Of markets, products and prices

The effects of the euro on European firms

BY LIONEL FONTAGNÉ, THIERRY MAYER
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European Firms In a Global Economy EFIGE

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European Firms In a Global Economy

EFIGE

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A preliminary version of the report was presented at the Bank of France, Paris, on 2 December 2008. The authors benefited from a debate involving Gilbert Cette, Guillaume Gaulier and Pierre Jaillet, as well as from the comments by other participants at the event.

* Figures for Belgium have been produced by Mauro Pisu.

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Foreword

'Money is a convenience and this restricts the optimum number of currencies.' This is how Nobel laureate Robert Mundell summarised the benefits of a common currency in his seminal 1961 article on optimum currency areas. In less cryptic terms this has ever since been taken as meaning that a common currency favours trade and this is why economists have relentlessly tried, first to predict, and then to assess, the effect of the euro on international trade flows.

This report first confirms the consensus that emerges from a growing body of literature: contrary to expectations trade flows have not increased meaningfully since the introduction of the euro. They may have grown by a couple of percentage points at most, but not a sufficient order of magnitude to yield a noticeable welfare gain. This comes as a disappointment for all those who justified the macroeconomic pains of forming a currency area in the name of integration and the efficiency gains it would yield.

However, trade effects cannot be measured by trade volumes alone. More trade does not necessarily mean more efficient organisation of production. It is indeed easy to construct examples where efficient organisation (say, the location of all production in the country where costs are lowest) results in less trade than the organisation adopted to protect a firm's profits from the possible effects of exchange rate fluctuations (say, the distribution across several countries of the stages of production). So trade volume can be a misleading yardstick. As important, if not more so, is *who* is trading and at *what price*. For allowing more producers to access foreign markets and lowering the price paid by consumers unambiguously result in welfare gains.

Here is where this report makes a difference. As regards the who issue, it builds on the approach developed in a previous Bruegel report by Ottaviano and Mayer, *The Happy Few*, to determine if the euro has resulted in an increase in the number of exporting firms (the 'extensive margin' of trade, according to the rather clumsy but now customary jargon). However, they find that the increase in the number of exporting firms has remained small. For the typical euro-area SME, life has not changed with

the single currency and the market remains primarily national. In other words, other obstacles – be it differences in regulation, legal framework, taxes or language – are significant enough to continue to act as binding constraints on internationalisation. This is a strongly disappointing message that deserves to be put before policymakers, especially at a time of crisis when signs of renewed fragmentation of the European market are emerging. The question is, what are the missing flanking policies that would have allowed small firms to benefit from a larger market and grow?

Fortunately there is better news about the *what price* issue. Here the euro has resulted in less volatile and lower prices, especially within the euro area, and this is a clear plus for consumers. They may have not noticed (at least, this is what they are telling opinion surveys such as *Eurobarometer*, where they complain about the inflationary effect of the euro) but thanks to lower trading costs and increased competition, they have gained additional purchasing power. This is in turn likely to have resulted in aggregate welfare gains, as the exporting firms' profits are likely to have increased as a consequence of reduced trading costs.

These are important, but limited, findings. This report is based on the best available evidence, but it is partial evidence only. The authors demonstrate impressive skill in dealing with partially consistent data but, clearly, much more could be said if comparable data had been available for more countries. This is why Bruegel and its partners in the EFIGE project are planning to conduct a multi-country company survey on firm internationalisation and performance. The project, led Giorgio Barba Navaretti, Gianmarco Ottaviano and Thierry Mayer, builds on the experience accumulated so far among the partners to this report and is expected to shed new and much sharper light on the patterns of internationalisation of European firms and how they affect, or are affected by, firm performance, organisation, skills, innovation and access to finance. First results will be published in time to celebrate the fiftieth anniversary of Mundell's paper and will assess to what extent his intuition has been borne out by the facts.

Jean Pisani-Ferry, Director, Bruegel
Brussels, January 2009

Executive summary

After initial enthusiasm, the current consensus estimate of the positive impact of the euro on trade within the euro area is below five percent. This estimate is often cited as a somewhat modest result given initial expectations.

This report argues that, as it is based on aggregate trade data, the current consensus masks important microeconomic gains that arise even if aggregate trade flows do not change.

First, the euro may have increased the availability of differentiated varieties of both final and intermediate products. In this respect, the single currency may have helped new exporters to enter euro-area markets. It may also have helped existing exporters to increase the number of products exported and the number of destinations they export to. If richer product variety has coincided with an offsetting reduction in average shipments per product, then aggregate exports will have not changed.

Second, through tougher competition associated with enhanced transparency and lower transaction costs, the introduction of the euro may have led to a synchronised fall in markups and prices across the euro area. With little impact on relative prices, one would not expect aggregate trade flows to have changed much either.

Using detailed product- and firm- level data for Belgium, France and Hungary, this report assesses to what extent these two sources of microeconomic gain are real.

In terms of gains from product variety the report finds that the introduction of the euro has had:

- A small positive differential effect on trade through an increase in the number of products exported ('extensive margin');
- A larger positive differential effect on average value of exports per product and per firm ('intensive margin');
- No trade diversion effect towards the euro area along either margin.

In terms of gains from price compression the report finds that after the introduction of the euro:

- The volatility of export prices has fallen in the euro area, mostly thanks to the removal of exchange rate volatility;
- Export price variations in the euro area have been mainly driven by the pricing strategies of new exporters;
- Export prices are lower inside than outside the euro area due to the pricing strategies of both incumbent and new exporters;
- Euro-area exporters have narrowed the dispersion of their export prices to markets in the euro area relative to markets outside the euro area, mainly thanks to reduced price discrimination within the euro area by incumbent exporters.

Thus, while the common currency has affected both product variety and export prices, the additional microeconomic gains of the euro seem to have been channelled more through price compression than through enhanced product variety.

There is little evidence that the euro has *per se* had any appreciable effect on the decision of European firms whether or not to start exporting. The very small percentage of European firms which export indicates that most firms, especially smaller ones, are deciding to focus only on their domestic markets and that the single market may thus still not be working optimally.

Having introduced a common currency, the European integration agenda should still give top priority to dealing with classic obstacles to single market access such as divergent product, service and consumer rules within the EU.

1 Introduction

'A single currency is ... a logical complement to the single market which makes it more efficient. Using a single currency increases price transparency, eliminates currency exchange costs, oils the wheels of the European economy, facilitates international trade...'

European Commission (http://ec.europa.eu/economy_finance/the_euro/)

It is received wisdom among economists and policymakers that exchange-rate volatility and transaction costs associated with multiple currencies depress trade. The foundations of this belief mostly rely on historical observation that trade grew substantially during the 'classical gold standard' at the turn of the twentieth century and led Mundell (1961) to claim that the main microeconomic benefit of a currency union would be trade creation among member countries.

After forty years this claim seemed empirically confirmed when Rose (2000) estimated that a common currency would boost trade by more than 200 percent. Since then that huge number has been constantly revised downward and the current consensus estimate of trade growth is no more than five percent. This estimate is often cited as a somewhat modest result given initial expectations. It is, however, based on aggregate data and may therefore mask important microeconomic gains that arise even for a given level of trade flows.

The first type of hidden microeconomic gain is the increased availability of different varieties of both final and intermediate product. The single currency may have helped new exporters to enter euro-area markets. It may also have helped existing exporters to increase the number of products exported and the number of destinations they export to. If richer product variety coincides with an offsetting reduction in average shipments per product, then aggregate exports would not change.

A second type of hidden microeconomic gain is the compression of prices. Tougher competition associated with enhanced transparency and lower transaction costs

may have led to a synchronised fall in markups and prices across the euro area. With little impact on relative prices, one would not expect aggregate trade flows to change much either.

This report uses detailed product- and firm-level data to shed light on these hidden gains. Unfortunately, statistical information of adequate detail and quality is currently available to EFIGE only for Belgium, France and Hungary. This nonetheless allows us to look at the effects of the euro from two complementary angles: that of two euro-area countries and that of a European 'euro-outsider'.

In terms of hidden gains from product variety we find that the introduction of the euro has had:

- A small positive differential effect on trade through the overall number of products exported ('extensive margin');
- A larger positive differential effect on the average value of exports per product per firm ('intensive margin');
- No trade diversion effect towards the euro area along either margin.

In terms of hidden gains from price compression we find that after the introduction of the euro:

- The volatility of export prices has decreased in the euro area, mostly thanks to the removal of exchange-rate volatility;
- Export price variations in the euro area have been mainly driven by the pricing strategies of new exporters;
- Export prices are lower inside than outside the euro area due to the pricing strategies of both incumbent and new exporters;
- Euro-area exporters have narrowed the dispersion of their export prices to markets in the euro area relative to markets outside the euro area, mainly thanks to reduced price discrimination within the euro area by incumbent exporters.

