has argued that the introduction of the euro has increased exports to the Euro area most probably through reducing the number of products that are not traded internationally. This hypothesis however is based on a framework in which all firms produce a single product. Recently, Bernard, Redding and Schott (2006, 2008) have introduced tractable general equilibrium models with multi-product firms.[40] Bernard, Redding and Schott (2006) shows that bilateral trade liberalisations will affect not only firms' survival and entry into export markets, as in single product firm models, but also the range of products that are produced and exported. More specifically, when either fixed or variable trade costs decrease the range of products all firms produce will shrink, but the number of products they export will rise. Firms will restrict their product scope since increased competition from abroad will force them to drop their less profitable products and concentrate on their core competencies. At the same time, the number of products exporters will ship abroad augments since, at lower trade costs, firms will find it profitable to export some additional products on which they have lower expertise.[41] Our results

[40] In this model, firms have a stochastic ability and expertise to produce specific products that are independent from each other. Higher firm-level ability raises productivity across all products however. Thus, high ability firms are larger than low ability ones not only because they sell more of the products they manufacture, but also because they produce more goods.

[41] Note that this effect is analogous to what happens to firms' survival and export market entry after trade liberalisation. Whereas the number of exporters increases because the export productivity cut-off will drop, allowing less productive companies to start shipping goods abroad, the total number of firms in the economy will decrease. This is because the survival cut-off point will rise thus forcing the least productive ones to exit. Therefore, following trade liberalisation, the economy or sector will concentrate production on their most productive firms. Likewise, multiproduct-firms will focus on their most productive manufactures. This has the important effect of generating not only reallocation of economic activity towards the most productive firm, as in single product firm models, but

concerning the effect of the introduction of the euro on the number of products firms export is consistent with this.

The estimated coefficients of the GDP, distance, border and common language are positive and highly significant for both margins. However, those of the intensive margin are considerably larger than those of the extensive margin, but for the border variable. This lends support to the idea that there may be substantial product specific sunk costs related to introduction of new products into export markets. Because of them exporters do not find it easy to increase the number of products they sell in foreign markets.

The results about the larger role of the *firm-level* intensive and extensive margins may appear to be in stark contrast with the findings of Mayer and Ottaviano (2007) for a sample of European countries and Bernard, Jensen, Redding and Schott (2007) for the US. Both studies have found that *at country-level* the extensive margin explain most of the variation in total exports across different destinations. The difference between these results could be due to mainly the different level of aggregation of the data used and thus the different extensive margins these studies consider. The present paper is at the level of the firm and defines the extensive margin as the number of products exported by firm to each destination only. Their extensive margin is broader and comprises the total number of exporters and exported products. In the presence of sunk costs of exports, those that firms pay to start exporting may be qualitatively and quantitatively different from those that have to be paid to start selling abroad an additional product. These costs may also be affected in different ways by various trade determinants.

For instance, Mayer and Ottaviano (2007, pp. 32) have suggested that the larger impact of common language on the number of exporters when compared to the average value of exports by exporters indicates that sharing a language tends to reduce the sunk costs of exports rather than the variable ones. Whereas this may be a reasonable explanation for these types of sunk costs, it does not necessarily follow that the same will hold true for product specific sunk costs. Once a firm starts exporting to a certain country these costs could be relatively unaffected by the language barrier. Thus, although the extensive margin, i.e. number of exporters, may dominate at country level, the opposite may be true at firm-level.

With regards firm-level variables, TFP and employment have as expected a positive effect on both margins. Their interaction terms with EMU11 dummy suggest that positive effect of the euro on the number of products firms export is larger for the lowly productive

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also within firm reallocation towards the products firms have highest expertise, i.e. productivity.

firms than for the highly efficient ones. This again suggests that smaller firms may have benefited more from the introduction of the euro than large ones.

The last two columns of Table 16 decompose the effect on the average value of exports per product by firm and destination into the average quantity and average unit value per product. These results should be interpreted with a certain degree of caution. This is because even at firm-level the products many firms export are greatly heterogeneous and their unit values are hardly comparable. Therefore, the average product-level quantity and price are likely to reflect, besides genuine information about quality of individual products, changes in the bundles of products firms export.[42]

Firstly, the result concerning the euro is suggestive of the fact that it has decreased the average value of exported products and had no effects on quantities. This finding is compatible with the hypothesis that the additional products the euro has enabled firms to export have smaller unit values than those they already exported. In other words the euro has made exporting products, with smaller unit values, profitable.

This explanation is consistent with the model recently proposed by Baldwin and Harrigan (2007), which features heterogeneous product quality and productivity levels . Their basic set-up is as in Melitz (2003), with the difference being that firms compete not only in terms of productivity, but also in terms of product quality. High quality goods get high prices and therefore are more profitable. Because of this only high quality goodsare exported to distant or difficult markets.

Our findings are not directly comparable with the model of Baldwin and Harrigan (2007) because they consider single product firms. However, in a multiproduct setting with different product quality it is possible to envisage that exporters will find it profitable to ship to more difficult markets only their higher quality goods. As trade barriers drop the same companies will start shipping to these markets their lower quality products also. Therefore the average unit values of the products they export will diminish.[43]

It is interesting to note the effect that the traditional gravity equation variables have on the average quantities and prices of exported products. GDP, common language and

[42] For instance, a firm operating in the clothing sector may export shoes and shirts. However, the value of one kilogramme of shoes is not comparable with that of shirts. To investigate more thoroughly the impact of the euro or any other variable of the quantity and value of exported products one would need to run regressions at product-firm level in order to compare a specific product exported by a specific firm before and after a policy change.

[43] This mechanism could be analogous to that of Bernard, Redding and Schott (2006) leading exporting firms to start exporting products on which they have lower *expertise* when trade costs fall.

border have all a positive and statistical significant effects on quantities, whereas the effect of distance is negative. The impact of all these factors on average unit values is reversed, with only distance being statistically insignificant. The reason of this, following Baldwin and Harrigan (2007), is likely to be linked to the fact that higher GDP, sharing a border and a common language make exports easier. Therefore, firms are not only able to ship more quantities to such destinations, but also products with lower unit values, which they do not find profitable to export to more difficult markets.

Interestingly, the firm-level variables suggest that the larger and more productive firms export more. Also, small firms appear to specialise in exporting goods with higher average unit values than large companies. The positive and significant interaction term between the euro dummy and TFP in the average price regression indicates that the negative effect the introduction of the common European currency may have had on average unit values has operated mainly through small firms.

Table 17 and Table 18 shows that the results presented thus far are robust to alternative specifications and estimation methods. Table 17 reports the results obtained using partner country fixed effects to control for country level characteristics other than those used so far. Obviously, in this specification distance, border and common language drop from the regression since they are collinear with the country-pair fixed effects. The coefficient estimates and their standard errors in Table 17 are remarkably similar to what reported in Table 16.

Table 18 exhibits firm-destination fixed effect estimates. This methodology eliminate any bias caused by the possible correlation between the firm-destination level idiosyncratic effect and some of the explanatory variables. This source of bias is not an unlikely possibility since our basic specification may not control for some, potentially many, firm- or country-level characteristics, which could be correlated with our explanatory variables. As it is well known, the drawback of this methodology is that it exploits the time series variation in the data only. Therefore, the effect of the euro will be identified only through the effect that it has had on exports over time.[44]

Perusing the figures in Table 18 and comparing them with those in the previous two tables it is possible to note that they are quantitative and qualitative similar. The economic and statistical significance of our estimates do not change. More specifically, the effect of the euro on the product extensive margin is positive and significant. The point estimate is

[44] Formal Hausman tests between the estimates in Table 18 and Table 16 always reject the null hypothesis of no difference between the two sets of estimates.

even larger than the corresponding ones in Table 16 and Table 17. As before, the interaction term between TFP and the euro dummy is negative. This as we have seen suggests that the positive effect of the European common currency on the number of products firms export is larger for lowly productive exporters than for highly productive ones. Also, these estimates confirm the negative impact of the euro on the product-level average unit values and the fact that these effects are stronger for less productive firms.

Finally, Table 19 explores the effect of the introduction of the euro over time in a random effects model. As it is possible to see, the impact of the euro on the number of products firms export to each destination is positive and significant in all years. This finding is suggestive of the fact the euro has permanently increased the number of products Belgian exporters export to other euro-countries. If any trend can be observed, this seems to be going upward. The effect of the euro on the unit values is negative for all years and appears to have slightly decreased over time.

5. Conclusions

Recent empirical research, initiated by Andrew Rose (2000), has argued that sharing a common currency may lead to a dramatic increase in bilateral trade between countries-an effect that would go much beyond eliminating nominal exchange rate volatility. Puzzled by the (implausibly large) magnitude of Rose's estimates, a large literature has examined trade intensities in (all types of) existing and historical currency unions. Although the estimated coefficients were smaller in magnitude, the results were generally affirmative for Rose's claim that common currencies increase trade; see Rose and Stanley (2005) for a meta-analysis. Still, given causality issues and other econometric problems in the analysis, it is widely argued that the true "natural experiment" to examine the common currency effect on trade is provided by the formation of the European Monetary Union.

