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Abstract

This paper investigates trade effects of the euro focusing on the impact on bystanders. A common currency is expected to lower both variable and fixed trade costs, inducing increased trade flows between currency-union members on both intensive and extensive margins of trade. While this trade-creating effect has gained attention in recent work using firm-level data, few studies have looked on the possible trade-diverting effect for firms remaining outside. In this paper, we use data for Swedish manufacturing firms covering the 1997-2006 period in order to assess the potential trade-diverting effects of the euro on Swedish exports. We consider variations in the impact of the euro taking both firm, industry and export-market characteristics into account. Our results suggest that there are some trade-diverting effects on the intensive margin but that these negative effects of the euro on trade flows are asymmetric and only valid for core markets within the Eurozone.

JEL classification: F10

Keywords: euro, trade diversion, exports, heterogeneous firms

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1. Introduction

The rationale behind the increased number of currency unions around the world is to stabilize economies and prevent countries from reaping efficiency gains by competitive depreciation of currencies. The Commission of the European Communities (1990) argued that a single currency in Europe should lead to benefits through a reduction in uncertainties and transaction costs, boosting dynamic gains through a better investment climate. Thus, the implementation of a single currency was expected to increase the benefits from the single market through increased trade and investment between member states. There is also a large and growing literature on the trade effects of currency unions in general and the Eurozone in particular. The results from these studies tend to confirm a positive effect on trade, although the magnitude of this effect varies widely across studies.[1]

The consensus of positive trade effects of a currency union on its member, however, is not carried over to the potential trade effects on bystanders. Bystanders' exports may fall due to the implementation of a currency union since bystanders face increased relative trade costs when trade costs among members fall. From a European-integration perspective, it is particularly interesting that not all EU member countries have adopted the euro. The effects of the euro on these bystanders have, however, gained much less attention in the literature than its effects on euro members.

The purpose of this paper is to fill this gap and study the euro's impact on bystander firms' exports to the Eurozone countries. The assessment of the trade effects follows the, by now, standard heterogeneous-firm model of the micro patterns of international trade and investigates the impact on both firms' intensive (the volume of export sales by existing exporters) and extensive (non-export firms becoming exporters) margin.[2] In a theoretical setting based on Chaney (2008), we identify the effects on outside firms' exports to the deeper integration area consisting of the Eurozone countries. We then assess these effects empirically making use of firm-level data for Swedish manufacturing firms covering the period 1997-2006. To our knowledge, this is the first study using very detailed information of firms' geographical export patterns in order to evaluate the effects of the implementation of the euro on both trade margins on outsiders with a micro-econometric approach.

At the average level, we find no evidence of trade diversion for Swedish firms' exporting to the Eurozone. However, we reveal an asymmetric effect on the intensive margin, suggesting that Swedish

[1] This is underscored by a comparison between the surveys by Baldwin (2006) and Flam (2009). Baldwin argues that the euro increased trade with 5-10 per cent. Flam, on the other hand, claims that the trade boost could be as high as 10-30 per cent and that trade with non-euro countries increased with half this magnitude. The large variation in estimated magnitudes across studies could be due to differences in samples and estimation techniques. A problem particularly in studies not using sufficiently detailed data is that findings could be aggravated simply by the aggregation of a myriad of microeconomic events that also varies across samples.

[2] As demonstrated by, e.g., Helpman et al. (2008) and Greenaway et al. (2010), ignoring the impact of changes on the extensive margin of trade could be of major concern and lead to biased estimates.

exporters lost market shares, but not markets, in less remote (in terms of size and integration to the rest of the world) Eurozone members due to the implementation of the euro.

The paper is organized as follows. Section 2 discusses how a single currency is expected to affect trade flows and reviews related studies. Section 3 provides the theoretical setting by analyzing the firms export decisions and the effects on bystanders. The empirical methodology and data are described in section 4 while section 5 presents the empirical results. Section 6 concludes.

2. The euro and trade effects

A common currency such as the euro is expected to affect trade by reducing various types of trade costs. The most obvious channel is the removal of costs associated with currency exchange and related transaction costs that will reduce prices and lead to increased trade among the Eurozone countries. In addition, increased price transparency and elimination of exchange rate volatility is anticipated to increase competition and inducing positive effects on trade among members. In the framework by Melitz (2003), the trade creating effects from reducing trade costs may be observed on two margins: the intensive margin where trade volumes of existing exporters increase and the extensive margin where the number of trading firms increases as the productivity threshold to enter the export market is lowered. As Melitz shows, effects on the intensive margin are induced by lowering variable trade costs, while the extensive margin is affected by an increased profitability from exporting through a fall in variable and/or fixed costs of trading. Among the costs associated with trade in different currencies, the transaction costs can be viewed as variable trade costs, while costs related to lack of price transparency and exchange rate volatility is likely to involve more fixed costs of trading.