To sum up: while the common currency has affected both product variety and export prices, *the additional microeconomic gains of the euro seem to have been channelled more through price compression than through enhanced product variety*.

The report is organised in three additional chapters. Chapter 2 provides an analytical framework to think about the microeconomic effects of the euro. Chapter 3 investigates the microeconomic gains in terms of product variety. Chapter 4 studies those

gains in terms of price compression. Chapter 5 summarises the evidence and discusses its policy implications. The report also includes a data appendix, a technical appendix and two statistical appendices containing a number of tables with additional information.

A final caveat. Firm-level data are typically collected independently by different public authorities or research institutions in different countries, either from balance sheets or from surveys. The lack of harmonisation or coordination among the different parties involved is unsurprising. Nonetheless, it prevents the creation of a homogeneous cross-country dataset. This explains why so few policy-relevant issues, such as the one discussed in this report, can currently be addressed systematically. An important contribution of the EFIGE project will be to make a quantum leap in the collection of richer, harmonised firm-level data across a larger set of European countries, namely Austria, France, Germany, Italy, Hungary, Spain and the UK.

2 The microeconomics of the euro effects

Has the euro affected the competitiveness of European firms? Has it altered their internationalisation strategies? This chapter brings the reader to the frontier of policy-relevant research on the topic and sets the stage for the new insights contained in the following chapters.

2.1 The happy few: a recap

European firms differ vastly in terms of their internationalisation patterns. An overview based on detailed firm-level data is contained in last year's EFIM report[1], which summarises the characteristics of European firms involved in international activities through exports or FDI ('internationalised firms', henceforth simply IFs).

The analysis of firm-level evidence presented in that report reveals some new facts that are simply unobservable at the aggregate level:

- *IFs are few.* They are rare and their distribution is highly skewed, as a handful of firms accounts for most aggregate international activity.
- *IFs are superstars.* They are different from other firms. They are bigger, generate higher added value, pay higher wages, employ more capital per worker and more skilled workers, and have higher productivity.
- *The pattern of aggregate exports, imports and FDI is driven by the changes in two 'margins'.* The 'intensive margin' refers to average exports, imports, FDI per firm. The 'extensive margin' refers to the number of firms actually involved in those international activities.
- *The 'extensive margin' is much more important* than the 'intensive margin', as the response of aggregate trade and FDI flows to country fundamentals takes place

1. EFIM2007: Mayer T. and G. Ottaviano (2007) *The Happy Few: The internationalisation of European firms*, Bruegel Blueprint Series vol. 3, Brussels

mostly through the extensive margin. This is impossible to see without firm-level data and thus has not been seen so far.

Accordingly, the international performance of European countries is essentially driven by a handful of high-performance firms. More generally, the extent to which firms are active in international markets is linked to their performance along a wide range of measures, such as size, value-added, wages, capital and skill intensity and productivity. Firms investing abroad (FDI) perform better than exporters and exporters in turn perform better than firms operating only in their home markets. The explanation for this is that foreign operations entail additional costs that only better-performing firms are able to cope with. These costs increase not only with the complexity of foreign operations (export vs FDI) but also with the number of foreign markets served and products supplied to those markets.

2.2 Models of export behaviour

Against this backdrop, the key issue is whether and how the euro has affected the behaviour of IFs. In addressing this issue we will focus on export rather than FDI due to much better statistical coverage.

It is helpful to set up a simple analytical framework, starting with Table 2.1. This table refers to France but the pattern would fit other European countries remarkably well.

Table 2.1: Distribution of French exporters over products and markets[2]
Share of French exporters in 2003 (total number of exporters: 99259)

Number of products	Number of markets			
	1	5	10+	Total
1	29.61	0.36	0.22	34.98
5	0.76	0.45	0.62	4.73
10+	0.95	0.89	10.72	18.57
Total	42.59	4.12	15.54	100

2. For more detailed figures, see Appendix A in EFIM, 2007.

Share of French exports in 2003
(total value of exports: €314.3 billion)

Number of products	Number of markets			
	1	5	10+	Total
1	0.7	0.08	0.38	1.86
5	0.3	0.08	1.06	1.97
10+	0.28	0.45	76.3	81.36
Total	2.85	1.55	85.44	100

Source: EFIM, 2007, Table 3.

The top panel of the table reports the percentage of firms exporting a given number of products (rows) to a given number of markets (columns). The table reveals a bipolar pattern as the highest percentage of firms is concentrated in the top left and bottom right cells. In particular, 30 percent of firms export only one product to only one market, while 10 percent of firms export more than ten products to more than ten markets.

The bottom panel reports the share of aggregate exports as a result of firms exporting a given number of products (rows) to a given number of markets (columns). The bipolar pattern is not present: firms exporting more than ten products to more than ten markets account for more than 75 percent of total exports. Hence, only firms which are large enough and a have a rich enough portfolio of products can penetrate a large number of foreign markets.

Table 2.1 suggests that firms can be classified in five broad models depending on the scope of their export activities:

- Firms that export *M*any products to *M*any countries (henceforth, simply MMs);
- Firms that export *F*ew products to *M*any countries (FMs);
- Firms that export *M*any product to *F*ew countries (MFs);
- Firms that export *F*ew products to *F*ew countries (FFs);
- Firms that export *N*o product to *N*o country (NNs).

The four exporting models are summarised in Table 2.2.

Table 2.2: Models of export behaviour

Exporting models	Few countries	Many countries
Few products	FF	FM
Many products	MF	MM

Comparing Table 2.2 with Table 2.1 reveals that the majority of French exporters are either FF's or MM's (roughly 30 percent and 10 percent respectively) but that the latter account for most exports (roughly one percent and 75 percent respectively). This is a common feature of most countries for which the corresponding statistical information is available.

2.3 Types of countries: treatment vs. control

The analysis of the microeconomic effects of the euro means tackling a difficult counterfactual question: what would have happened to European firms if the euro had not been introduced? This implies identifying a benchmark against which to evaluate the actual behaviour of firms. The simplest approach, and the one adopted in this report, is to compare the behaviour of firms in countries that have adopted the euro and those that have not. We call the firms in the former countries the 'treated group' and firms in the latter countries the 'control group'. The reason for these labels is that, as in a medical experiment, the firms in the treated group have received 'medication' (in our case, the euro) while those in the control group have not, or in medical terms, they have been given a 'placebo'.

Of course, in order to identify the impact of the euro, the firms in the two groups should differ only in terms of that specific treatment. Hence, before inferring anything about the euro effects, one has to net out any relevant difference not directly attributable to the common currency. For example, one should bear in mind that the introduction of the euro is part of a larger EU programme, contained in the Treaty on European Union (the Maastricht Treaty), entitled economic and monetary union (EMU). All European countries belong to EMU, not only those that have adopted the euro. It would be extremely hard to separate the impact of the common currency from the impact of EMU if all countries not using the euro were not part of the EMU either. In such a scenario the EMU would act as a 'confounding factor' that might lead us to attribute to the treatment some effects that are not in fact attributable to it.

Since all EU countries are members of EMU, but only a subset of them have adopted the euro as their own currency, we can compare the behaviour of firms among four

types of countries:

- Those that are in the EMU and use the euro;
- Those that are in the EMU but do not use the euro;
- Those that are in Europe but are not in the EMU and do not use the euro;
- Those that are not in Europe, are not in the EMU and do not use the euro.

Very important: due to data coverage, we identify as our 'treated group' the firms belonging to the countries that in 1999 adopted the euro as their common currency. We then take three 'control groups'. First, the closest to the treated group – and thus the best control group for spotting the impact of the euro – includes firms belonging to what we call 'non-euro area EU15' countries, namely those countries that in 1999 belonged to the EU but did not adopt the euro[3]. The second control group, called 'non-euro area Europe', refers to European countries that in 1999 did not belong to the EU. This group can be used to investigate the impact of the EMU. The last control group includes countries sampled from the rest of the world and can be used to separate the impact of Europe-specific developments from global trends. Box 2.1 gives the detailed composition of the 'treated' group and the various control groups.

BOX 2.1: The euro: 'treated group' and 'control groups'	
Euro-area ('treated group')	Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain
Non-euro area EU15	Denmark, Sweden, United Kingdom
Non-euro area Europe	Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Norway, Poland, Slovakia, Slovenia, Switzerland
Non-euro area world	[According to data availability]

Note: Greece joined the euro after 1999 and is thus, for the purposes of this project, excluded. Choice of third countries is governed by data limitations.