In this paper, we explore the pattern and dynamics of trade between the 15 member countries of the European Union (as of 2003) over the period from 1995 through 2004. Furthermore, we provide fresh evidence on this issue analysing a data set of Belgian firms with export destinations to get additional insights on how the introduction of the euro may have affected total trade.

Applying a standard differences-in-differences specification, we confirm previous findings that trade between the member countries of the EMU appears to have increased after the adoption of the euro. The estimated effect is economically moderate, on the order of 10-15 percent, but (in most cases) statistically significant. In combination with Rose's

(2000) results that a common currency may dramatically increase trade, this rapid and largely unexpected gain in trade intensity among EMU member countries may suggest that there is (much) more to come.

Using highly disaggregated data and a variety of econometric techniques to describe the pattern of trade, however, we find no measurable change in bilateral trade relationships within the EU. For instance, there is no observable increase in the number of varieties traded between the member countries of the EMU. Also, trade growth within EMU is not consistently higher than in non-member countries. As a result, we argue that there is no fundamental shift in European trade patterns towards intra-EMU trade. While it may still be (much) too early to assess the long-run benefits from EMU, a simple extrapolation of the recent experience may be misguided.

The firm-level analysis using Belgian data reveals further details about the possible channels through which the euro could have impacted on trade. Firstly, firm-level regressions suggest that euro has raised the probability of exports to countries that have adopted it. This effect is stronger for small firms than for large ones. This is indicative of the fact that the euro have lowered the sunk costs of exports and therefore enabled firms, especially small ones, to start exporting. Secondly, decomposing firm-level exports to each destination into the product-extensive and -intensive margins points to the fact that the euro has affected positively the number of products exporters ship to euro-area countries. Again, small firms appear to have benefited more than large enterprises. The decomposition of the product intensive margin at firm-destination level into product-level average quantity and unit values of exports suggest that newly exported products have lower unit values than the ones firms already exported. The impact of the euro on average unit values is indeed negative and significant.

Overall this can be taken as evidence corroborating a modified version of the new-goods hypothesis put forward by Baldwin (2006a, 2006b) allowing for multi-product firms, as in Bernard, Redding and Schott (2006, 2008). The euro, decreasing the variable and/or fixed costs of exports, has enabled existing exporters to enlarge the range of products they sell abroad. The fact that the effect of the euro on average unit values is negative reinforces this interpretation since the newly shared European currency has rendered the exports of goods with lower unit values profitable.

Whereas this study has provided new detailed evidence about the channels through which the effects of the euro on exports may take place different issues remain to be investigated. The same type of analysis should be conducted with datasets from other countries to see if the firm-level results we have presented are specific to Belgium or have

a general validity. Also, analyses at product-firm level by destinations would shed further light on how the euro has affected the pricing behaviour of firms in foreign markets and provide additional details on the impact of the euro firm-level export decisions.

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Table 1: Trade with EMU by country

	Exports to EMU11/Exports to EU15, 1999	Growth of exports to EMU11, 1999-2004	Growth of exports to EMU11, 1995-1998
Luxembourg	0.95	115.9	--
United Kingdom	**0.92**	**8.8**	**30.0**
Austria	0.90	37.1	26.4
Greece	**0.85**	**10.9**	**-1.8**
Spain	0.84	36.1	39.8
Belgium	0.83	49.3	18.1
Netherlands	0.80	36.0	27.0
Portugal	0.80	44.9	29.3
Italy	0.80	21.0	19.8
France	0.80	21.4	25.4
Germany	0.78	39.3	22.7
Sweden	**0.72**	**20.4**	**27.4**
Denmark	**0.70**	**34.4**	**14.5**
Ireland	0.66	35.3	65.5
Finland	0.61	23.8	26.1

Notes: All figures in percent. The figures were calculated from Eurostat data.

Table 2: EU trade before and after the introduction of the euro

	EU	EMU12	Non-EMU12			EMU12 (% EU)
			EMU12-Non-EMU	Non-EMU-EMU12	Non-EMU-Non-EMU	
Ø 1995-97						
Total trade (tn. €)	1.05	0.71	0.16	0.16	0.03	67.23
# obs. with trade >0	772,630	463,085	132,559	144,676	32,309	59.94
# products with trade >0	12,086	12,060	11,645	11,857	10,581	99.78
Ø 2002-04						
Total trade (tn. €)	1.65	1.14	0.26	0.22	0.04	69.02
# obs. with trade >0	801,957	485,877	138,651	144,732	32,697	60.59
# products with trade >0	10,988	10,957	10,504	10,759	9,637	99.72
Change (%)						
Total trade (tn. €)	57.50	61.71	57.35	41.59	39.87	
# obs. with trade >0	3.80	4.92	4.60	0.04	1.20	
# products with trade >0	-9.08	-9.15	-9.80	-9.26	-8.92	

Notes: Figures calculated from Eurostat data (8-digits CN level). Data for Belgium and Luxembourg are merged.

Table 3: Gravity results for total trade

	Theory-consistent specification		Other specifications			
	Time-variant exporter and importer fixed effects	**Time-variant exporter and importer fixed effects**	**Without pairwise fixed effects**	**Only time-invariant exporter and importer fixed effects**	**Only time-invariant pairwise fixed effects**	**Pooled OLS**
EMU11	0.093#		0.276#	0.176**	0.121**	0.309**
	(0.053)		(0.164)	(0.054)	(0.025)	(0.120)
EMU12		0.066				
		(0.043)				
Log distance			-0.979**	-0.979**		-1.461**
			(0.107)	(0.101)		(0.142)
Log exporter GDP				0.364**	0.433**	0.709**
				(0.116)	(0.071)	(0.056)
Log importer GDP				0.488**	0.410**	0.685**
				(0.095)	(0.073)	(0.059)
Common border			-0.063	-0.059		-0.367#
			(0.114)	(0.107)		(0.204)
Common language			0.598**	0.593**		0.550*
			(0.162)	(0.151)		(0.252)
Exporter and importer fixed effects?	Time-variant	Time-variant	Time-variant	Time-invariant	No	No
Pairwise fixed effects?	Time-invariant	Time-invariant	No	No	Time-invariant	No
# obs.	2,002	2,002	2,002	2,002	2,002	2,002
Adj. R^2	0.98	0.98	0.96	0.96	0.94	0.76

Notes: Dependent variable is the log of imports. Year controls are included but not reported. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 4: Evolution over time

EMU11 × 1999	0.042 (0.035)	
EMU11 × 2000	0.083 (0.051)	
EMU11 × 2001	0.108* (0.051)	
EMU11 × 2002	0.106 (0.064)	
EMU11 × 2003	0.065 (0.070)	
EMU11 × 2004	0.121 (0.077)	
EMU11 × 2005	0.126 (0.079)	
EMU12 × year1		-0.019 (0.028)
EMU12 × year2		0.013 (0.031)
EMU12 × year3		0.043 (0.043)
EMU12 × year4		0.059 (0.074)
EMU12 × year5		0.071 (0.075)
EMU12 × year6		0.113 (0.069)
EMU12 × year7		0.123 (0.076)
Exporter and importer fixed effects?	Time-variant	Time-variant
Pairwise fixed effects?	Time-invariant	Time-invariant
# obs.	2002	2002
Adj. R^2	0.98	0.98

Notes: Dependent variable is the log of imports. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 5: Gravity results for disaggregated trade data

	Total		1-digit level		Section	2-digit level
EMU11	0.093#	0.071		0.072	0.082	0.077
	(0.053)	(0.048)		(0.052)	(0.056)	(0.062)
EMU12			0.059			
			(0.043)			
Exporter and importer fixed effects?	Time-variant	Time-variant	Time-variant	Time-variant, industry-specific	Time-variant	Time-variant
Pairwise fixed effects?	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant
# obs.	2,002	21,740	21,740	21,740	44,610	192,288
# industries	1	10	10	10	21	97
Adj. R^2	0.98	0.86	0.86	0.93	0.80	0.73

Notes: Dependent variable is the log of imports. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 6: Gravity results by section