Independent of whether the euro influences variable or fixed costs of exporting, its implementation may have trade diversion effects for outsiders. A fall in trade costs in the Eurozone implies a fall in the perceived price on these countries' markets, which implies that the relative cost of trading with the Eurozone from outside increases. So even if the absolute cost for outsiders to reach the Eurozone remain unchanged after the euro's implementation, outsiders' exports will become relatively more costly on the euro markets and thus lead to trade diversion effects. These effects may occur on both trade margins as will be discussed in section 3.1.[3]

The large variation, as mentioned, in the estimates of the magnitude of the euro effect in previous studies could be due to the use of too aggregated data and failure to take into account both margins of

[3] Notice that trade diversion in this context differs from the traditional trade-diversion effects in custom-union analysis since there will be no negative impact on within-union countries. The formation of a customs union (or any other regional integration area) eliminates tariffs between member countries and creates a tariff-revenue loss on imports for the government. A common currency, on the other hand, involves no such loss. The removal of currency-related trade costs will only lead to lower prices that benefit consumers of imported goods.

trade. Baldwin and Di Nino (2006) and Flam and Nordström (2006) are the first attempts to investigate the euro effect on both the intensive and extensive margins using detailed data at the product level. Both studies find positive trade effects on both margins and similar results are found in more recent studies also relying on product-level data (Bergin and Lin, 2011, and Badinger and Türcan, 2014).

In order to control for micro-economic dynamics and to understand the effect of the euro on the behavior of exporting firms, firm-level data, however, are to be preferred. Only a few studies have considered the impact of the euro using trade data at the firm level. Berthou and Fontagné (2008) use data on French exporting firms for the period 1998 to 2003. The authors find positive effects on firms' extensive margins to the Eurozone but no effects on their intensive margins. Esteve-Pérez et al. (2011) investigate trade of Spanish manufacturing firms between 1994 and 2002 and find that the introduction of the euro increased sales per firm and the number of firms exporting to the Eurozone. The study also shows that the role of firm size in the decision to export to the euro area weakened after the introduction of the euro.

To our knowledge, the descriptive statistics provided by Baldwin et al. (2008) and Fontagné et al. (2009) are the only studies that have considered the possible trade-diversion effect on outsiders using firm-level data. Baldwin et al. compare trade effects of the euro for two Eurozone countries (Belgium and France) and two outside countries (Hungary and Sweden) using simple difference-in-difference technique. For the two Eurozone countries, the study finds pro-trade effects on both the extensive and intensive margin. On the other hand, no effects are found for Hungary and Swedish firms even seem to have increased trade to the Eurozone countries on the intensive margin.[4] Hence, their findings do not support any trade diversion effects induced by the euro. Fontagné et al. use detailed firm-level information for Belgium, France and Hungary in order to calculate the shares of intensive and extensive trade margins in total export variations during the implementation of the euro (1998-2003). A comparison of the variation of the different margins between countries in the Eurozone and outside suggests no euro effect on non-euro members (Hungary in this case).

3. Firms' export decision

Our reference point for firms' export decisions is the framework of heterogeneous firms in international trade (see Melitz, 2003, Helpman et al., 2008, and Chaney, 2008). This class of models

[4] The positive effect on Swedish firms' trade with the Eurozone is in line with the findings in Flam and Nordström (2007) and Gil-Pareja et al. (2008) that both obtain trade-creation effects between Eurozone countries and outsiders. These studies, however, make use of aggregated data (at the country-level) that may lead to inflated estimates.

extends the new trade theory by introducing heterogeneity in firm productivity and sunk costs of exporting. Heterogeneity implies that the price of a firm's product falls with its productivity, increasing the demand for the firm's unique variety. The fixed costs of exporting imply that a domestic firm will only find it profitable to serve a foreign market as long as it can cover these fixed costs. Thus, firms' self-select into export activities, and whether a firm chooses to export to a particular market or not will depend on both its productivity level and the costs of exporting to that particular market.

Using the approach and notation in Chaney (2008), we can illustrate each firm's export decision by three equations. The first equation shows country *j*'s demand for a variety produced by a firm φ located in country *i*:

$$x_{ij}(\varphi) = p_{ij}(\varphi)q_{ij}(\varphi) = \mu Y_j \left(\frac{p_{ij}(\varphi)}{P_j}\right)^{1-\sigma} \quad (1)$$

where φ is the randomly drawn (from a Pareto distribution with the shape parameter γ) labor productivity of the firm[5], p_{ij} is the price of the firm's variety in country *j* (including production and transport costs), q_{ij} is the firm's number of units sold on country *j*'s market, μ stems from the utility function and gives the share of income devoted to manufactures, Y_j is total income of country *j*, P_j is the ideal price index in *j*, and σ is the elasticity of substitution between varieties of manufactures. The ideal price index is a function of the price of all the goods consumed in country *j* and will be affected by the cost of exporting to country *j* from all locations *k* around the world. It is given by the following equation:

$$P_j = \left[\sum_{k=1}^{N} w_k L_k \int_{\bar{\varphi}_{kj}}^{\infty} \left(\frac{\sigma}{\sigma-1}\frac{w_k \tau_{kj}}{\varphi}\right)^{1-\sigma} dG(\varphi)\right]^{\frac{1}{(1-\sigma)}} \quad (2)$$

where w_k is the wage level (or the productivity level) in country *k*, L_k is size of country *k* (i.e., the number of workers), τ_{kj} is the variable trade cost between *j* and *k*, $G(\varphi)$ is the distribution of productivity in manufactures, and $\bar{\varphi}_{kj}$ is the productivity threshold for exporting firms. The threshold for exporting is defined as:

$$\bar{\varphi}_{ij} = \left[\left(\frac{\sigma}{\mu}\right)^{1/(\sigma-1)} \left(\frac{\sigma}{\sigma-1}\right)\right] \left(\frac{f_{ij}}{Y_j}\right)^{1/(\sigma-1)} \frac{w_i \tau_{ij}}{P_j} \quad (3)$$