3. The problem raised by such a control group (DK, SE, UK) is threefold. First, this group consists of only a limited number of alternative destinations of goods and so offers limited scope for observing any adjustment in terms of the number of markets served. Second, given the size of these three countries, we end up with a control group largely dominated by the UK. Just comparing exports to euro-area countries with exports to the UK, before and after euro introduction, may be an unsatisfactory exercise. Third, euro introduction might also have impacted euro-area exports to non-euro area EU destinations. For instance, if some fixed cost to export a new product is recovered by exporting to Germany, the Netherlands and Belgium, a French firm may find it economically justifiable also to export it to Denmark thanks to the highly integrated nature of the EU single market.

2.4 The microeconomic effects of the euro

The microeconomic effects of the euro (if any) originate from reducing various kinds of transaction and hedging costs between euro-area countries, thus promoting international trade and competitive pricing in the area.

In particular, there are six channels through which the reduction in transaction costs may work. The first four channels concern trade flows:

1 Through the **export participation channel** some non-exporters become active in international markets. In terms of the taxonomy in Table 2.2, some firms switch from the NN to the FF models.
2 Through the **market coverage channel** exporters start to serve a larger number of foreign countries. Accordingly, some firms switch from the FF to the FM models while others switch from the MF to the MM ones.
3 Through the **product variety channel** exporters start to sell a larger number of products in foreign markets. Accordingly some firms switch from the FF to the MF models, while others switch from the FM to the MM ones.
4 Through the **export intensity channel** exporters increase the sales of each product in each foreign market in which it is sold. Accordingly this channel does not in itself affect the distribution of firms across the different models of export behaviour.

The next two channels concern the response of prices to lower transaction costs:

5 Through the pure **transaction cost channel** a fall in the costs associated with exporting activities is directly translated into lower export prices.
6 Finally, through the **competition channel,** increased arbitrage opportunities for customers as a result of lower transaction costs force firms to reduce their markups and limit their ability to extract value by quoting different prices in different countries (a practice called 'pricing to market' or simply PTM)[4]. This maps into lower export price levels and lower price dispersion across national markets.

The possibility for firms to switch to exporting models characterised by the supply of a larger number of products to a larger number of countries depends on the potential impact of the euro on two types of transaction costs. On the one hand, the euro may

4. When markets are perfectly integrated, price gaps trigger arbitrage that either eliminate the price differences or prevent the firms from creating them in the first place.

have reduced export costs. In this case we would expect an increase in the number of exporters and an increase in the average number of destinations served by incumbent exporters. On the other hand, the euro may have made it less costly for firms to manage and export richer ranges of products, some of which are possibly customised to specific national markets. This would map into an increase in the average number of products which firms export.

2.5 Are these effects real?

In a recent report Baldwin et al (2008) provide an assessment of the existing evidence on the microeconomic effects of the euro based on the comparison between the treated and control groups described in Box 2.1. Their general conclusion is that trade flows have indeed been affected by the introduction of the euro but, at the same time, we are still far from a clear understanding of the relative importance of the different channels highlighted in the previous section[5]. This conclusion rests on three broad sets of facts.

2.5.1 Trade flows

Since Rose (2000), the trade-enhancing effects of the single currency have been by far the main focus of most studies. Between 1998 and 2007 the value of exports and imports of goods within the euro area increased from 26 percent to 33 percent of GDP. Trade in services within the euro area also increased from five to seven percent of GDP. However, as discussed by Ottaviano, Taglioni and Di Mauro (2008), such evidence is at best only a first approximation of the possible gains arising from the euro.

First of all, care must be taken in conclusively linking the reported rise in trade to the introduction of the euro. In the past decade other major international developments, including the continuing process of EU integration and the ongoing rapid pace of globalisation, have acted as confounding factors, interacting with the single currency and thereby influencing the evolution of trade in the euro area. That is why the trade-enhancing effects of the single currency have been subject to closer scrutiny in order to control for such confounding factors.

5. As we will see, the reason is the lack of proper statistical information at the appropriate level of disaggregation. That is why the most complete investigation of the channels through which the microeconomic effects of the euro operate is the simulation exercise proposed by Ottaviano, Taglioni and Di Mauro (2008).

The early literature reported very heterogeneous results in terms of trade creation, ranging from zero percent (Berger and Nitsch, 2005) to almost 1400 percent (Alesina, Barro and Tenreyro, 2002). The current consensus view is that the single currency has had a small but positive effect on trade flows associated with a permanent change in the demand for exports. Interestingly, most of the sectors with above-average trade effects are those where relevant scale economies are observable or where firms have strong market power, with very little impact perceived in primary industries. This suggests that the competition channel could be crucial.

Table 2.3 provides a summary of related studies. Bun and Klaassen (2007) and Baldwin and Taglioni (2008) respectively report impact estimates of three percent and two percent additional trade within the euro area. In the period 1996-2006, the latter study identifies a three-percent impact of the single currency on euro-area countries' exports to non-euro area EU countries, with a slight diversion of about one percent for exports from the latter to the former. These results are somewhat lower than those of earlier studies. Flam and Nordström (2003, 2006) report a seven-percent increase in euro-area exports to Denmark, Sweden and the UK as well as an almost nine-percent increase in intra-EA trade. Over the period up to 2002, Micco, Stein and Ordonez (2003) find an effect ranging from six percent (in the short run for a sample limited to EU15) to 20 percent (in the long run for a wider OECD sample).

Table 2.3: Trade effects of the euro

	Bun and Klassens (2007)	Baldwin and Taglioni (2008)*	Berger and Nitsch (2005)	Flam and Nordstrom (2003)*	Micco, Stein and Ordonez (2003)
Intra-euro area	3%***	2%***	0%	8.8%***	6-20%***
Exports from non-euro area to euro area	n.a.	-1%**	n.a.	0.8%	n.a.
Exports from euro area to non-euro area	n.a.	3%***	n.a.	7.1%***	n.a.
Period of analysis	1967-2002	1996-2006	1948-2002	1980-2002	1980-2002/ 1992-2002

Note: * estimates based on EU15 sample; ** statistically significant at five percent; *** statistically significant at one percent

Several studies in this area suffer from methodological problems. A key contribution of Baldwin et al (2008) is to identify the correct econometric procedure. This gives the result reported in the second column of Table 2.3, estimating the trade-creating effect of the single currency within euro-area countries to be positive and highly significant, but as small as two percent. There is also some evidence of trade diversion but half as large. Finally, the impact on euro-area exports to non-euro users is three percent. Hence, the adoption of the euro has a non-negligible impact on outsiders too. Finally, to speak about 'the' impact of the euro on trade is an enormous oversimplification, given the major differences across sectors and countries. The problem is that 'there is really not enough data to firmly establish such differences in a credible fashion' (Baldwin et al, 2008, p.42).

These findings can be summarised as:

Fact 1: After the introduction of the euro, aggregate trade flows between euro-area countries increased by two percent, as compared to trade flows between non-euro area countries. Aggregate trade flows from euro-area countries to non-euro area countries increased by three percent, as compared to trade flows between non-euro area countries.

2.5.2 New products

What is the relative importance of the first four channels described in section 2.4 in driving the increase in trade flows within the euro area?

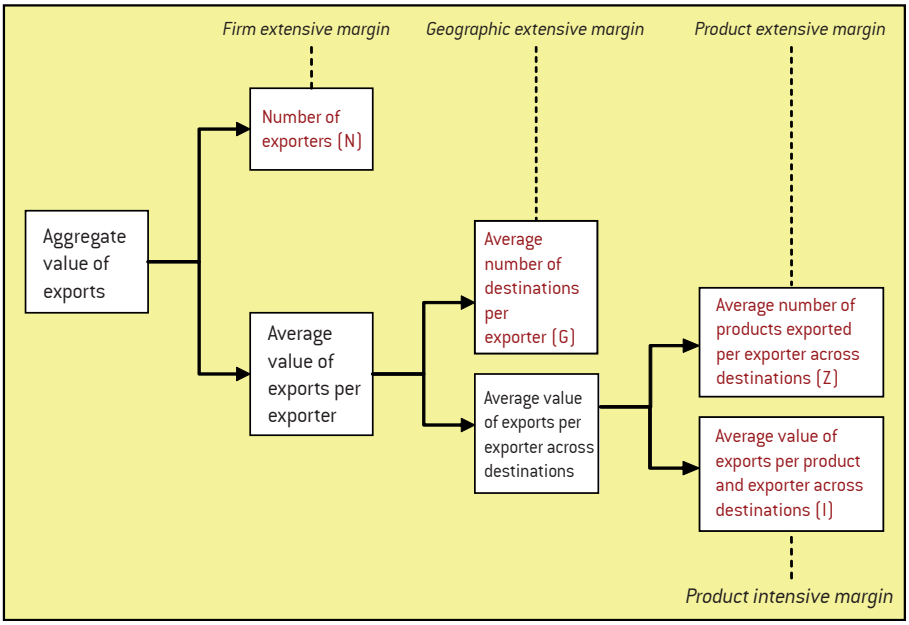
An answer to this question can be obtained only from firm-level datasets reporting not only total exports and the number of firms exporting but also the number of products exported per firm, the average number of destination markets per product exported, and the average value of per-product exports to each destination market. Only when these pieces of information are available is it possible to decompose the aggregate trade flow into its different components ('margins'), which can then be associated with the different channels through which the effects of the common currency may operate.