Section	Description	Coefficient	# obs.	Adj. R^2
I	Live animals; Animal products	0.117 (0.147)	2152	0.92
II	Vegetable products	0.244 (0.223)	2149	0.93
III	Animal or vegetable fats and oils and their cleavage products; Prepared edible fats; Animal or vegetable waxes	0.401 (0.278)	1943	0.87
IV	Prepared foodstuffs; Beverages, spirits and vinegar; Tobacco and manufactured tobacco substitutes	0.149# (0.087)	2178	0.94
V	Mineral products	-0.352 (0.279)	2147	0.88
VI	Products of the chemical or allied industries	0.344 (0.231)	2175	0.95
VII	Plastics and articles thereof; Rubber and articles thereof	0.019 (0.137)	2177	0.96
VIII	Raw hides and skins, leather, furskins and articles thereof; Saddlery and harness; Travel goods, handbags and similar containers; Articles of animal gut (other than silkworm gut)	-0.238 (0.231)	2120	0.93
IX	Wood and articles of wood; Wood charcoal; Cork and articles of cork; Manufactures of straw, of esparto or of other plaiting materials; Basketware and wickerwork	-0.137 (0.154)	2146	0.92
X	Pulp of wood or of other fibrous cellulosic material; Recovered (waste and scrap) paper or paperboard and articles thereof	0.080 (0.148)	2150	0.94
XI	Textiles and textile articles	-0.067 (0.102)	2179	0.94
XII	Footwear, headgear, umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof; Prepared feathers and articles made therewith; Artificial flowers; Articles of human hair	0.086 (0.261)	2138	0.94
XIII	Articles of stone, plaster, cement, asbestos, mica or similar materials; Ceramic products; Glass and glassware	0.111 (0.123)	2158	0.96
XIV	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; Imitation jewellery; Coin	0.026 (0.310)	2099	0.88
XV	Base metals and articles of base metal	0.037 (0.101)	2184	0.95
XVI	Machinery and mechanical appliances; Electrical equipment; Parts thereof; Sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	0.166 (0.130)	2184	0.96
XVII	Vehicles, aircraft, vessels and associated transport equipment	0.088 (0.218)	2168	0.93
XVIII	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; Clocks and watches; Musical instruments; Parts and accessories thereof	0.430** (0.138)	2164	0.95
XIX	Arms and ammunition; Parts and accessories thereof	0.255 (0.481)	1825	0.78
XX	Miscellaneous manufactures articles	-0.063 (0.166)	2150	0.95
XXI	Works of art, collectors' pieces and antiques	0.250 (0.246)	2024	0.91

Notes: Dependent variable is the log of imports. The specification is similar to the benchmark specification in column 1 of Table 3. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denotes significant at the 1, 5 and 10 percent level, respectively.

Table 7: Extensive and Intensive Margins

	Log of total imports	Log of number of trade varieties	Log of average import value per variety	Log of total imports	Log of number of trade varieties	Log of average import value per variety
EMU11	0.122#	0.006	0.116#			
	(0.065)	(0.020)	(0.065)			
EMU12				0.056	-0.007	0.063
				(0.046)	(0.013)	(0.043)
Exporter and importer fixed effects?	Time-variant	Time-variant	Time-variant	Time-variant	Time-variant	Time-variant
Pairwise fixed effects?	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant
# obs.	2,002	2,002	2,002	2,002	2,002	2,002
Adj. R^2	0.98	0.99	0.96	0.98	0.99	0.95

Notes: Dependent variable is noted in the first line. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 8: Gravity results by trade duration

	Imports separ'ted by duration	**Imports of products not always imported**	**Imports of products imported over all years**	**Imports separ'ted by duration**	**Imports of products not always imported**	**Imports of products imported over all years**
EMU11	0.118*	0.052	0.183*			
	(0.056)	(0.065)	(0.080)			
EMU12				0.058	0.070	0.045
				(0.044)	(0.060)	(0.059)
Exporter and importer fixed effects?	Time-variant	Time-variant	Time-variant	Time-variant	Time-variant	Time-variant
Pairwise fixed effects?	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant	Time-invariant
# obs.	4,004	2,002	2,002	4,004	2,002	2,002
Adj. R^2	0.95	0.98	0.98	0.95	0.99	0.98

Notes: Dependent variable is noted in the first line. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 9: Sample export share after trimming

Year	1		2		3		4		5		6	
	a	b	a	b	a	b	a	b	a	b	a	b
	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number
1996	0.995	0.784	0.891	0.769	0.865	0.769	0.841	0.752	0.695	0.539	0.667	0.464
1997	0.996	0.800	0.912	0.786	0.888	0.786	0.845	0.768	0.674	0.567	0.646	0.485
1998	0.999	0.967	0.898	0.948	0.875	0.945	0.833	0.921	0.662	0.696	0.632	0.592
1999	0.999	0.960	0.898	0.940	0.873	0.937	0.814	0.911	0.638	0.717	0.613	0.607
2000	0.999	0.968	0.857	0.948	0.832	0.944	0.774	0.920	0.600	0.726	0.574	0.609
2001	0.999	0.963	0.846	0.940	0.822	0.937	0.770	0.912	0.574	0.713	0.545	0.594
2002	0.999	0.958	0.831	0.932	0.809	0.928	0.773	0.907	0.554	0.711	0.492	0.590
2003	0.999	0.960	0.846	0.935	0.823	0.931	0.789	0.926	0.557	0.737	0.496	0.607
2004	0.999	0.957	0.848	0.930	0.824	0.926	0.793	0.919	0.560	0.740	0.499	0.610
2005	0.999	0.955	0.844	0.929	0.820	0.924	0.789	0.917	0.510	0.740	0.493	0.605

Notes: 1: sample after dropping vat whose total value of trade with EU was below 250000 Euro; 2: after dropping trade transactions not involving changes in ownership; 3: after dropping transactions with missing partner country or Greece or Luxemburg; 4: after dropping trade transactions with value or weight that are missing or zero; 5: after merging with balance sheet data; 6: after selecting manufacturing and wholesale and retail industries

Table 10: Descriptive statistics, all industries, all firms and destinations

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total value of exports(billions)	112.6548	128.1237	132.6983	134.7831	155.5251	161.5377	174.5508	176.4603	194.4322	210.6821
Market shares (10% largest exporters)	0.911	0.911	0.908	0.904	0.909	0.911	0.921	0.924	0.924	0.926
Nb of exporters	26,981	26,905	26,364	24,969	26,164	26,292	25,672	25,411	24,552	23,814
Average nb of products by exporter	8.6	8.7	8.9	9.3	9.0	9.1	9.4	9.7	10.1	10.3
Average value by exporter (millions)	4.175	4.762	5.033	5.398	5.944	6.144	6.799	6.944	7.919	8.847
Average value by variety	200,789	220,565	224,296	223,101	248,423	248,679	263,872	257,851	258,943	264,003

Source: NBB.

Table 11: Descriptive statistics - All industries, all firms by destinations

	Total value of exports				Market share (10 percent largest exporters)			
year	EMU11	nonEMU3	nonEMUeurope	nonEMUworld	EMU11	nonEMU3	nonEMUeurope	nonEMUworld
1996	71.431	13.522	4.685	23.017	0.788	0.872	0.900	0.954
1997	76.936	16.493	5.960	28.735	0.791	0.874	0.907	0.953
1998	81.951	17.539	6.498	26.710	0.790	0.871	0.909	0.950
1999	83.960	17.929	6.183	26.711	0.792	0.871	0.903	0.951
2000	94.350	19.430	7.319	34.425	0.799	0.859	0.910	0.957
2001	97.800	20.501	8.091	35.145	0.801	0.862	0.915	0.958
2002	98.192	20.769	8.792	46.798	0.806	0.864	0.922	0.969
2003	102.779	20.321	9.033	44.327	0.810	0.869	0.920	0.971
2004	113.574	21.742	9.617	49.500	0.818	0.872	0.913	0.973
2005	120.722	23.079	11.406	55.476	0.827	0.879	0.910	0.974

	Number of exporters				Value of exports by exporter			
year	EMU11	nonEMU3	nonEMUeurope	nonEMUworld	EMU11	nonEMU3	nonEMUeurope	nonEMUworld
1996	9449	5165	10492	19350	7.560	2.618	0.446	1.190
1997	9748	5431	10512	19265	7.893	3.037	0.567	1.492
1998	9967	5645	10575	18328	8.222	3.107	0.614	1.457
1999	10046	5825	9991	17101	8.358	3.078	0.619	1.562
2000	10576	6108	10479	17981	8.921	3.181	0.698	1.915
2001	10851	6268	10663	18018	9.013	3.271	0.759	1.951
2002	10683	6174	10774	17504	9.191	3.364	0.816	2.674
2003	10817	6229	10684	17271	9.502	3.262	0.845	2.567
2004	10953	6193	9977	17006	10.369	3.511	0.964	2.911
2005	10836	6223	9181	16999	11.141	3.709	1.242	3.263

	Number of products by exporter				Value of exports by variety			
year	EMU11	nonEMU3	nonEMUeurope	nonEMUworld	EMU11	nonEMU3	nonEMUeurope	nonEMUworld
1996	14.378	6.335	3.704	4.524	256640.5	268184	80907.21	131973.1
1997	14.007	6.225	3.828	4.703	272766.1	311699.8	97206.1	155655.8
1998	14.302	6.425	3.776	4.632	274685.9	305975.1	104888.6	153502.6
1999	14.484	6.567	3.890	4.644	268530.5	292505.8	101114.1	158027.7
2000	13.896	6.511	3.994	4.568	297412.9	309563.8	109503	192100.6
2001	13.948	6.607	3.945	4.566	294812	313194.4	117087.9	191751.5
2002	14.353	6.722	4.041	4.676	289663.3	316932.3	121587.1	253409.6
2003	14.626	6.718	4.190	4.743	292212.6	305073.1	118493	233571.1
2004	15.150	7.234	5.175	4.779	300958.3	298390.8	90348.76	254905
2005	15.235	7.298	5.717	4.935	314345.1	308059.4	97193.2	250209.8

Source: NBB.