[5] This also defines the firm since φ is firm specific.

where f_{ij} are the fixed costs of establishing on the foreign market. Chaney (2008) uses the productivity threshold to solve for the equilibrium price index, which is then plugged into the demand equation in order to find the equilibrium export of a firm located in *i* to country *j*. The expressions become:

$$x_{ij}(\varphi) = \begin{cases} \lambda \left(\frac{Y_j}{Y}\right)^{(\sigma-1)/\gamma} \left(w_i \tau_{ij}\right)^{(1-\sigma)} \left(\theta_j\right)^{(\sigma-1)} (\varphi)^{(\sigma-1)}, if\ \varphi > \bar{\varphi}_{ij} \bar{\varphi}_{ij} = \\ 0\ otherwise \end{cases}$$

$$\nu \left(\frac{Y}{Y_j}\right)^{1/\gamma} \frac{w_i \tau_{ij}}{\theta_j} \left(f_{ij}\right)^{1/(\sigma-1)} \tag{4}$$

$$\left(\theta_j\right)^{-\gamma} = \sum_{k=1}^{N} (Y_k/Y) \left(w_k \tau_{kj}\right)^{-\gamma} \left(f_{kj}\right)^{-((\gamma/(\sigma-1))-1)}$$

where λ and ν are constants (see Chaney, 2008, for details), and *Y* is total income in the world. θ_j is an aggregate index of importer *j*'s remoteness from the rest of the world. It shows that the higher the trade cost for other countries to reach *j*, the more remote is country *j* globally, and hence the more it will trade with country *i* (see also Anderson and van Wincoop, 2003).[6]

The set of equations in (4) displays that each firm's decision as to if and how much to export depends on both the irreversible fixed costs and the variable trade costs of exporting. As demonstrated above, however, both trade margins (the extensive and the intensive, respectively) are not only affected by the bilateral trade costs between the exporter and the importer but also on the general openness of the importing country, as captured by θ_j. As a more open country will have a better opportunities to import from competing firms located in other countries (reflected by a lower price level), the relative cost for firms to reach the importer will be higher.

3.1 The bystander effect

When illustrating the bystander effect, we assume that trade costs between the exporting country *i* (Sweden) and the importing country *j* remain unchanged, i.e. that $d\tau_{ij}$ and df_{ij} equal zero. However, as some of the importing countries *j* initiate a deeper integration (e.g. by implementing the euro), the bystanding Swedish firms will face a trade shock even though the bilateral trade costs between Sweden and these countries do not change. The reason is that the integration process makes these countries less remote towards each other leading to a decreased demand for Swedish exports. The fall in the bystanders' exports occurs on both trade margins. First, the intensive margin of an exporting firm in *i* falls since consumers divert their demand towards relatively cheaper import from members of the deeper integration area. Secondly, the extensive margin falls as increased competition from a

[6] Note that γ is an inverse measure of heterogeneity of firms and it is assumed to be larger than (σ-1) in order to ensure a size distribution with a finite mean in the equilibrium (see Chaney, 2008).

shrinking foreign market increases the productivity threshold and, in turn, makes some unproductive firms face losses and exit market *j*. These effects can be traced by focusing on the effects of a change in trade costs (both fixed and variable) between *k* and *j* (holding the relationship between *i* and *j* unaffected) on the trade elasticities of *j*'s import demand from *i* on both margins:

$$\frac{\partial x_{ij}}{\partial \tau_{kj}}\frac{\tau_{kj}}{x_{ij}} = (\sigma-1)\frac{\tau_{kj}}{\theta_j}\frac{\partial \theta_j}{\partial \tau_{kj}} > 0, \quad \frac{\partial x_{ij}}{\partial f_{kj}}\frac{f_{kj}}{x_{ij}} = (\sigma-1)\frac{f_{kj}}{\theta_j}\frac{\partial \theta_j}{\partial f_{kj}} > 0$$

$$\frac{\partial \bar{\varphi}_{ij}}{\partial \tau_{kj}}\frac{\tau_{kj}}{\bar{\varphi}_{ij}} = \frac{\tau_{kj}}{\theta_j}\frac{\partial \theta_j}{\partial \tau_{kj}} < 0, \quad \frac{\partial \bar{\varphi}_{ij}}{\partial f_{kj}}\frac{f_{kj}}{\bar{\varphi}_{ij}} = \frac{f_{kj}}{\theta_j}\frac{\partial \theta_j}{\partial f_{kj}} < 0 \tag{5}$$

where the first line gives the elasticities on the intensive margin and the second line the elasticities on the extensive margin showing how increased openness between two euro countries (*j* and *k*) decreases the volume of exports to *j* for each Swedish exporter and that fewer firms enter market *j* as the productivity threshold increases. The expressions in (5) also suggest an asymmetric impact on the two margins. In particular, with typical estimates for σ between 5 and 10 (see Anderson and van Wincoop, 2004) we expect a smaller impact on the extensive as compared to the intensive margin of trade. Finally, it should be noted that in this framework the bystander effect is completely driven by the indirect effect of the euro on the importer's price level operating through the remoteness variable θ_j.