Figure 2.1 describes the decomposition of a country's aggregate exports taking into account the numbers of exporters, products exported and markets served. Inspecting the figure reveals that the microeconomic effects of the euro channelled through export participation materialise in changes along the 'firm extensive margin' (number of exporters – N). Those channelled through product variety materialise in

changes along the 'geographic extensive margin' (average number of destinations per exporter – G) and the 'product extensive margin' (average number of exported products per exporter across destinations – Z). Those channelled through export intensity materialise in changes along the 'product intensive margin' (average value of exports per product and exporter across destinations, henceforth simply called 'intensive margin' – I) and these could be attributable to underlying changes in either average quantity exported or average export price per product and exporter across destinations.

Chapter 3 will analyse the responses of the different export margins to the introduction of the euro. Chapter 4 will investigate the reponses of export prices distinguishing between those attributable to changes of incumbent exporters' strategies at the intensive margin and those attributable to firms' entry into and exit from the export market at the extensive margin.

Figure 2.1: The margins of adjustment of aggregate exports



Note: For explanation of N, Z, G, I, see section 2.5.2

As discussed in the EFIM report, datasets that allow for decompositions like the one in Figure 2.1 are available only for a very limited subset of European countries. Among them, there are two euro-area countries (Belgium and France), one non-euro

area EU country (Sweden) and a non-euro area Europe country (Hungary). Though small, this sample is nonetheless enough to cover the three groups of countries defined in Box 2.1 and to perform treatment-control comparisons[6].

Baldwin et al (2008) exploit this opportunity to take a first step towards assessing the relative importance of the various channels. Results show significant cross-country variation.

The French data provide no clear-cut prima facie evidence of an overall euro trade effect or an impact on the firm intensive margin (value exported per exporter). What seems to have happened is that the euro has induced French firms to export a wider range of products and to a wider range of markets inside the euro area but these adjustments along the product and market extensive margins have been approximately offset by a reduction in the firm extensive margin: fewer French firms export to the euro area, and to other EU destinations, after the introduction of the euro. In other words, the shares of MM, MF and FM firms among exporters has increased but the total number of exporters (FF+MF+FM+MM) has fallen.

The Belgian data confirm the notion that product variety is an important channel through which the euro operates, but less categorically. The Hungarian and Swedish results are interesting in two respects. First, they suggest that countries actually need to share the euro in order to get any effect. Second, they show that the existence of the euro does not make any real difference for trade flows between countries not sharing use of the euro.

Overall, at this stage the only clear prima facie finding is that the euro has increased the number of products traded between euro-area countries but not the number of those traded between non-euro area countries nor the number of those traded between euro-area and non-euro area countries. Accordingly, it seems that the impact of the euro on aggregate exports between euro-area countries has been mainly channelled through an increase in product variety.

6. This report is mainly based on simple treatment-control comparisons considering the three countries as representative of their types. One should bear in mind that country-specific shocks whose effects followed the same timing as those of the introduction of the euro could blur the picture. While we are not aware of any such shocks, deeper investigation would require more sophisticated econometric techniques that fall far beyond the scope of this policy report. See, for example, the discussion in section 3.4.4.

2.5.3 Prices

In quantitative terms, for all euro-area countries except Ireland, Baldwin et al (2008) establish that the introduction of the euro has reduced export prices in the euro-area countries by between approximately one and five percent. Hence, the euro seems to have put downward pressure on export prices within the euro area.

However, whether this drop is due to the transaction cost channel or the competition channel remains an open question. Due to data limitations, an indirect way to see whether the competition channel is indeed at work is to check whether firms were exploiting the opportunities for PTM ('pricing to market') before the introduction of the single currency. In particular, Baldwin et al (2008) check whether large euro-area countries were already treating the other euro-area markets as if they were domestic from the specific point of view of 'pass-through', ie the translation of exchange-rate fluctuations into export-price changes.

The underlying idea is that PTM is possible only in the presence of relevant transaction costs and, if an exporter prices to market, the export price in the exporter's currency adjusts to absorb exchange-rate fluctuation. For example, an appreciation of the exporter's currency would lead to a reduction in the price measured in that currency as the exporter tries to defend his foreign market share by moderating the price change faced by foreign customers in their own currency. In this respect, if the transaction costs associated with the use of different currencies were relevant, exporters would be able to treat the various national markets as 'segmented' and PTM would lead to asymmetric export price responses to exchange-rate fluctuations depending on the country of destination.

This has not been the case. Indeed, during the 1995-1999 period firms in the large euro-area countries were already treating the other euro-area markets as if they were domestic, at least in terms of translating exchange-rate fluctuations into price changes.

The findings are quite different for the non-euro area destinations in that the large euro-area countries were indeed treating them differently from domestic ones.

This may be seen as casting doubt on the choice of 1999 as a cut-off period for the investigation of the effects of the euro. The pass-through analysis is, however, too indirect. Its main drawback is the inability to reveal anything about the impact of the disappearance of bilateral exchange-rate fluctuations after the introduction of the

common currency. Moreover, the translation of exchange-rate fluctuations into price changes is a very narrow way to look at the issue of whether firms in euro-area countries treat euro-area markets as more or less integrated after the euro.

2.6 Summary

This chapter has introduced some concepts and methods on which the investigations in the following chapters will be based.

- First, we have argued that empirical investigations of the effect of the euro on aggregate exports have concluded that it has been positive but limited in size.

- Second, we have suggested that little action at the aggregate level may still mask major microeconomic gains at the 'intensive' and 'extensive' margins of exports. On the one hand, the euro may have increased the availability of different varieties of both final and intermediate products by helping new firms to enter euro-area export markets. It may also have helped existing exporters to increase the number of products exported and the number of destinations served. If richer product variety coincided with an offsetting reduction in average shipments per product, then aggregate exports would not change.

- Third, we have highlighted that additional microeconomic gains may have been generated by the compression of prices. Tougher competition associated with enhanced transparency and lower transaction costs may have led to a synchronised price fall in markups and prices across euro area. With little impact on relative prices, one would not expect aggregate trade flows to change much either.

3 Trade effects of the euro

Has euro adoption increased trade between euro area members? Has it diverted trade away from European countries outside the euro area? This chapter[7] addresses these questions, focusing on the different margins of adjustment highlighted in chapter 2: number of exporters, number of markets served per exporter, number of products per exporter, exports per product/exporter, value of exports by shipment.

3.1 Data and method

Testing for the microeconomic transmission channels of the euro means using highly disaggregated data. Two options may be contemplated here. The first option is to rely on trade data at the product level, as recorded in international trade data statistics. The most granular level is the HS6 classification of traded products – with around 5000 product categories[8]. However, using those data, one cannot assess whether an increase in the value of bilateral exports in one product category can be explained by incumbent firms increasing the value of their shipments, or new firms exporting to the same trade partner within the same product category (see Box 3.1).

The second option is to use firm-level trade data with product decomposition, which permits a clear description of the micro-level adjustment. In this chapter we choose this second option, exploiting firm-level export databases at the product level. Hence, for each exporter, we have information on the value of exports detailed by product CN8 category (10,000 product categories). These databases are clearly much more detailed than the product-level export databases at the country level used in existing studies. Crucially, they allow us to identify the destination market, which is the case for very few firm-level export databases. From these data, we can compute the

7. This chapter is based on an early draft version co-authored by Antoine Berthou. It also includes figures that have been generously provided by Balázs Murakozy and László Halpern for Hungary as well as by Mauro Pisu for Belgium. Data used to construct Belgian figures have been provided by the National Bank of Belgium. For confidentiality reasons, it is clearly impossible to pool the three data sets, and calculations have been performed independently by the different teams.
8. Some support for the hypothesis that new goods have been exported after the euro was launched is present in the literature (Baldwin and di Nino, 2007, Flam and Nordström, 2007).

number of exporters on each market, the average number of products exported by firm on each market, and the average value of exports by product[9].

Among the datasets currently available to EFIGE partners, such a level of detail is available only for two euro-area countries (Belgium and France) and for one non-euro area Europe country (Hungary)[10]. This nonetheless gives enough variation to perform the treatment-control comparisons described in Section 2.3. The intention is to compare the dynamics of two different subsets of exports: trade flows that are 'treated' by the effects of the euro, and trade flows that are not 'treated' by the effects of the euro. This gives four groups of trade flows:

- Flows between euro-area countries;
- Flows between a euro-area and a non-euro area country;
- Flows between a non-euro area and a euro-area country;
- Flows from non-euro area countries.