Table 12: Export gravity equation at country-level

	Exports	Number of firms	Average exports per firm	Number of products	Average exports per firm-product	Average quantity per firm-product	Average price per firm-product
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Random effects			
emu11	0.034	0.007	0.026	-0.01	0.034	-0.004	0.035
	[0.031]	[0.015]	[0.024]	[0.015]	[0.025]	[0.047]	[0.041]
ldist	-0.385*	-0.198	-0.17	-0.076	-0.08	-0.072	-0.012
	[0.192]	[0.123]	[0.135]	[0.083]	[0.151]	[0.275]	[0.140]
lmgdp	0.713**	0.295**	0.472**	0.187**	0.324**	0.199+	0.107
	[0.071]	[0.027]	[0.051]	[0.028]	[0.049]	[0.107]	[0.071]
border	0.517	0.107	0.323	0.045	0.216	0.937*	-0.691**
	[0.350]	[0.149]	[0.267]	[0.109]	[0.265]	[0.379]	[0.264]
comlang	0.532+	0.449**	0.137	0.270*	-0.095	0.348	-0.460*
	[0.285]	[0.136]	[0.231]	[0.107]	[0.258]	[0.290]	[0.184]
constant	15.216**	5.563**	8.852**	6.546**	1.732	2.854	-0.697
	[1.723]	[0.950]	[1.206]	[0.704]	[1.273]	[2.340]	[1.360]
R-squared	0.961	0.962	0.945	0.942	0.887	0.836	0.832
Country	12	12	12	12	12	12	12
Observations	120	120	120	120	120	120	120
				Fixed effects			
emu11	0.04	0.007	0.033+	-0.011	0.045+	0.006	0.039
	[0.027]	[0.016]	[0.018]	[0.019]	[0.023]	[0.049]	[0.044]
lmgdp	0.537**	0.297**	0.240*	0.228**	0.012	-0.214+	0.226+
	[0.108]	[0.039]	[0.105]	[0.050]	[0.104]	[0.123]	[0.120]
constant	15.355**	4.428**	10.927**	5.629**	5.298**	7.901**	-2.603+
	[1.401]	[0.497]	[1.359]	[0.644]	[1.347]	[1.582]	[1.543]
R-squared	0.927	0.927	0.812	0.729	0.479	0.061	0.374
Country	12	12	12	12	12	12	12
Observations	120	120	120	120	120	120	120

Source: NBB. Notes: Robust t-statistics in brackets; ** p<0.01, * p<0.05, + p<0.1; year dummies included.

Table 13: Pooled logit model of export market entry

	(1)	(2)	(3)	(4)
lmgdp	0.293	0.295	0.371	0.371
	[56.575]**	[56.117]**	[64.479]**	[64.469]**
ldist	-0.29	-0.298	-0.373	-0.373
	[25.999]**	[25.475]**	[29.471]**	[29.484]**
border	0.13	0.114	0.154	0.152
	[6.630]**	[5.336]**	[6.668]**	[6.602]**
comlang	0.475	0.477	0.605	0.605
	[30.515]**	[30.564]**	[36.072]**	[36.091]**
emu11		0.025	0.031	-0.041
		[2.043]*	[2.336]*	[0.423]*
TFP			0.945	0.94
			[127.128]**	[104.095]**
log of emp			0.609	0.617
			[169.348]**	[136.629]**
emu11* TFP				0.01
				[1.079]
emu11* log of emp				-0.014
				[2.758]**
Observations	6478558	6478558	6478558	6478558
Firm-destination	1084478	1084478	1084478	1084478

Source: NBB. Notes: Clustered t-statistics in brackets (clusters defined as firm-destination combinations) ** p<0.01, * p<0.05, + p<0.1; year and two-digit industry dummies included.

Table 14: Conditional (fixed effect) logit model of export market entry (manufacturing and wholesale and retail: 1996-2005)

	(1)	(2)
lmgdp	0.519	0.453
	[5.757]**	[4.958]**
emu11	1.494	
	[8.118]**	
emu11*1999		1.372
		[7.430]**
emu11*2000		1.384
		[7.478]**
emu11*2001		1.466
		[7.897]**
emu11*2002		1.506
		[8.110]**
emu11*2003		1.539
		[8.283]**
emu11*2004		1.637
		[8.787]**
emu11*2005		1.62
		[8.698]**
tfp_lp	0.774	0.774
	[40.889]**	[40.892]**
lnemp	1.438	1.439
	[81.783]**	[81.825]**
emu11* TFP	-0.115	-0.115
	[6.814]**	[6.782]**
emu11* log emp	-0.049	-0.05
	[5.123]**	[5.224]**
Observations	503377	503377
Firm-destinations	59969	59969

Source: NBB. Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; year dummies included.

Table 15: Random effects estimation of total trade (manufacturing and wholesale and retail: 1996-2005)

	Total exports	Total exports	Total exports	Total exports
lmgdp	0.37	0.367	0.414	0.415
	[38.64]**	[38.14]**	[43.41]**	[43.48]**
log distance	-0.335	-0.324	-0.366	-0.367
	[17.28]**	[16.33]**	[18.56]**	[18.62]**
border	0.25	0.276	0.321	0.317
	[6.79]**	[7.25]**	[8.46]**	[8.35]**
comlang	1.122	1.118	1.204	1.204
	[39.27]**	[39.14]**	[42.06]**	[42.08]**
emu11		-0.038	-0.032	-0.02
		[2.21]*	[1.89]+	[0.23]
TFP			0.401	0.4
			[51.08]**	[43.52]**
log of emp			0.376	0.382
			[65.68]**	[60.73]**
emu11*TFP				0.002
				[0.26]
emu11*log of emp				-0.011
				[2.11]*
Constant	7.649	7.615	-3.365	-3.405
	[10.39]**	[10.34]**	[5.96]**	[5.98]**
Observations	427199	427199	400552	400552
Number of firm-dest.	91531	91531	85274	85274

Source: NBB. Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; the independent variable set includes year and Nace three-digit industry dummies.

Table 16: Random effects estimation
(manufacturing and wholesale and retail: 1996-2005)

	Total exports	# products	average export value per product	average quantity per product	average price per product
	(1)	(2)	(3)	(4)	(5)
lmgdp	0.415	0.063	0.352	0.376	-0.022
	[43.48]**	[17.45]**	[41.20]**	[34.04]**	[3.67]**
log distance	-0.367	-0.084	-0.283	-0.294	0.01
	[18.62]**	[10.38]**	[15.91]**	[12.75]**	[0.80]
border	0.317	0.183	0.134	0.302	-0.174
	[8.35]**	[12.92]**	[3.97]**	[7.04]**	[7.55]**
comlang	1.204	0.367	0.836	0.965	-0.125
	[42.08]**	[31.63]**	[32.62]**	[29.33]**	[6.91]**
emu11	-0.02	0.086	-0.106	0.027	-0.128
	[0.23]	[2.52]*	[1.31]	[0.30]	[3.23]**
TFP	0.4	0.079	0.323	0.315	-0.002
	[43.52]**	[22.85]**	[39.23]**	[33.99]**	[0.61]
lnemp	0.382	0.169	0.21	0.246	-0.023
	[60.73]**	[63.24]**	[38.35]**	[36.62]**	[6.65]**
emu11*TFP	0.002	-0.008	0.01	0	0.011
	[0.26]	[2.67]**	[1.42]	[0.05]	[2.97]**
emu11*lnemp	-0.011	-0.002	-0.009	-0.007	-0.001
	[2.11]*	[0.85]	[1.96]*	[1.45]	[0.55]
Constant	-3.405	-1.703	3.519	-3.09	6.753
	[5.98]**	[13.30]**	[6.03]**	[3.81]**	[21.59]**
Observations	400552	400552	400552	400552	400552
Number of group(vat land)	85274	85274	85274	85274	85274

Source: NBB. Notes: Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; the independent variable s
et includes year and Nace three-digit industry dummies.

Table 17: Random effects estimation with export destination fixed effects (manufacturing and wholesale and retail: 1996-2005)

	Total exports	# products	average export value per product	average quantity per product	average price per product
	(1)	(2)	(3)	(4)	(5)
lmgdp	0.606	0.122	0.484	0.445	0.037
	[9.88]**	[5.21]**	[8.78]**	[7.08]**	[1.40]
emu11	0.011	0.09	-0.079	0.04	-0.119
	[0.12]	[2.62]**	[0.96]	[0.44]	[2.97]**
TFP	0.401	0.08	0.324	0.316	-0.002
	[43.68]**	[22.94]**	[39.37]**	[34.10]**	[0.62]
log of emp	0.383	0.169	0.211	0.247	-0.023
	[60.98]**	[63.38]**	[38.53]**	[36.76]**	[6.69]**
emu11_TFP	0.001	-0.009	0.01	-0.001	0.01
	[0.14]	[2.75]**	[1.31]	[0.11]	[2.91]**
emu11_lnemp	-0.012	-0.002	-0.01	-0.008	-0.002
	[2.35]*	[0.93]	[2.18]*	[1.55]	[0.71]
Constant	-8.184	-3.002	0.061	-6.632	2.648
	[9.36]**	[10.56]**	[0.07]	[5.50]**	[3.05]**
Observations	400552	400552	400552	400552	400552
Number of group(vat land)	85274	85274	85274	85274	85274

Source: NBB. Notes: Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; the independent variable set includes year and Nace three-digit industry dummies.