4. Empirical specifications

Most studies assessing the euro effect use aggregated trade flows, implying not only that the impact of a trade resistance variable becomes inflated by firm heterogeneity (see Chaney, 2008)−and hence higher than on firm level−but also that it is not possible to distinguish between the extensive and the intensive margins of trade. Hence, in order to obtain more precise estimates and to investigate the impact of the euro on both margins we consider the possible trade diverting effects of the euro on Swedish exports at the firm level. Our benchmark specification of the gravity equation reflecting trade on the intensive margin is based on equation (4):

$$\begin{aligned} lnx_{fjt} = {} & ((\sigma-1)/\gamma)lnY_{jt} + (\sigma-1)ln\theta_{jt} + (\sigma-1)ln\varphi_f + Euro_{jt} \\ & + \pi_{fj} + \delta_t + \rho\Phi_{fjt} + \varepsilon_{fjt} \end{aligned} \tag{6}$$

where x_{fjt} is the export volume of firm *f* to importer *j* at time *t*, Y_{jt} is the GDP of the importer at time *t*, θ_{jt} is the remoteness variable calculated as $\theta_{jt} = \sum_k d_{kj}/GDP_{kt}$ where d_{kj} is the distance between country *k* and *j*, φ_f is total factor productivity (TFP) measured as in Olley and Pakes (1996), $Euro_{jt}$ is an indicator of Eurozone membership (1 after 1999 if *j* is a Eurozone member, 0 otherwise), π_{fj} and

δ_t are fixed effects capturing firm-importer and time invariant trade costs (and omitted variables or measurement errors), Φ_{fjt} is the Mills ratio used as a correction term in order to control for the selection bias, and $\varepsilon_{fjt}$is an error term.[7] The two-step approach of equation (6) is based on Wooldridge (1995, 2002) and is further discussed below and in the appendix.[8]

We also investigate the extensive margin of trade and whether the euro has an impact on the probability of export participation. An implementation of the euro that makes the Eurozone countries more integrated and less remote (as the price level in the Eurozone drops) would make it harder for Swedish firms to enter and increase the threshold productivity level of exporting to the Eurozone. When it comes to the empirical specification of assessing the impact of the euro on Swedish firms' propensity to export to the Eurozone, we lean on the approach used by Bastos and Silva (2012). Hence, the point of departure is in firms' probability of exporting instead of structurally estimating the productivity-threshold value of exporting given by equation (4). This implies the following reduced form:

$$P\left[lnx_{fjt} > 0\right] = P\left((1/\gamma)lnY_{jt} + ln\theta_{jt} + ln\varphi_f + Euro_{jt} + \pi_{fj} + \delta_t + \varepsilon_{fjt}\right) \quad (7)$$

where variables are defined as above. The export participation equation (7) is estimated using a linear probability model (LPM) with fixed effects as in Bastos and Silva (2012) since it allows us to capture unobserved firm-importer effects without facing the problems of incidental parameters problem that may be a problem in a probit. In addition, the LMP gives a "*good estimates of the partial effects on the response probability near the center of the distribution*" of the independent variables (Wooldridge, 2002, p. 455) in line with our purpose.

4.1 Data

Our firm-level data is provided by *Statistics Sweden* and consists of an unbalanced panel of 3,601 firms in the manufacturing sector covering the period 1997 until 2006. For all years we have detailed information on each firm's output, choice of factor inputs, details of its ownership structure and on export volumes to each export destination. In order to have a relevant group of comparison outside the Eurozone, we limit our sample to 31 high-income OECD countries. The balanced panel of potential export activities for each year is more than 100,000 but only 30 percent of these are actually activated. Of the activated export flows, around 36 percent were heading for the Eurozone. A detailed definition

[7] A more thorough discussion of the variables is found in the data section below.
[8] Note that a one-step approach of using an ordinary fixed effect specification without the Mill's ratio leads to similar results. We focus, however, on the results from the two-step approach since both the theoretical model and the empirical test of the significance of the selection mechanism suggest this is the appropriate method.

of the sample and the variables used can be found in Table 1.[9] The stylized facts of firm export behavior match those in other countries. For example, we find that exporters are around 13 percent more productive and that they are larger than non-exporters. Figure 1 gives a rough development of the export share of our sample heading for the Eurozone. The figure displays a great variation with a peak at around 50 percent at the implementation of the euro, followed by an instant fall and then a rebound in 2004.