Concretely, for Belgium and France we can compare the evolution of the trade margins to euro-area destinations with the evolution of the trade margins to non-euro area destinations. Then, for Hungary, we can observe the evolution of the trade margins to euro-area and non-euro area destinations. Any effect of euro trade within the euro area should translate into a different pattern of French and Belgian trade margins with respect to euro-area destinations when compared with: (i) the evolution of Belgian and French trade margins with respect to non-euro area countries; (ii) the evolution of Hungarian trade margins with respect to all destinations. The time window we cover is 1998-2003.

BOX 3.1: The trade effects of the euro: aggregate and product-level evidence

The bulk of the literature on the impact of monetary integration on trade has used aggregated trade data, along the lines of Rose (2000). Using cross-section data, and estimating the impact of currency union by means of a simple dummy variable in a gravity equation explaining bilateral trade at the aggregated level, Rose identifies a huge impact (235 percent) of currency unions on bilateral trade. A subsequent paper (Glick and Rose, 2002) uses panel data rather than simple cross-sectional data, and finds that currency unions still double trade flows between members.

9. The methodology used in this chapter is based on Berthou and Fontagné (2008a).
10. See Box 2.1 in chapter 2 for definitions of the different types of countries.

Baldwin (2006) surveys this literature and identifies a series of methodological shortcomings of this initial approach. The bottom line of this methodological debate is that such estimates of the impact of a currency union on bilateral trade cannot be extrapolated to the European case. Indeed, studies performed after the introduction of the euro conclude that the magnitude of the impact was in a range between negligible and moderate. But even such moderate effects are much larger than suggested by the literature on the trade effects of exchange-rate volatility and on the magnitude of transaction costs associated with the presence of multiple currencies. Accordingly, the question is not about the methodological shortcomings of the simple gravity approach, which leads to huge estimates, and is more specific to the source of the non-negligible impact of the euro that has been identified in the literature.

The 'new goods hypothesis' provides a possible explanation: by reducing transaction costs, and by eliminating exchange-rate volatility, the euro may have led to an increase in the number of exported goods to euro-area destinations, even if the value of exports for each good has been affected very little. This has led to an in-depth analysis of the microeconomic patterns of trade flows based on trade data at the country and product level. Baldwin and di Nino (2006) tackle head-on the effect of the euro on the persistence of zero trade flows in product-level databases by making use of a database containing five thousand (HS6) product categories. They find some (limited) evidence of the new goods hypothesis. Flam and Nordström (2007) define the extensive margin in terms of product categories that are not continuously traded over time. Considering countries of the euro area ('treated group') versus ten OECD outsiders ('control group'), they find that two thirds of the effects of the euro translate into a higher value of exports into product categories that are not continuously traded over time.

These studies fall short of a full assessment of the impact of the euro on the margins of trade because they observe the number of traded products or destinations for a given product category but not the true microeconomic dimension, ie the products and the markets served by the individual firms.

3.2 From products to 'varieties'

A crucial issue is to define the unit of analysis, ie the 'thing' that firms ship. This concept is obvious from the point of view of the individual firm. It is less obvious when one has to classify products as different based on statistical categories. Following

Berthou and Fontagné (2008a), we call 'variety' the thing that firms ship and we define a 'variety' as a (HS8) product category exported by a single firm. Two firms exporting products within the same product category will accordingly be considered as exporting different varieties. The potential number of varieties is therefore enormous (eg one billion potential varieties for France: 100,000 firms times 10,000 HS categories). Each of these varieties can be exported towards one of two hundred destination markets. However, as shown in Table 2.1 for France, the actual number of observed flows is only a tiny proportion of the theoretical maximum: each firm is shipping goods in a limited number of product categories and to a limited number of destination markets.

Using the export data for individual firms, we compute the intensive and extensive trade margins defined at the *variety* level distinguishing among four types of destination countries: euro area, non-euro area EU, non-euro area Europe and the rest of the world (which we call 'non-euro area world')[11]. The 'variety-level intensive margin' corresponds to the average value of exports by variety, for each destination within a region. The 'variety-level extensive margin' corresponds to the average number of varieties that are exported at least once within a region, multiplied by the number of destination countries for each variety within the region.

3.3 Trade margins and their components

For Belgium, France and Hungary we compute the intensive and extensive margins of exports distinguishing among different types of destination: euro area, non-euro area EU, non-euro area Europe and non-euro area world. For each destination type the extensive margin is the number of varieties exported, while the intensive margin is the average value of exports per variety. Since each destination type is composed of several countries, we have to take into account the number of countries varieties are shipped to within the type. Accordingly, we compute the extensive margin of exports to a certain destination type R as the number of varieties exported to at least one destination in R, multiplied by the average number of destinations in R those varieties serve.

Concretely, let us call N^R the number of exporters and Z^R their average number of varieties exported to destination type R. The total number of varieties exported – at least once – to R equals N^R x Z^R. Some varieties are possibly exported to several destinations in R and we call G^R the average number of destinations by variety

11. See Box 2.1 for details.

exported to destination type R. The extensive margin of exports can then be expressed as $E^R = N^R \times Z^R \times G^R$. Finally, let us call I^R the intensive margin of exports (defined above as the average value of exports per variety) and V^R the total value of exports to destination type R, the following decomposition holds:

$$V^R = E^R \times I^R = N^R \times Z^R \times G^R \times I^R$$

ie total exports equal the number of exporters *times* the average number of varieties they export to destination type R *times* the average number of destinations in R each variety serves *times* the average value of exports per variety.

3.4 Trade effects of the euro within the euro area

We are now ready to assess the impact of the euro on the different components of aggregate trade flows. We start with a snapshot taken in 1998. Then we will see how the various components and the trade margins responded to the 1999 introduction of the common currency. This section looks at Belgium and France; the next looks at Hungary.

3.4.1 Before treatment

Table 3.1 provides an overview of the various components of exports for France and Belgium in 1998.

Table 3.1: Trade margins and related components in 1998 (France and Belgium)

France					
	N	Z	G	E	I
Euro area	45,388	6.97	2.14	677,272	168,247
Non-euro area EU	22,272	4.69	1.42	147,727	192,593
Non-euro area Europe	36,156	3.68	1.28	170,617	85,141
Non-euro area world	62,854	5.76	1.88	679,562	101,437
Belgium					
	N	Z	G	E	I
Euro area	11,773	13.41	2.06	324,600	261,567
Non-euro area EU	6184	6.28	1.57	61,105	300,567
Non-euro area Europe	10,852	3.71	1.55	62,384	108,018
Non-euro area world	18,931	4.54	2.06	176,898	166,296

Source: National customs services, EFIGE calculations. Note: For explanation of N, Z, G, I, see section 3.3

Column N shows the number of firms exporting to each destination. According to column Z, on average each Belgian or French firm exports more products to the euro area than to other destinations. In 1998, each Belgian firm was exporting on average 13 different products to the euro area, as compared to only six to the non-euro area EU. Similarly French firms were exporting on average seven different products to the euro area, as compared to fewer than five to the non-euro area EU.

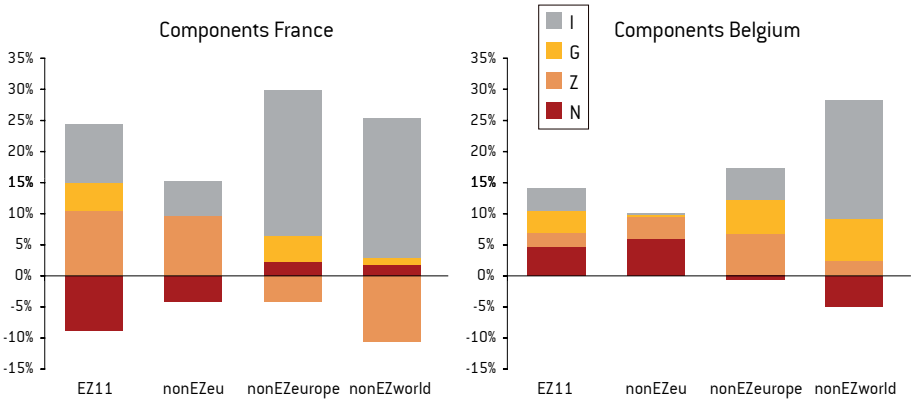
Hence, in 1998 French and Belgian firms exported a larger number of varieties and served a larger number of countries in the future euro area than elsewhere.

3.4.2 After treatment: changes in the components

How have the various components of total exports reacted to the introduction of the euro? Are the small effects observed at the macro level hiding larger counter-effects at the micro level?

The variations in the different components over the period 1998-2003 are reported in Figure 3.1. The left panel concerns France. The right panel concerns Belgium. Results differ according to destination types.