Table 18: Fixed effects estimation
(manufacturing and wholesale and retail: 1996-2005)

	Total exports	# products	average export value per product	average quantity per product	average price per product
	(1)	(2)	(3)	(4)	(5)
lmgdp	0.586	0.117	0.469	0.434	0.035
	[9.14]**	[4.81]**	[8.14]**	[6.77]**	[1.35]
emu11	0.033	0.102	-0.069	0.026	-0.095
	[0.36]	[2.81]**	[0.80]	[0.28]	[2.36]*
TFP	0.328	0.066	0.262	0.245	0.017
	[31.29]**	[16.61]**	[27.75]**	[23.78]**	[4.03]**
log of emp	0.527	0.176	0.351	0.367	-0.017
	[44.88]**	[35.02]**	[34.11]**	[31.78]**	[3.33]**
emu11_TFP	-0.003	-0.01	0.006	-0.003	0.009
	[0.42]	[2.97]**	[0.81]	[0.38]	[2.61]**
emu11_lnemp	-0.002	-0.001	-0.001	0.003	-0.005
	[0.46]	[0.62]	[0.22]	[0.65]	[1.96]*
Observations	400552	400552	400552	400552	400552
Number of group(vat land)	85274	85274	85274	85274	85274

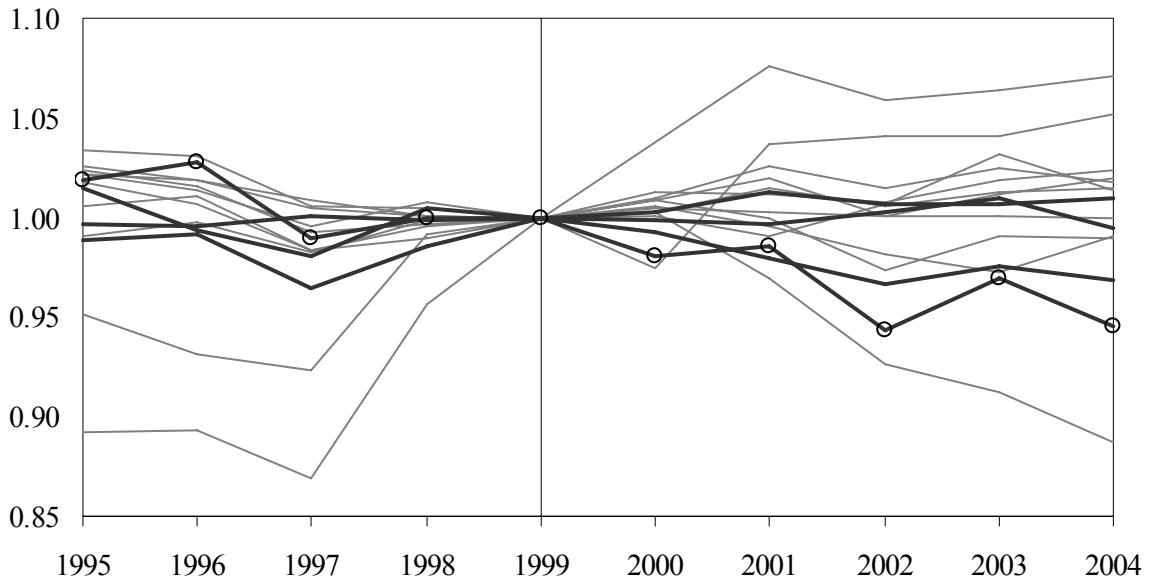
Source: NBB. Notes: Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; the independent variable set includes year and Nace three-digit industry dummies.

Table 19: Random effects estimation: euro effect over time (manufacturing and wholesale and retail: 1996-2005)

	Total exports	# products	average export value per product	average quantity per product	average price per product
	(1)	(2)	(3)	(4)	(5)
lmgdp	0.415	0.063	0.351	0.376	-0.022
	[43.44]**	[17.39]**	[41.18]**	[34.02]**	[3.71]**
log distance	-0.368	-0.085	-0.283	-0.294	0.010
	[18.59]**	[10.41]**	[15.86]**	[12.71]**	[0.77]
border	0.317	0.182	0.135	0.303	-0.175
	[8.34]**	[12.86]**	[3.98]**	[7.06]**	[7.56]**
comlang	1.204	0.367	0.836	0.965	-0.125
	[42.06]**	[31.61]**	[32.61]**	[29.33]**	[6.93]**
emu11*1999	0.000	0.082	-0.081	0.060	-0.138
	[0.00]	[2.38]*	[1.00]	[0.65]	[3.42]**
emu11*2000	-0.040	0.077	-0.117	0.022	-0.134
	[0.45]	[2.23]*	[1.43]	[0.24]	[3.32]**
emu11*2001	-0.043	0.075	-0.118	0.014	-0.127
	[0.48]	[2.18]*	[1.44]	[0.15]	[3.14]**
emu11*2002	-0.029	0.088	-0.117	0.016	-0.127
	[0.32]	[2.55]*	[1.42]	[0.17]	[3.13]**
emu11*2003	-0.014	0.095	-0.109	0.017	-0.121
	[0.15]	[2.75]**	[1.32]	[0.19]	[2.99]**
emu11*2004	-0.014	0.090	-0.104	0.031	-0.130
	[0.16]	[2.58]**	[1.26]	[0.33]	[3.20]**
emu11*2005	0.002	0.102	-0.100	0.023	-0.117
	[0.02]	[2.92]**	[1.20]	[0.25]	[2.89]**
TFP	0.400	0.080	0.323	0.315	-0.002
	[43.53]**	[22.86]**	[39.23]**	[33.99]**	[0.61]
log of emp	0.382	0.169	0.210	0.246	-0.022
	[60.74]**	[63.26]**	[38.35]**	[36.61]**	[6.64]**
emu11*TFP	0.002	-0.008	0.010	-0.000	0.011
	[0.26]	[2.66]**	[1.41]	[0.06]	[2.98]**
emu11*log of emp	-0.011	-0.002	-0.009	-0.007	-0.001
	[2.11]*	[0.87]	[1.95]+	[1.42]	[0.58]
Constant	-3.415	-1.694	-0.641	-3.094	3.252
	[5.99]**	[13.16]**	[1.40]	[3.82]**	[3.96]**
Observations	400552	400552	400552	400552	400552
Number of group(vat land)	85274	85274	85274	85274	85274

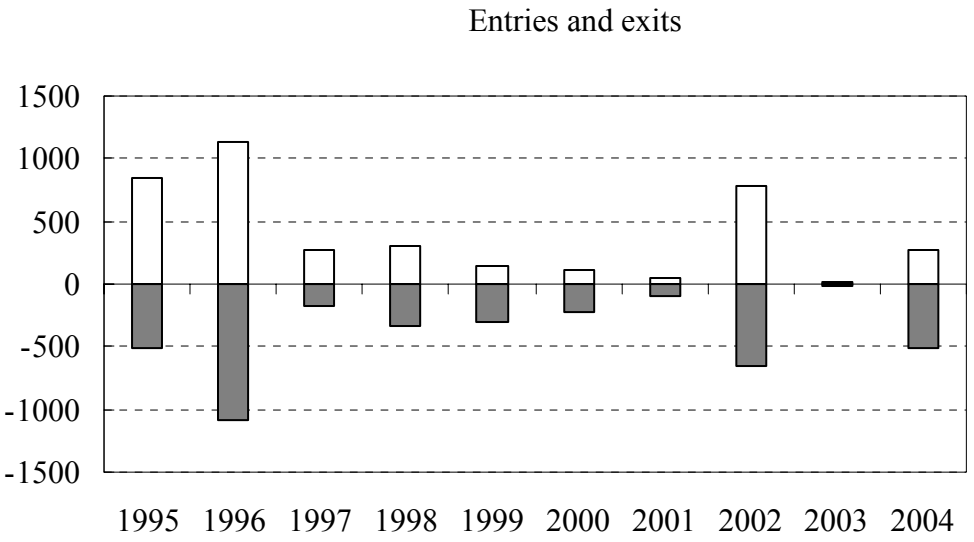
Source: NBB. Notes: Clustered t-statistics in brackets (clusters defined as firm-destination combinations); ** p<0.01, * p<0.05, + p<0.1; the independent variable set includes year and Nace three-digit industry dummies.

Figure 1: Share of trade with EMU11 countries in total EU trade by country (1999=100)



Notes: Non-EMU member countries are plotted as thick line. Greece is the circled line.