[Table 1 about here]

[Figure 1 about here]

5. Empirical results

Our first set of results is found in Table 2, which shows the assessment of the euro on Swedish firms' intensive trade margin using firm-destination specific fixed effects and time dummies. All specifications are based on a two-step approach in order to control for any bias due to a selection into exporting and we correct the standard errors for this technique by using bootstrapped standard errors clustered in firm-destination groups. The Mill's ratio stems from a probit model using the methodology discussed in Wooldridge (1995, 2002) and a more detailed discussion of this approach is presented in the appendix. Our benchmark regression is found in column 1 Table 2 that. In addition to the firm-country specific effects, we control for GDP and the remoteness of the importer, as well as the TFP of the exporting firm.

Besides having the correct sign for the coefficient of the importer's GDP, the result is in line with the structural models of Chaney (2008) and Eaton et al. (2007). These studies estimate the ratio $\gamma/(\sigma-1)$ to be around 2 and 1.5 respectively. Our result is in the same ballpark since the coefficient of the importer's GDP equals $(\sigma-1)/\gamma$ (see the firm-level gravity equation (6)), suggesting an inversed ratio of around 1.6, that is, just between the two values suggested by earlier studies focusing on US and French data sets.

The coefficient for productivity suggests a positive relationship and is in line with our expectations and earlier studies. The magnitude of this effect, however, is quite small compared to the theoretical prediction of $(\sigma-1)$. This downward bias may be explained by firm-level fixed effects picking up persistent productivity effects such as management, organization or product quality.

[9] Notice that we only consider firms that exist for at least two sequential years and that have at least 20 employees.

The assessment of the trade effect of the euro on bystanders is captured with the help of a treatment dummy (Eurozone) taking the value of 1 after 1999 for each trade partner belonging to the Eurozone and zero otherwise.[10] For our benchmark specification in column 1, however, the result suggests that the potential trade-diverting effect of the euro has not been met. In other words, Swedish firms do not seem to have reduced their exports to the euro area after the single currency was introduced, a result in line with previous studies. This result is upheld in column 2 of Table 2 where we narrow down the sample to include only (current) EU countries as control destinations.

The results above may be an artefact based on a selection process where firms exporting to the Eurozone have a unique set of characteristics. Although we try to capture these with time-invariant firm-destination specific effects we investigate this matter further by considering additional firm characteristics. The specifications in columns 2 and 3 in Table 2 therefore include the size of the firm (number of employees) and the number of euro members each firm has affiliates in, respectively.

Firm size has been used in several other studies focusing on firms' exports. Our results are in accordance with these as we find that increased size of the firm is positively related to firm exports. A larger firm may also find it easier to manage currency problems or find the perceived sunk costs of exporting to be lower (see e.g. Gullstrand, 2011) and therefore be less affected by any trade diversion. The interaction between the euro effect and the firm size, however, suggests no such relationship. Larger firms do not react differently to the implementation of the euro compared to smaller firms.

In addition to firm size, we examine the importance of FDI activity when it comes to the euro effect. The assumption is that deeper integration in the Eurozone may lead to positive effects on affiliated firms in that area, which may spill over to mother firms in Sweden. Therefore the number of Eurozone members each firm has affiliates in is incorporated in column 4 in Table 2. This variable, however, is not correlated with exports and firms with FDI activity in the Eurozone do not behave differently from other firms after the implementation of the euro.[11]

Table 3 shows the results of our assessment of the euro effect on the propensity to export, our specification being a reduced form of equation 7. According to the theoretical framework, the threshold productivity level of exporting increases with trade costs and falls with the size as well as the remoteness of the importer. Since we focus on the propensity of exporting instead of how the threshold changes, we expect the inverse relationship. In addition to GDP, remoteness and firm-

[10] The complete partner sample is presented in Table 1.
[11] We have tested if including a dummy for whether firms own foreign firms or not change our results. It did not and the dummy was insignificant.

destination fixed effects, we incorporate firms' TFP and size (measured as the number of employees) in our benchmark specification (see columns 1 and 2 in Table 3). The relationship between these destination and firm characteristics and firms' propensities of exporting is as expected. Larger and more productive firms are more likely to export, and they are more likely to export to larger than to smaller countries.

As argued, deeper integration within the Eurozone is expected to make the members less remote and increase trade costs, in relative terms, for Swedish firms to reach the area, lowering the propensity of exporting. Nevertheless, we do not find any results supporting this relationship. Firms are not less prone to export to the Eurozone after the implementation of the euro.

[Table 3 about here]

6. Asymmetric effects of the euro?

The results so far suggest very modest or no trade diversion effects of the euro on Swedish firms' exports, in line with the descriptive studies by Baldwin et al. (2006) and Fontagné et al. (2009). The lack of trade diversion may, however, be concealed by asymmetry across Swedish euro partners. In Anderson and van Wincoop (2003) trade barriers have an asymmetric effect on trade due to the price indices (or the multilateral resistance variables) in the gravity equation. The asymmetric effect is a result from a larger import fraction in consumption in smaller countries (as consumers face a smaller number of domestically produced varieties) leading to trade barriers towards the rest of the world being more important. A uniform reduction of trade barriers through a common currency may therefore have a bigger impact on the price indices of smaller countries compared to larger ones where the price indices in smaller countries (or more remote countries keeping everything else equal) fall more. Consequently, Swedish firms may face a more severe trade diversion effect of the euro from smaller (more remote) countries.