Figure 3.1: Variations in the components of aggregate exports (1998-2003)



Source: National customs services, EFIGE calculations.
Note: EZ = euro area (euro zone). For explanation of N, Z, G, I, see section 3.3

Euro-area destinations
In the case of France, the number of firms exporting to euro-area destinations decreased significantly over the period, while the average number of products exported per firm and the average number of destinations per variety increased. For these destinations there is also a positive variation of the intensive margin, defined as the average value of exports per product and exporter across destinations.

In the case of Belgium, the number of firms, the number of products exported per firm, and the number of destinations per variety increased. The intensive margin also increased to some extent, but at a much lower rate than the extensive margin.

Accordingly, since introduction of the euro, more Belgian firms export more products to more destinations within the euro area. Fewer French firms export more products to more destination markets within the euro area.

Non-euro area EU destinations
For non-euro area EU destinations, as in the case of euro-area destinations, the number of French firms decreased, while the number of products exported per firm as well as the average value of exports per product and exporter across destinations increased significantly. However, contrary to what we observe for euro-area destinations, there is no variation in the number of countries served per variety within the non-euro area EU region. This is obviously due to the fact that this region consists of three countries only.

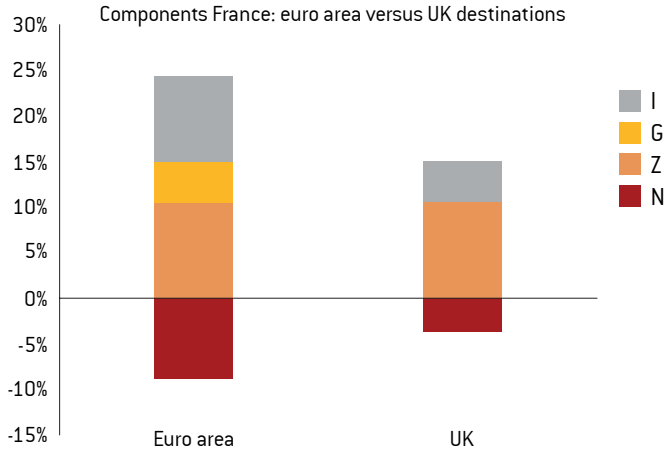
Similarly for Belgian firms the pattern is similar between non-euro area EU and euro-area destinations, with an increase in the number of exporters as well as in the number of products exported per firm. However, the growth in the number of destinations per variety, and the growth of the intensive margin were much more limited.

Hence, since the introduction of the euro, changes observed *within the European Union* do not differ much for destinations in the euro area and destinations outside the euro area.

Denmark, Sweden and the UK are very different in several respects. In particular, the exchange-rate policy of Denmark had been targeting the German mark before the introduction of the euro and the common currency thereafter. Sweden is also currently targeting the euro. Hence, only the UK seems to be following the kind of independent exchange-rate policy that, by comparison, may reveal the impact of the

euro on trade flows. Figure 3.2 reproduces the left panel of Figure 3.1 comparing euro-area destinations with the UK. Overall, the results are very similar suggesting that it is not some specific feature of Denmark and Sweden that drives them.

Figure 3.2: Variations in the components of aggregate exports: euro area vs. UK (1998-2003)



Source: National customs services, EFIGE calculations.
Note: For explanation of N, Z, G, I, see section 3.3

Destinations located outside the EU15

The picture for French exports to non-euro area Europe and non-euro area world destinations is clearly different from what has just been described. The number of exported products decreased, while there are only small positive variations in the number of exporting firms and in the number of destinations per variety. For non-euro area Europe and non-euro area world destinations, the increase in the value of French exports is driven by the intensive margin with a specialisation of French exporters in a reduced number of varieties, and an increase in the value of the corresponding shipments. Also, a limited number of new exporters appears, while existing exporters ship their products to a slightly increased number of markets.

Unlike France, in the case of Belgium the right chart in Figure 3.1 reveals a decrease in the number of exporters, especially to destinations outside Europe.

Thus, after the introduction of the euro, fewer Belgian firms export more products to more destinations outside the EU. More French firms export fewer products to more destinations outside the EU.

Overall, Figure 3.1 reveals the importance of taking into account the different components of the extensive margin to explain the growth of the total value of exports. Data for both France and Belgium suggest that, beyond the entry or exit of firms, the variation in the number of products exported by each firm and the variation in the number of destinations for each product exported by firm contribute significantly to the variation in the total value of exports.

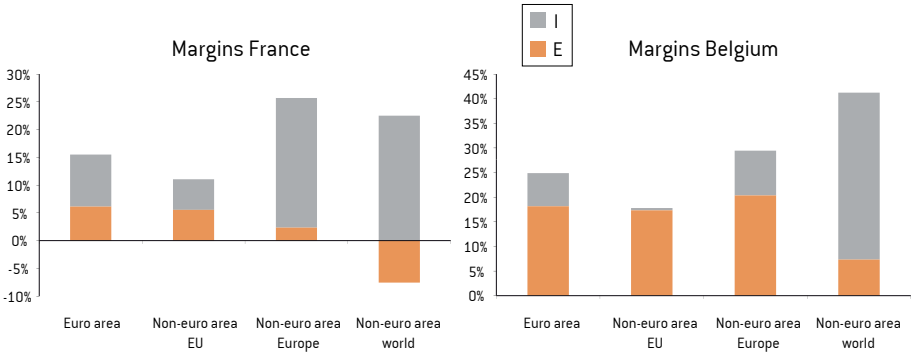
We summarise our findings from Figure 3.1 as:

Fact 2: After introduction of the euro, the number of product varieties exported and number of markets served by euro-area firms have grown faster for EU15 destinations than for destinations in the rest of Europe and the rest of the world.

3.4.3 After treatment: changes in the margins

Figure 3.3 reports the net variation of the intensive margin of exports for France and Belgium over the period 1998-2003. This margin refers to the average value of exports per product and exporter across destinations. For the same countries and over the same period it also reports the combined variations in the number of exporting firms, the number of products exported and the number of destinations served. These three numbers together define the extensive margin of exports.

Figure 3.3: Variations in the intensive and extensive margins (1998-2003)

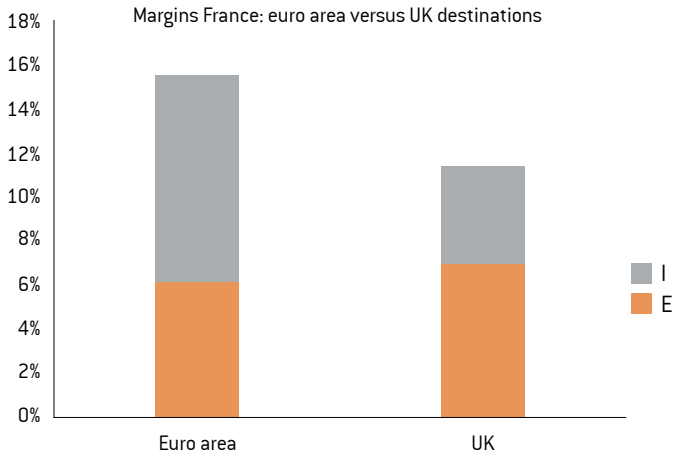


Source: National customs services, EFIGE calculations.
Note: For explanation of E, I, see section 3.3

The figure shows that the share of the increase in the total value of exports attributable to the extensive margin is higher for destinations that are better integrated with France and Belgium. In particular, the left chart indicates that the extensive margin contributes to nearly half of the growth of French exports to euro area and non-euro area EU destinations, while its contribution is only marginal for non-euro area Europe destinations, and even negative for non-euro area world destinations. In the case of Belgium, the right chart indicates that the extensive margin contributes to more than two thirds of the growth of total exports for the euro area, non-euro area EU and non-euro area Europe destinations, while it contributes only marginally to the growth of exports to non-euro area world destinations. Conversely, both charts show that the changes in the intensive margin were more significant for destinations outside the EU and even more so for those outside Europe.

Figure 3.4 reproduces the left panel of Figure 3.3 comparing euro-area destinations with the UK. Again, the results are very similar to those obtained for the wider group of non-euro area EU countries suggesting that it is not some specific feature of Denmark and Sweden that drives them.

Figure 3.4: Variations in the intensive and extensive margins: euro area vs. UK (1998-2003)



Source: National customs services, EFIGE calculations.
Note: For explanation of E, I, see section 3.3

Hence, we can highlight:

Fact 3: Since introduction of the euro, changes in the total value of euro-area exports have been mainly driven by the number of exporting firms, products exported and countries served in the case of euro-area destinations and by the average value of exports per product and exporter across destinations in the case of non-European destinations.

Moreover, in the case of EU15 markets, the contribution of the average value of exports to the growth of aggregate exports has been larger for destinations inside the euro area.