Figure 2: Product codes at the 8-digits CN level



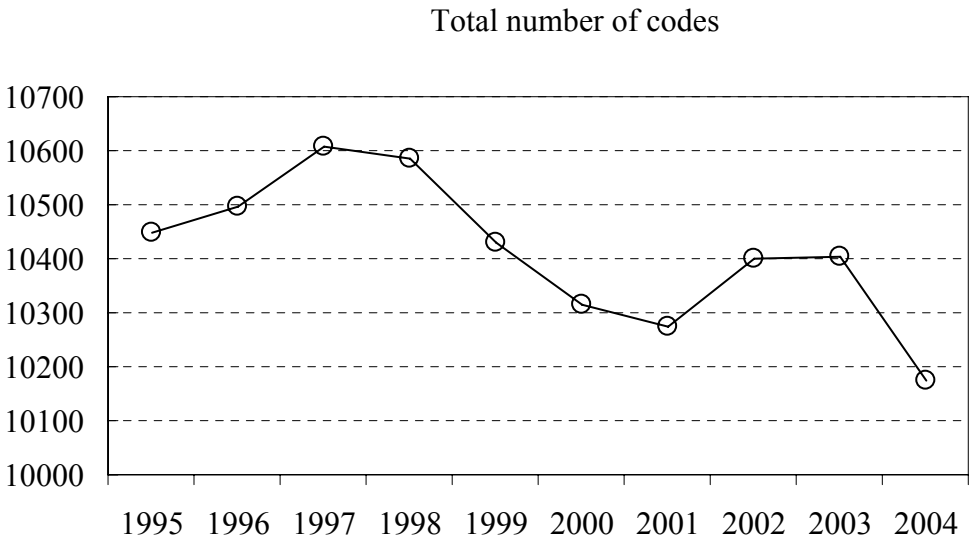


Figure 3: Product differentiation and the trade effect of the euro

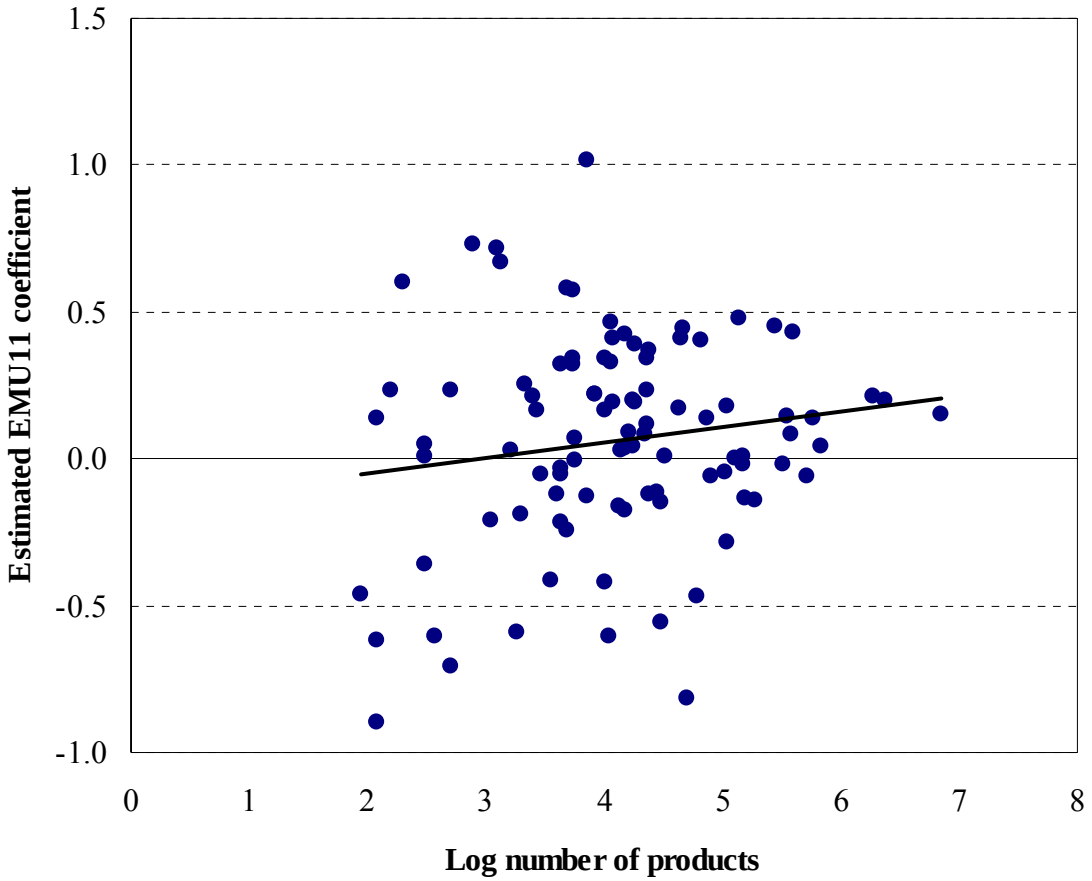
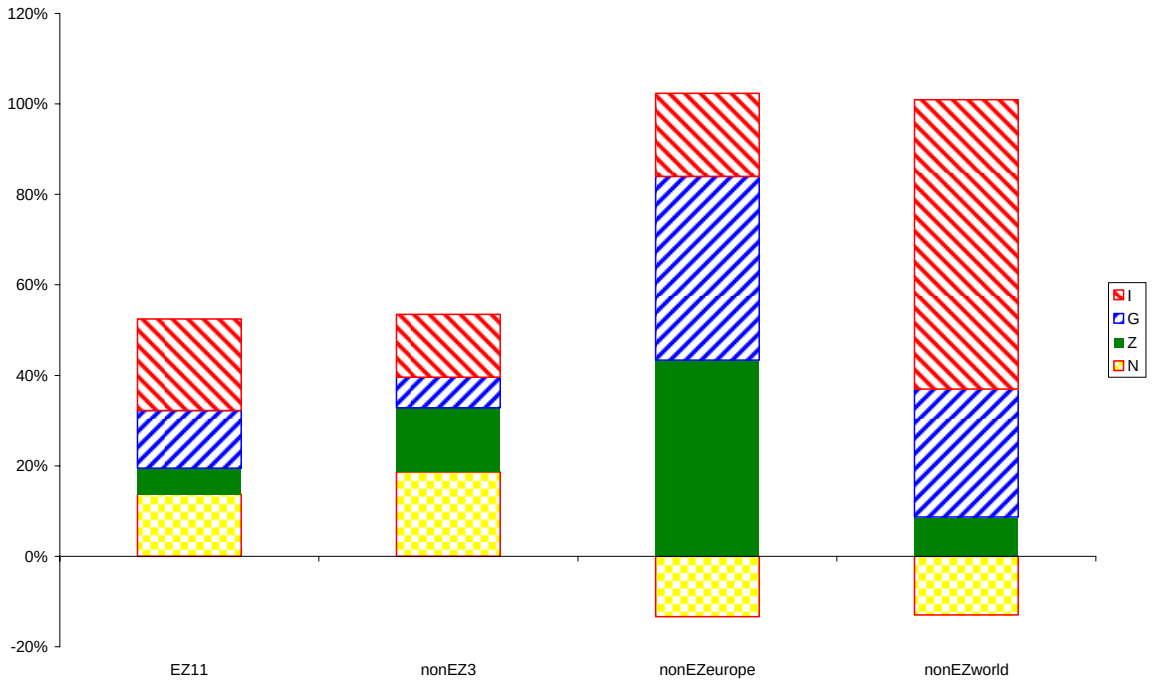
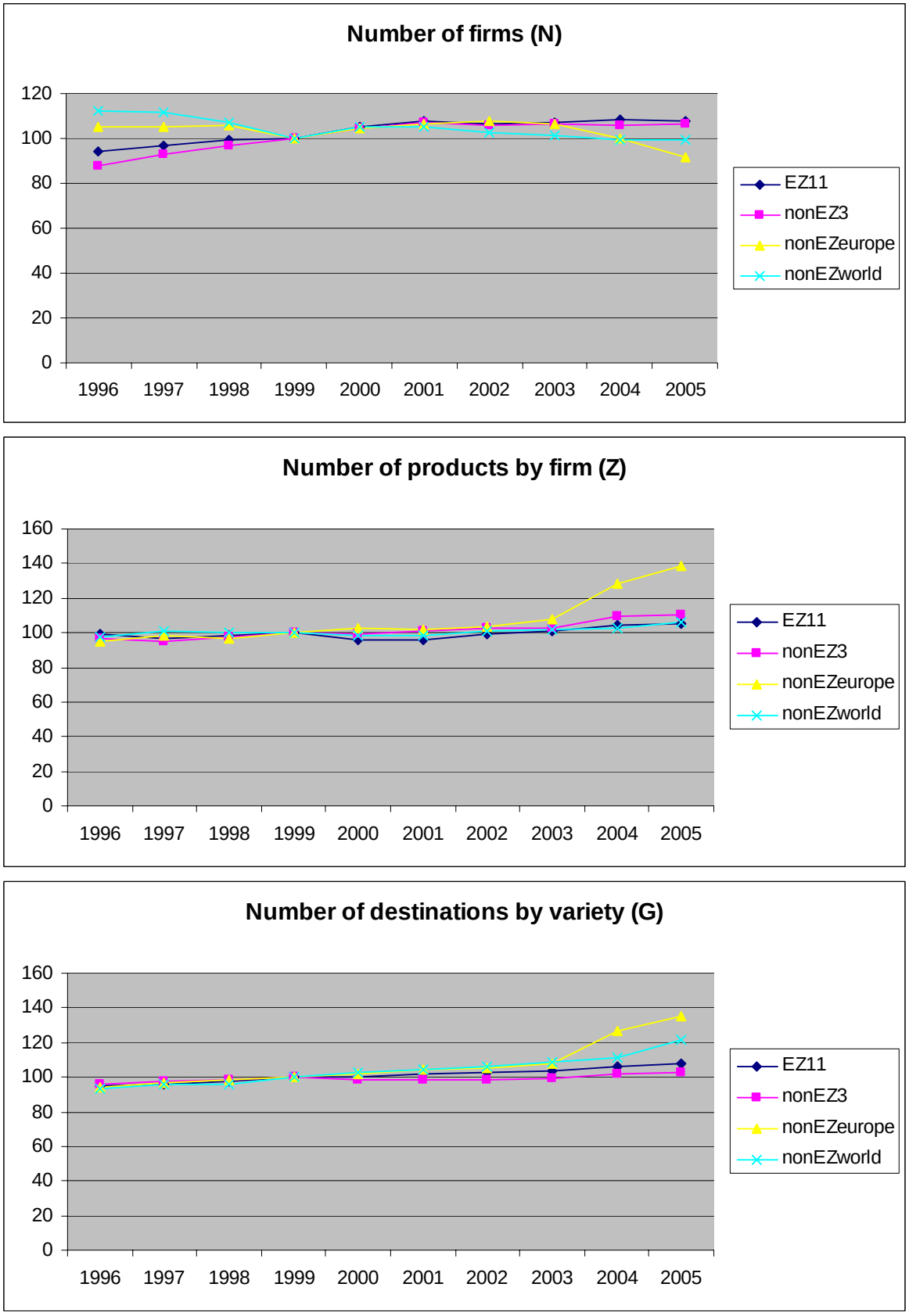