The discussion above relies on the assumption of a symmetric trade cost reduction, i.e. firms in a smaller country face a similar reduction of export costs as firms in a larger country. Casella (1996) questions this symmetry regarding the trade effects of free trade areas. According to Casella there are economies of scale when it comes to "*the market each firm can serve*", implying that the size of the "home market" is important for a firm's competitiveness. A firm in a remote country far from central markets has thus more to gain from an increased common market, as competitiveness of firms in smaller countries will increase more relative to firms in larger ones. This is supported by Badinger and Breuss (2009) who investigate the potential asymmetric effects from a market expansion induced by the euro and find that smaller countries improved their export performance by 3-9 percent relative to

larger ones. One implication of this finding is that the import prices of remote countries may instead fall less since they import from firms located in more central areas where firms have smaller gains from economies of scale as they already serve a large market.

An additional dimension is the euro effect on trade costs involving bystanders. So far, we have focused on trade costs between countries implementing the euro, assuming that trade costs between Sweden and the Eurozone are unchanged. This assumption may be questioned since a reduction of the number of currencies in Europe may not only be an advantage for the Eurozone, it may also be beneficial for non-members. As Mélitz (2004) puts it: "*If some countries form a currency union, there are fewer units of account in the world and therefore lower trade barriers for everyone*". That is, Swedish firms may find it easier to export to all members of the Eurozone since only one unit of account is used. As showed by Bacchetta and van Wincoop (2005), the size of the market using the same currency is an important determinant of the choice of invoicing currency in trade. Hence, following the introduction of the euro, Swedish exports will more likely be set in euro prices instead of a large variety of currencies including the Swedish Crown. There is also some empirical evidence of an increased importance of using the euro as an invoicing currency in trade for both members and potential members of the euro area since the end of the 1990s (see Kamps, 2006). If this is the case, Swedish firms exporting to the Eurozone may face trade creation instead of trade diversion. The overall impact depends on the magnitudes of two opposing effects: the reduction in the price indices in importing Eurozone members leading to trade diversion, versus the reduction in bilateral trade costs leading to trade creation.[12]

Thus, our discussion emphasizes the possibility of an asymmetric trade effect of the euro, but also that the asymmetry may go in both directions. On the one hand, a more remote country, such as Finland compared to Germany, may have a greater trade diverting effect on Swedish exports as the remote country is more dependent on imports and therefore experience a greater fall in the price level. On the other hand, as Finland already imported from the more scale-efficient firms located in Germany before the euro, it could be that the relative price level falls more in Germany as the cost of German imports from Finland decreases when Finnish firms serve a greater market. In addition, the trade effect of the euro is affected by the possibility for Swedish firms to use the same currency for a larger market. The final impact on trade becomes an empirical question. We address this with help of an interaction between the Eurozone dummy and the remoteness variable, and the results are found in Table 4 and 5 for the intensive and the extensive margins respectively.

[12] See Obstfeld and Rogoff (1996) and Obstfeld (2001).

The relationships between destination as well as firm characteristics and firms' intensive and extensive margins are all robust. The only difference as compared to our earlier results is that we have unmasked a non-linear relationship on the intensive margin between the implementation of the euro and the remoteness of the destination. The positive sign of the interaction term in Table 4 indicates that Swedish firms' exports was relatively higher with less remote countries such as Finland after the implementation of the euro, compared to less remote countries such as Germany or Belgium.[13] This relationship is robust for the alternative specification in column 3 incorporating the firm's skill intensity and to a redefinition of the implementation year of the euro.[14]

The results in Table 5 do not reveal a similar non-linearity of the euro effect on the extensive margin of trade. Hence, Swedish firms are neither more nor less prone to export to remote Eurozone members compared to central members, and the inclusion of additional firm characteristics does not affect this result. Altogether, our findings suggest that Swedish exporters lost market shares, but not markets, in less remote Eurozone members due to the implementation of the euro.

7. Conclusions

This paper adds to the literature on trade effects of currency unions by addressing the issue of trade diversion using detailed firm-level data. An understanding of the impact of a single currency on outside firms' engagement on export markets is essential from a policy perspective as it points to the possible costs of remaining outside. The results from our micro-econometric approach, however, indicate that the average trade diversion effect of the euro on Swedish exporting firms is small or non-existent. This is an important finding since it suggests that Swedish firms did not lose in competitiveness within the Eurozone as a whole and supports previous descriptive studies of no trade diverting effects of the euro.[15] We see this results to be particularly relevant for other EU members that, similar to Sweden, have not yet adopted the euro.

At the same time, our analysis reveals an asymmetric effect of the euro on Swedish firms' exports. In particular, the implementation of the euro induced increased trade on the intensive margin with the more remote countries within the Eurozone compared to the core countries. This finding is in line with the argument that price levels will fall less in more remote countries of an integration area and, hence, will make it easier for outside firms to maintain market shares in these countries.

[13] Notice that this result does not depend on whether we use the OECD or EU25 sample.
[14] The results remain robust for including additional control variables as well such as number of employees.
[15] To address earlier studies using aggregated data, we note that our analysis do not show any signs of trade creation between the Eurozone and outsiders as suggested in Flam and Nordström (2007) and Gil-Pareja et al. (2008).