3.4.4 Treatment versus control

Assessing the effects of the euro entails comparing the dynamics of the trade margins between the 'treatment group', ie French and Belgian exports to euro-area destinations, and the 'control group', ie French and Belgian exports to non-euro area destinations. Since the two groups should differ only in terms of euro-area treatment, before inferring anything about the euro effects one has to net out any relevant difference not directly attributable to the common currency. Potential confusion arises since the euro is part of a larger programme of economic integration in which several non-euro area countries are involved. In principle, the best way to deal with this confounding factor would be to select as a control the group of non-euro area countries whose integration record most closely resembles that of the euro area. In this respect, the best control group should consist of non-euro area EU countries. As both euro area and non-euro area EU countries belong to the EMU, any differences in behaviour of firms from the two groups may indeed reveal the impact of the euro[12].

Figures 3.1 and 3.3 tell clear stories. The latter shows that both for Belgium and France the differential behaviour between euro-area exports to euro-area countries and euro-area exports to non-euro area EU countries is essentially due to the response of the intensive margin, defined as the average value of exports per product and exporter across destinations.

12. See Berthou and Fontagné (2008a) for a careful investigation of the implications of choosing different types of non-euro area destinations as control groups. In particular, they show that, when the control group consists of all non-euro area destinations, French data support the so called 'new goods hypothesis', according to which the euro has mainly had a positive impact on the number of varieties exported in the euro area. Intuitively, this can be seen by considering that the bars of the comprehensive non-euro area control group would be given by some average of the three non-euro area bars in Figure 3.3.

Accordingly, we have:

Fact 4: The comparison between EU15 destinations inside and outside the euro area reveals that the impact of the euro on trade flows within the euro area has been positive and mainly channelled through an increase in the average value of exports per product.

Figure 3.1 shows that the small difference in fluctuation in the extensive margins between euro-area and non-euro area EU countries masks different behaviours in some of their components. In the case of France, the average number of euro-area destinations per variety increased, while the average number of non-euro area EU destinations per variety did not change. This effect is offset by the counter-movement in the number of exporters, which falls much more for euro-area than for non-euro area EU destinations. Similarly, for Belgium, the average number of euro-area destinations per variety increased but its impact on the extensive margin is cancelled out by the rise in the average number of products exported per firm, which is smaller for euro-area than to non-euro area EU destinations.

Hence, the comparison between euro-area and non-euro area EU destinations reveals that both for Belgium and France the impact of the euro on the extensive margin of trade within the euro area has been negligible as the increase in the average number of destinations per product exported has been absorbed by offsetting changes in the average number of products exported per firm or in the number of exporting firms.

The finding that the nature of the control group is so important when we estimate the effect of the euro does not, however, imply that the common currency has had no effect on the extensive margin of exports.

It may be the case that euro introduction has indeed had no differential effect on exports between euro-area and non-euro area EU destinations. But more fundamentally, beyond the fact that we have evidence only for two members of the euro area, the problem with such 'laboratory' work is that the control group is very specific. One should bear in mind that the non-euro area EU group consists of three countries only[13]. Relative to the EU15, two of them are hard to export to being small and remote (Denmark and Sweden) and one is easy to export to being large and close (UK). All

13. We have decided to limit our investigation to 2003 in order not to have an additional source of change with EU enlargement.

this explains, first, why one should not expect to find any sizable variation in the G components of the non-euro area EU bars in the two panels of Figures 3.1 and 3.3. Second, it might be the case that real exchange rates or growth in destination markets are key determinants of the observations made so far.

It is therefore useful to complement our findings with the results obtained from more detailed econometric analysis by Berthou and Fontagné (2008b), who control for individual destination characteristics (such as market size and real exchange rates) instead of relying on simple treatment-control comparisons. The questions they address are: how the euro has affected the decision whether or not to enter euro-area and non-euro area export markets; if the euro has affected the average value of shipments of exporters to each euro-area market; and if the euro has impacted the varieties exported to euro-area markets. Using similar data for Belgium, Nitsch and Pisu (2008) control for destination-firm-specific characteristics, focusing on EU15 destinations only to highlight euro-area versus non-euro area EU comparisons.

The bottom line is that the number of exported products per firm to euro-area markets has increased for Belgian and French firms. On the contrary, the evidence regarding the decision to enter export markets is mixed, with no impact attributable to the euro introduction in the French case.

Fact 5: The comparison between destinations inside and outside the EU15 reveals that the impact of the euro on trade flows within the EU15 has been positive and mainly channelled through an increase in the average number of products exported per destination by each firm.

Whether this impact is due to the common currency *per se* or to its interaction with other concomitant EU policies remains an open issue.

3.5 Trade effects of the euro outside the euro area

After analysing the dynamics of the trade margins for exports from two euro-area countries, Belgium and France, we now investigate the evolution of those margins for a non-euro area Europe country, Hungary, over the same period 1998-2003[14]. As in the previous section, we start with a snapshot taken in 1998 and then illustrate how the various components of aggregate exports have responded to the introduction of the common currency.

14. Hungary joined the EU in 2004.

3.5.1 Before treatment

Table 3.2 provides an overview of the various components of exports for Hungary in 1998 across the four types of destination.

Table 3.2: Trade margins and related components in 1998 (Hungary)

	N	Z x G	E	I
EZ	10244	5.70	58381	224777
NonEZeu	1708	3.11	5316	168191
NonEZeurope	7924	5.63	44607	47671
NonEZworld	5933	6.70	39743	66544

Source: National customs services, EFIGE calculation.
Note: EZ = euro area (euro zone). For explanation of N, Z, G, E, I, see section 3.3

The column N in the table shows that in 1998 Hungary had fewer exporters than France and Belgium, which is not surprising given different economic sizes.

The third column reports the average number of 'shipments' per firm defined as the number of varieties exported per firm *times* the average number of destinations per variety exported (Z x G). The reason is that Hungarian data do not allow us to disentangle the number of products exported per firm (Z) and the number of destinations for each product within each destination type (G). While French firms exported on average 6.97 varieties to 2.14 partners to the euro area (nearly 15 shipments per firm), and Belgian firms exported on average 13.41 products to 2.06 destinations (more than 27 shipments per firm), the average number of shipments for Hungarian firms is only 5.70.

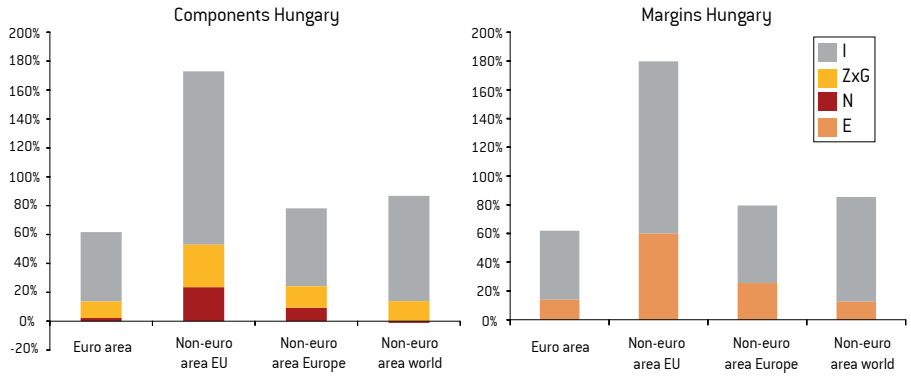
Accordingly, in 1998 Hungarian firms exported a smaller number of varieties and served a smaller number of countries in the future euro area than Belgian and French firms.

Turning to the trade margins, column E and I reveal that Hungarian exports to the euro area were characterised by a much smaller extensive margin and a larger intensive margin than Belgian and French exports. In other words, relative to Belgium and France, for Hungary the average value of exports per product and exporter across destinations was more important than the number of exporting firms, products exported and countries served.

3.5.2 After treatment: changes in components and margins

How did the various components of total exports respond to the introduction of the euro? Figure 3.5 gives an answer, reporting the variations of the components of the extensive margin in its left panel and the variation of the two margins in its right panel.

Figure 3.5: Variations in trade margins and related components (Hungary, 1998-2003)



Source: National customs services. EFIGE calculations.
Note: For explanation of N, Z, G, E, I, see section 3.3

The left panel does not reveal any differential pattern across types of destinations. The growth of the total value of exports to non-euro area EU destinations is larger than for other destinations over the period, most probably related to a special agreement about the purchase of Swedish fighter aircraft by Hungary. Once this is taken into account, the relative importance of the different components of aggregate exports is broadly the same across destination types. The only exception is the very small decrease in the number of firms exporting to non-euro area world destinations.

Turning to the right panel, assembling the components of the extensive margin highlights the fact that, for all destination types, the variation in the total value of exports over the period was mainly driven by the intensive margin. While this also applied in the case of French exports to non-euro area Europe or non-euro area world destinations and of Belgian exports to non-euro area world destinations, it is very different from what we observed for French and Belgian exports to euro-area destinations.