Figure 4: Contribution to growth of exports of different margins (1996-2005)



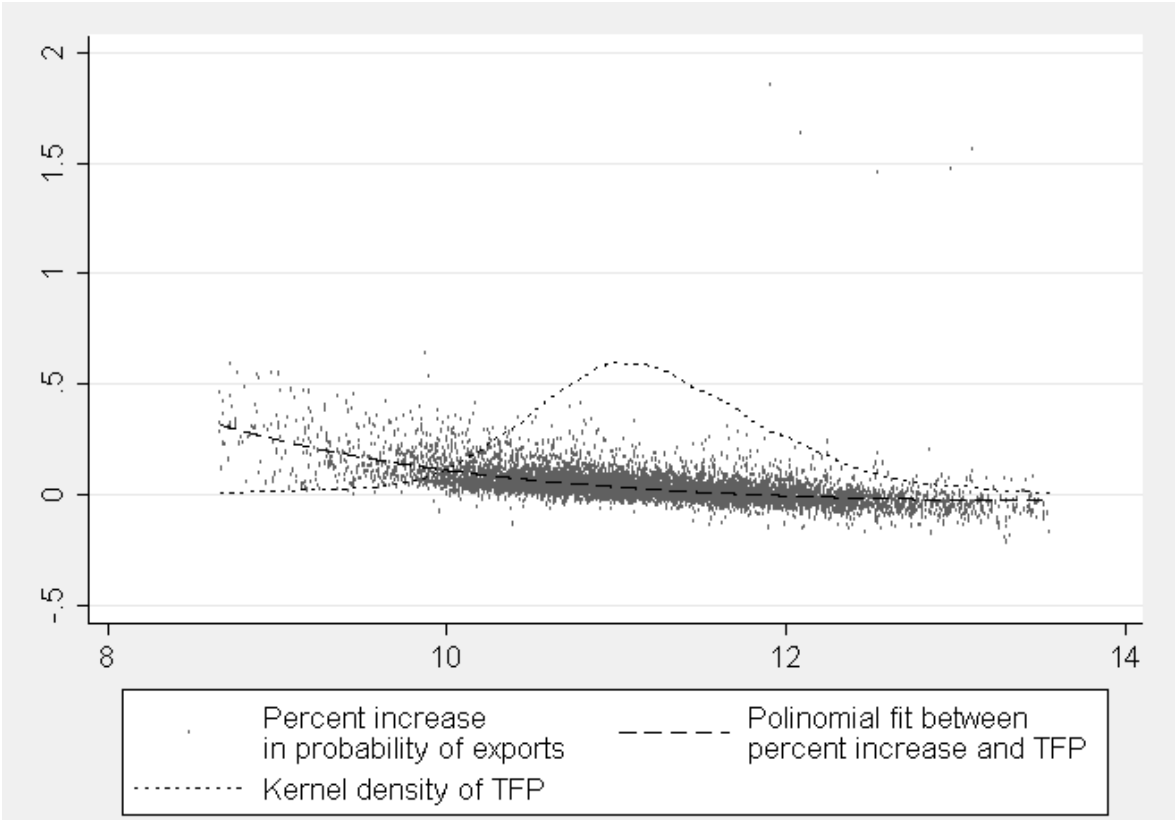
Source: NBB. Notes: *N* is the number of exporters; *Z* is the average number of products exported by firm, *G* the average number of destinations at product-firm (variety) level; *I* is the average value of exports at destination-variety level

Figure 5: Components of the extensive margin of exports (base year is 1999)



Source: NBB. Notes: *N* is the number of exporters; *Z* is the average number of products exported by firm, *G* the average number of destinations at product-firm (variety) level; *I* is the average value of exports at destination-variety level

Figure 6: Percentage increase in the predicted probability of exports in 1999 due to the introduction of the euro



Source NBB. Note: 1 is 100 percent; estimates in Table 14 column were used; top and bottom one percent tails of the productivity distributions dropped.

Appendix A

Table A1: Gravity results by chapter

Ch.	Description	Coeff.
14	VEGETABLE PLAITING MATERIALS; VEGETABLE PRODUCTS NOT ELSEWHERE SPECIFIED OR INCLUDED	-0.8964
27	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES	-0.8169
65	HEADGEAR AND PARTS THEREOF	-0.7102 *
80	TIN AND ARTICLES THEREOF	-0.6201 #
78	LEAD AND ARTICLES THEREOF	-0.6064
60	KNITTED OR CROCHETED FABRICS	-0.6062 #
50	SILK	-0.5893
54	MAN-MADE FILAMENTS; STRIP AND THE LIKE OF MAN-MADE TEXTILE MATERIALS	-0.5557 #
8	EDIBLE FRUIT AND NUTS; PEEL OF CITRUS FRUIT OR MELONS	-0.4654
97	WORKS OF ART, COLLECTORS' PIECES AND ANTIQUES	-0.4651
1	LIVE ANIMALS	-0.4195
34	SOAP, ORGANIC SURFACE-ACTIVE AGENTS, WASHING PREPARATIONS, LUBRICATING PREPARATIONS, ARTIFICIAL WAXES, PREPARED WAXES, POLISHING OR SCOURING PREPARATIONS, CANDLES AND SIMILAR ARTICLES, MODELLING PASTES, 'DENTAL WAXES' AND DENTAL PREPARATIONS WITH A BASIS OF PLASTER	-0.4167
45	CORK AND ARTICLES OF CORK	-0.3564
61	ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, KNITTED OR CROCHETED	-0.2842 *
86	RAILWAY OR TRAMWAY LOCOMOTIVES, ROLLING STOCK AND PARTS THEREOF; RAILWAY OR TRAMWAY TRACK FIXTURES AND FITTINGS AND PARTS THEREOF; MECHANICAL (INCLUDING ELECTROMECHANICAL) TRAFFIC SIGNALLING EQUIPMENT OF ALL KINDS	-0.2439
43	FURSKINS AND ARTIFICIAL FUR; MANUFACTURES THEREOF	-0.2139
5	PRODUCTS OF ANIMAL ORIGIN, NOT ELSEWHERE SPECIFIED OR INCLUDED	-0.2073
18	COCOA AND COCOA PREPARATIONS	-0.1922
23	RESIDUES AND WASTE FROM THE FOOD INDUSTRIES; PREPARED ANIMAL FODDER	-0.1787
76	ALUMINIUM AND ARTICLES THEREOF	-0.1590
25	SALT; SULPHUR; EARTHS AND STONE; PLASTERING MATERIALS, LIME AND CEMENT	-0.1461
62	ARTICLES OF APPAREL AND CLOTHING ACCESSORIES, NOT KNITTED OR CROCHETED	-0.1412
87	VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING STOCK, AND PARTS AND ACCESSORIES THEREOF	-0.1354
17	SUGARS AND SUGAR CONFECTIONERY	-0.1250
31	FERTILISERS	-0.1243
94	FURNITURE; BEDDING, MATTRESSES, MATTRESS SUPPORTS, CUSHIONS AND SIMILAR STUFFED FURNISHINGS; LAMPS AND LIGHTING FITTINGS, NOT ELSEWHERE SPECIFIED OR INCLUDED; ILLUMINATED SIGNS, ILLUMINATED NAMEPLATES AND THE LIKE; PREFABRICATED BUILDINGS	-0.1209
63	OTHER MADE-UP TEXTILE ARTICLES; SETS; WORN CLOTHING AND WORN TEXTILE ARTICLES; RAGS	-0.1114
20	PREPARATIONS OF VEGETABLES, FRUIT, NUTS OR OTHER PARTS OF PLANTS	-0.0630
38	MISCELLANEOUS CHEMICAL PRODUCTS	-0.0604
42	ARTICLES OF LEATHER; SADDLERY AND HARNESS; TRAVEL GOODS, HANDBAGS AND SIMILAR CONTAINERS; ARTICLES OF ANIMAL GUT (OTHER THAN SILKWORM GUT)	-0.0517
35	ALBUMINOIDAL SUBSTANCES; MODIFIED STARCHES; GLUES; ENZYMES	-0.0502
55	MAN-MADE STAPLE FIBRES	-0.0447
89	SHIPS, BOATS AND FLOATING STRUCTURES	-0.0331
39	PLASTICS AND ARTICLES THEREOF	-0.0220
22	BEVERAGES, SPIRITS AND VINEGAR	-0.0218
83	MISCELLANEOUS ARTICLES OF BASE METAL	-0.0049
44	WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL	0.0017
79	ZINC AND ARTICLES THEREOF	0.0051
16	PREPARATIONS OF MEAT, OF FISH OR OF CRUSTACEANS, MOLLUSCS OR OTHER AQUATIC INVERTEBRATES	0.0085
48	PAPER AND PAPERBOARD; ARTICLES OF PAPER PULP, OF PAPER OR OF PAPERBOARD	0.0114
71	NATURAL OR CULTURED PEARLS, PRECIOUS OR SEMI-PRECIOUS STONES, PRECIOUS METALS, METALS CLAD WITH PRECIOUS METAL, AND ARTICLES THEREOF; IMITATION JEWELLERY; COIN	0.0257
49	PRINTED BOOKS, NEWSPAPERS, PICTURES AND OTHER PRODUCTS OF THE PRINTING INDUSTRY; MANUSCRIPTS, TYPESCRIPTS AND PLANS	0.0290