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Tables and figures

Table 1: *Definitions and sources*

Characteristics	***Definition (source)***	***Mean (min, max)***
Firm level (based on all firm-year observations)		
TFP	Total factor productivity defined and calculated as in Olley and Pakes (1996).	4.04 (*0.001, 170.5*)
Employees	Number of employees in full year equivalents.	177 (*20, 23762*)
Physical capital	Capital stock per employee. The capital stock is calculated by the perpetual method using book value the first year. Depreciation rates for equipment and for buildings are 0.1 and 0.05 respectively.	2.98 (*0.01, 1098*)
Skilled	The share of technicians in total workforce.	0.43 (*0.01, 1*)
Destination level (based on all destination-year observations)		
GDP	Gross domestic product in billions and in constant price US $ (CEPII).	1035 (*5.5, 132000*)
Remoteness	$\theta_{jt} = \sum_k d_{kj}/GDP_{kt}$ where d_{kj} is the distance between country k and j.	1278 (*893, 1501*)
Eurozone	Dummy variable indicating Eurozone membership.	
Sample information		
Eurozone	AT, BE, EE, ES, FI, FR, DE, GR, IE, IT, LU, NL, PT, SI, SK	
EU25	Eurozone + CZ, DK, GB, HU, PL	
OECD high income	EU25 + AU, CA, CH, IL, IS, JP, KR, NO, NZ, US (*Note that Cyprus, Latvia, Malta and Romania are excluded from the sample since they are not included in the OECD high income country list.*)	
Exporters	30 % of all potential export flows from Swedish firms to OECD is activated and 36 % of these export flows were heading for the Eurozone. 85 % of all firms exported and these firms are on average 13 % more productive and 223 % more employees (These differences are statistically significant and based on a two-sample t-test between exporters and non-exporters).	
Firms	The sample of 3601 firms between 1997 and 2006 excludes firms existing for less than three years and having less than 20 employees.	

Table 2: *Euro effect on bystanders - the intensive margin*

	(1)	(2)	(3)	(4)
ln GDP	0.622	0.972	0.621	0.633
	(0.00)	(0.00)	(0.00)	(0.00)
Eurozone	-0.019	-0.020	-0.019	0.002
	(0.31)	(0.39)	(0.29)	(0.94)
ln remoteness	1.673	1.580	1.672	1.645
	(0.00)	(0.40)	(0.00)	(0.00)
ln TFP	0.050	0.047	0.050	0.055
	(0.00)	(0.00)	(0.00)	(0.00)
FDI activity[a]			0.050	
			(0.26)	
Eurozone·× FDI activity[a]			0.006	
			(0.90)	
ln employees				0.738
				(0.00)
Eurozone·× ln employees				-0.023
				(0.23)
Sample	OECD	EU25	OECD	OECD
Mills ratio	-0.372	-0.375	-0.372	-0.272
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	264912	178233	264912	264912
R^2 (within)	0.013	0.015	0.013	0.025
R^2 (between)	0.061	0.116	0.061	0.130

Note: Each regression is based on a fixed-effect model (firm-destination fixed effects) with year-specific effects. The standard errors are bootstrapped (clustered in firm-destination groups) 400 times in order to correct standard errors in the second step. [a] Number of Eurozone countries where the firm has FDI activity.

Table 3: *Euro effect on bystanders - the extensive margin*

	(1)	(2)
ln GDP	0.056	0.063
	(0.00)	(0.00)
Eurozone	0.001	-0.007
	(0.94)	(0.29)
ln remoteness	-0.083	0.078
	(0.32)	(0.85)
ln TFP	0.005	0.006
	(0.00)	(0.00)
ln employees	0.069	0.073
	(0.00)	(0.00)
Sample	OECD	EU25
Observations	895454	579540
R^2 (within)	0.006	0.008
R^2 (between)	0.115	0.158

Note: Each regression is based on a fixed effect model (firm-destination fixed effects) with year-specific effects. The standard errors are clustered around destinations.

Table 4: *Euro effect on bystanders – the intensive margin and asymmetry*

	(1)	(2)	(3)
ln GDP	0.616	0.868	0.625
	(0.00)	(0.00)	(0.00)
Eurozone	-3.702	-3.618	
	(0.00)	(0.00)	
ln remoteness	2.088	-1.954	1.999
	(0.00)	(0.30)	(0.00)
Eurozone·× ln remoteness	0.516	0.502	
	(0.00)	(0.00)	
ln TFP	0.050	0.047	0.049
	(0.00)	(0.00)	(0.00)
ln skilled			-0.059
			(0.12)
Eurozone (1st year 1999)			-3.679
			(0.00)
Eurozone (1st year 1999) × ln remoteness			0.513
			(0.00)
Sample	OECD	EU25	OECD
Mills ratio	-0.375	-0.378	-0.376
	(0.00)	(0.00)	(0.00)
Observations	264912	178233	264912
R^2 (within)	0.013	0.015	0.013
R^2 (between)	0.061	0.120	0.059