56	WADDING, FELT AND NONWOVENS; SPECIAL YARNS; TWINE, CORDAGE, ROPES AND CABLES AND ARTICLES THEREOF	0.0381
72	IRON AND STEEL	0.0419
68	ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, MICA OR SIMILAR MATERIALS	0.0446
46	MANUFACTURES OF STRAW, OF ESPARTO OR OF OTHER PLAITING MATERIALS; BASKETWARE AND WICKERWORK	0.0501
53	OTHER VEGETABLE TEXTILE FIBRES; PAPER YARN AND WOVEN FABRICS OF PAPER YARN	0.0725
28	INORGANIC CHEMICALS; ORGANIC OR INORGANIC COMPOUNDS OF PRECIOUS METALS, OF RARE-EARTH METALS, OF RADIOACTIVE ELEMENTS OR OF ISOTOPES	0.0814
12	OIL SEEDS AND OLEAGINOUS FRUITS; MISCELLANEOUS GRAINS, SEEDS AND FRUIT; INDUSTRIAL OR MEDICINAL PLANTS; STRAW AND FODDER	0.0856
74	COPPER AND ARTICLES THEREOF	0.0917
64	FOOTWEAR, GAITERS AND THE LIKE; PARTS OF SUCH ARTICLES	0.1148
3	FISH AND CRUSTACEANS, MOLLUSCS AND OTHER AQUATIC INVERTEBRATES	0.1349
70	GLASS AND GLASSWARE	0.1369
67	PREPARED FEATHERS AND DOWN AND ARTICLES MADE OF FEATHERS OR OF DOWN; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR	0.1395
73	ARTICLES OF IRON OR STEEL	0.1418
84	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF	0.1479 #
58	SPECIAL WOVEN FABRICS; TUFTED TEXTILE FABRICS; LACE; TAPESTRIES; TRIMMINGS; EMBROIDERY	0.1650
92	MUSICAL INSTRUMENTS; PARTS AND ACCESSORIES OF SUCH ARTICLES	0.1678
40	RUBBER AND ARTICLES THEREOF	0.1749
52	COTTON	0.1810
96	MISCELLANEOUS MANUFACTURED ARTICLES	0.1896
33	ESSENTIAL OILS AND RESINOIDS; PERFUMERY, COSMETIC OR TOILET PREPARATIONS	0.1898
85	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES	0.1979
51	WOOL, FINE OR COARSE ANIMAL HAIR; HORSEHAIR YARN AND WOVEN FABRIC	0.2016
24	TOBACCO AND MANUFACTURED TOBACCO SUBSTITUTES	0.2097
29	ORGANIC CHEMICALS	0.2115
19	PREPARATIONS OF CEREALS, FLOUR, STARCH OR MILK; PASTRYCOOKS' PRODUCTS	0.2163
69	CERAMIC PRODUCTS	0.2203
13	LAC; GUMS, RESINS AND OTHER VEGETABLE SAPS AND EXTRACTS	0.2323
66	UMBRELLAS, SUN UMBRELLAS, WALKING STICKS, SEAT-STICKS, WHIPS, RIDING-CROPS AND PARTS THEREOF	0.2326
41	RAW HIDES AND SKINS (OTHER THAN FURSKINS) AND LEATHER	0.2346
93	ARMS AND AMMUNITION; PARTS AND ACCESSORIES THEREOF	0.2549
59	IMPREGNATED, COATED, COVERED OR LAMINATED TEXTILE FABRICS; TEXTILE ARTICLES OF A KIND SUITABLE FOR INDUSTRIAL USE	0.3187
57	CARPETS AND OTHER TEXTILE FLOOR COVERINGS	0.3224
37	PHOTOGRAPHIC OR CINEMATOGRAPHIC GOODS	0.3286
21	MISCELLANEOUS EDIBLE PREPARATIONS	0.3434
10	CEREALS	0.3443
95	TOYS, GAMES AND SPORTS REQUISITES; PARTS AND ACCESSORIES THEREOF	0.3446 #
11	PRODUCTS OF THE MILLING INDUSTRY; MALT; STARCHES; INULIN; WHEAT GLUTEN	0.3711
81	OTHER BASE METALS; CERMETS; ARTICLES THEREOF	0.3926
15	ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PREPARED EDIBLE FATS; ANIMAL OR VEGETABLE WAXES	0.4013
30	PHARMACEUTICAL PRODUCTS	0.4073
82	TOOLS, IMPLEMENTS, CUTLERY, SPOONS AND FORKS, OF BASE METAL; PARTS THEREOF OF BASE METAL	0.4096 #
32	TANNING OR DYEING EXTRACTS; TANNINS AND THEIR DERIVATIVES; DYES, PIGMENTS AND OTHER COLOURING MATTER; PAINTS AND VARNISHES; PUTTY AND OTHER MASTICS; INKS	0.4207
90	OPTICAL, PHOTOGRAPHIC, CINEMATOGRAPHIC, MEASURING, CHECKING, PRECISION, MEDICAL OR SURGICAL INSTRUMENTS AND APPARATUS; PARTS AND ACCESSORIES THEREOF	0.4331 *
7	EDIBLE VEGETABLES AND CERTAIN ROOTS AND TUBERS	0.4462
2	MEAT AND EDIBLE MEAT OFFAL	0.4534
91	CLOCKS AND WATCHES AND PARTS THEREOF	0.4633
4	DAIRY PRODUCE; BIRDS' EGGS; NATURAL HONEY; EDIBLE PRODUCTS OF ANIMAL ORIGIN, NOT ELSEWHERE SPECIFIED OR INCLUDED	0.4763 #
98	COMPLETE INDUSTRIAL PLANT	0.5103

9	COFFEE, TEA, MATÉ AND SPICES	0.5737
6	LIVE TREES AND OTHER PLANTS; BULBS, ROOTS AND THE LIKE; CUT FLOWERS AND ORNAMENTAL FOLIAGE	0.5780 *
36	EXPLOSIVES; PYROTECHNIC PRODUCTS; MATCHES; PYROPHORIC ALLOYS; CERTAIN COMBUSTIBLE PREPARATIONS	0.6010
47	PULP OF WOOD OR OF OTHER FIBROUS CELLULOSIC MATERIAL; RECOVERED (WASTE AND SCRAP) PAPER OR PAPERBOARD	0.6696
88	AIRCRAFT, SPACECRAFT, AND PARTS THEREOF	0.7158 #
75	NICKEL AND ARTICLES THEREOF	0.7295
26	ORES, SLAG AND ASH	1.0167 *

Notes: Dependent variable is the log of imports. The specification is similar to the benchmark specification in column 1 of Table 3. Standard errors (robust to clustering by country-pairs) are in parentheses. **, * and # denotes significant at the 1, 5 and 10 percent level, respectively.