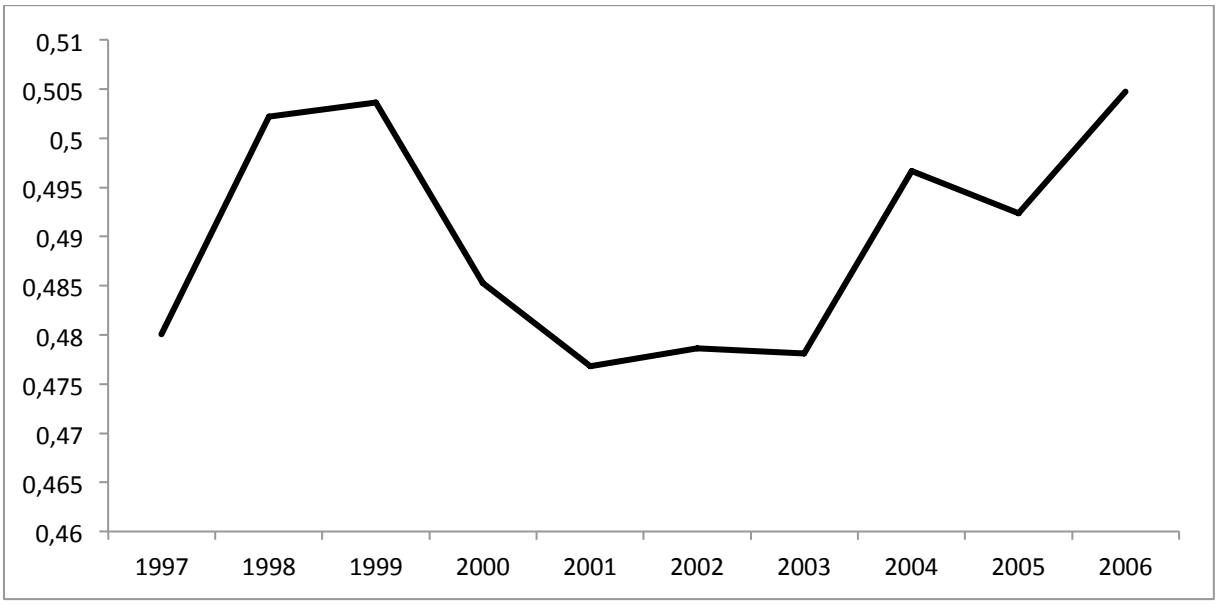
Note: Each regression is based on a fixed-effect model (firm-destination fixed effects) with year-specific effects. The standard errors are bootstrapped (clustered in firm-destination groups) 400 times in order to correct standard errors in the second step.

Table 5: *Euro effect on bystanders - the extensive margin and asymmetry*

	(1)	(2)
ln GDP	0.056	0.056
	(0.00)	(0.00)
Eurozone	0.064	0.064
	(0.49)	(0.49)
ln remoteness	-0.090	-0.090
	(0.31)	(0.31)
Eurozone·×	-0.009	-0.009
ln remoteness	(0.49)	(0.49)
ln TFP	0.005	0.005
	(0.00)	(0.00)
ln employees	0.069	0.072
	(0.00)	(0.00)
ln physical capital		0.009
		(0.00)
ln skilled		0.002
		(0.35)
Sample	OECD	OECD
Observations	895454	895454
R^2 (within)	0.006	0.006
R^2 (between)	0.114	0.119

Note: Each regression is based on a fixed-effect model (firm-destination fixed effects) with year-specific effects. The standard errors are clustered around destinations.

Figure 1: *Eurozone's export share of total OECD exports*



Appendix

The first step in our two-step approach of estimating the impact of the euro on firms' intensity of exporting is based on Wooldridge (1995, 2002) using a probit-form selection equation with a Mundlak approach of controlling for fixed effects. Our first step is therefore specified as follows:

$$P\left[lnx_{fj} > 0\right] = P(\beta_1 x + \delta_1 z + \beta_2 \bar{x} + \delta_2 \bar{z} + i + \varepsilon_{fj}),$$

where *i* is 3-digit industry dummies, *x* is a vector with logged firm characteristics; skilled (defined as the share of technicians in the labor force), TFP, and the number of employees. The vector *z* includes logged (except for the binary variables) destination characteristics; GDP, population, distance, openness (defined as total trade divided by GDP), legal status (binary taking the value of 1 if the country has a UK legal origin) and common religion (binary taking the value of 1 if the country has a common official religion). Bar ($\bar{x}, \bar{z}$) indicates the average of continuous firm (x) and country (z) characteristics, which is the Mundlak approach of capturing fixed effects (see e.g. Wooldridge, 2002).

We allow for a general selection mechanism by including fixed effects (using the Mundlak approach) and the rich set of variables indicated above since they have all shown to be important when it comes to predicting the propensity of exporting. The selection into exporting is identified by the non-linearity in Mill's ratio as well as by using common religion (as in Helpman et al., 2008) at country level and the share of technicians at the firm level (this skilled variable is insignificant at the second step) as exclusion restrictions (as indicated in the robustness check in Table 4 column 3). This selection model is used for each year and 2-digit sectors in order to calculate annual specific Mill's ratio, which are thereafter pooled and used in the second step firm-level gravity equation. Due to a large number of annual-sector regressions, we do not present the result. They are however available upon request.