Hence, after the introduction of the euro, changes in the total value of exports of Hungary were mainly driven by the intensive margin in the case of both euro-area and non-euro area destinations.

3.5.3 Treatment vs. control

As in the cases of Belgium and France, assessing the effects of the euro entails comparison of the dynamics of the trade margins between the 'treatment group', ie Hungarian exports to euro-area destinations, and the 'control group', ie Hungarian exports to non-euro area destinations. Since the two groups should differ only in terms of euro-area treatment, the best control group consists of non-euro area EU countries, as this nets out the potentially confounding influence of the EMU.

The comparison between the first two bars from the left in the two charts of Figure 3.5 tell a clear story. First, as the rise in total exports was much stronger to non-euro area EU than euro-area destinations, the introduction of the euro does not seem to have promoted Hungarian trade to the euro area. Second, as in the right chart the second bar from the left looks much like a scaled-up version of the first, the introduction of the euro has not affected the relative importance of the intensive and extensive margins of exports to EU destinations. Third, the left chart shows that the relative importance of the number of exporters for the extensive margin has grown disproportionately to non-euro area EU destinations.

To summarise, we can state:

Fact 6: There is no evidence that the euro has diverted trade flows from European countries outside the euro area to countries inside the euro area.

3.6 Exchange rate fluctuations

Data for France and Belgium suggested in the previous section that the euro has promoted trade within the euro area mainly thanks to an increase along its intensive margin. The extensive margin has been little affected. However, among its components, the average number of destinations per product exported by firms has gained in importance. On the other hand, the euro has not diverted trade from non-euro area Europe countries to euro-area countries. For non-euro area Europe countries the only visible effect is a decrease in the relative importance of the number of exporters to euro-area destinations with respect to non-euro area EU countries.

These results have been obtained by comparing the dynamics of the various components of Belgian, French and Hungarian exports to euro-area and non-euro area EU destinations with the aim of disentangling the impact of the euro from the impact of the EMU. However, the question of exactly how the euro generated its trade effects remains unanswered. Berthoud and Fontagné (2008a) make a first attempt at tackling this issue by checking whether in the period 1998-2003 the dynamics of French exports were attributable to changes in real exchange rates or in the real GDP of destination countries. They find that a real appreciation of the euro (ie a loss of competitiveness) reduced French exports to all destinations both through the intensive margin and the extensive margin (bilaterally measured as NxZ). However, in the case of EU15 destinations, the negative effect was channelled only through the intensive margin. Moreover, an increase in the real GDP of export destinations had a positive impact on both trade margins when all destinations are considered, and only on the extensive margin when non-euro area EU destinations are considered.

Accordingly, we have:

Fact 7: Real appreciation of the euro reduces French exports to EU15 countries through the average value of exports per product and exporter, while the number of exporters, products exported and countries served is also affected when all destination countries are considered. Real GDP growth of EU15 countries increases French exports to those destinations through the number of exporters, products exported and countries served. The average value of exports per product and exporter is also affected when all destinations are considered.

3.7 Summary

Empirical investigation of the effect of the euro on aggregate exports leads to the conclusion that it has been positive but limited in size. However, we have little evidence about its effect at firm level.

This chapter has exploited newly available firm-level export databases for Belgium, France and Hungary to decompose aggregate exports into their fundamental components: the number of exporting firms, firms' average number of products exported, firms' average number of destinations per product, and firms' average value of exports per product. For each exporting country, we have repeated the exercise for different types of destination: euro-area members, EMU countries outside the euro area, other European countries and the rest of the world. We have compared the behaviour of the various components of aggregate exports across the different types

of destination in order to disentangle the trade effects specific to the euro from those driven by other concurrent events.

- First, the comparison between EU15 destinations inside and outside the euro area has revealed that the impact of the euro on trade flows within the euro area has been positive and mainly channelled through an increase in firms' average value of exports per product.

- Second, the comparison between destinations inside and outside the EU15 has shown that the impact of the euro on trade flows within the EU15 has been positive and mainly channelled through an increase in the average number of products exported per destination by each firm. However, whether this impact has been attributable to the common currency *per se* or to its interaction with other concomitant EU policies remains an open issue.

- Third, real appreciation of the euro has diverted euro-area exports away from euro-area destinations mainly through changes in firms' average value of exports per product. Real GDP growth of destination countries has diverted euro-area exports away from euro-area destinations mainly through changes in firms' average number of exported products.

4 Price effects of the euro

Has euro adoption affected the pricing behaviour of European firms? Has it changed the price level and the disparity between prices in the euro area? This chapter[15] addresses these questions from the point of view of export prices, zooming in on the implications of the different price channels highlighted in Section 2.4 for price discrimination.

4.1 Data and method

To understand the impact of the euro on the level and dispersion of prices, we rely on unit values of exports. In so doing, we compare results obtained from two distinct samples[16]. The first covers the whole universe of products exported by French firms, which should directly be affected by monetary integration. The second sample covers a census of Hungarian firms. This allows us to highlight the effects of the euro on euro-area and non-euro area countries. In both cases, we use the individual dimension of the data systematically to distinguish composition effects from changes in firms' pricing strategies (see Box 4.1 for details).

BOX 4.1: The Law of One Price and firm-level data

The Law of One Price (LOOP) states that an integrated market should have a single price for each (properly defined) product. A large part of the academic literature looks at whether the introduction of the euro has yielded price convergence and smaller deviations from the LOOP using either 1) micro-level price data for very specific industries or 2) product-level price data.

In the first category, two main industries are studied in the literature. Goldberg and Verboven (2001) as well as Gil-Pareja and Sosvilla-Rivero (2008) focus on

15. This chapter is based on a commissioned background CEPII working paper written by Isabelle Méjean and Julien Martin. It also includes figures that have been generously provided by Balasz Murakozy and Lazlo Halpern for Hungary.
16. See Appendix A for additional details.

the European motor vehicle market, for which firm-level data is extremely rich due mainly to the high level of interest that competition authorities have in this industry. The studies find that the introduction of the euro increased price convergence. Baye, Gatti, Kattuman and Morgan (2005) study the impact of the euro on prices charged for 28 electronic products by online retailers and find that there was no impact on price convergence. While cars and electronics are interesting products, the limitations of using a single industry are clear. What is the global policy message from the conflicting results on firm-level price convergence in the two sectors?

In the second category, Lutz (2003), as well as Engel and Rogers (2004), use retail prices for a set of narrowly defined products bought in different EU cities. Both find that the introduction of the euro had a small to negligible effect on price dispersion and price convergence. The use of product/city-level price data is even more problematic than the sector studies noted above. This approach potentially has large sample composition effects. As discussed in Chapter 3, the introduction of the euro changed the composition of firms selling in different countries and the mix of products sold. As a consequence, the change in pricing strategies, which is what one intends ultimately to identify, will be less precisely estimated from product/city-level prices. Accordingly, whether the inconclusive results of this type of analysis come from the composition bias, or from the absence or small magnitude of the impact of the euro is quite unclear. Using instead firm-level export pricing data allows us to overcome this problem.

We use, in particular, firm-level unit values. Being FOB ('free-on-board') prices, unit values directly reflect the pricing strategies of firms on different markets, unlike national retail prices that may differ simply because different producers may sell different products in different national markets. Also, observed retail prices are affected by local cost factors, by the organisation of distribution and by taxes. Even if the euro had actually reduced price discrimination in the euro area, this effect may not be observable statistically in retail prices, if the dispersion in local cost factors, which is very stable over time, is a first-order explanation of the retail price level.

Last but not least, the use of unit values makes the *level* of our measure of prices meaningful. That is why, while most existing studies focus on the time path of relative prices, we are able to study the impact of the euro on price levels.

Three different exercises (below) allow us to study the level and evolution of export prices across destinations in the euro-area group, the non-euro area EU group and the rest of the OECD. Note that the control group outside the EU is slightly different here compared to the previous chapter. We want to be able to compare both evolution *and levels* of prices inside and outside the euro area. For the level comparison, it is quite important to have control groups that are comparable in terms of income per capita, so that the unit value of a specific exported good pertains to a comparable variety, in particular in terms of quality levels. The non-euro area OECD group therefore replaces the non-euro area European and non-euro area world control groups of the previous section. The non-euro area OECD group contains Australia, Canada, South Korea, USA, Hungary, Iceland, Japan, Mexico, Norway, New Zealand, Poland, Slovakia, Czech Republic, Switzerland and Turkey.

- First, we aggregate individual bilateral export prices into price indices. The behaviour of the export price index provides us with information on the *time evolution* in the price of the aggregate export basket. Computing it for different destination markets allows us to compare price developments in a geographic dimension. Provided that the common currency has helped to reduce the macroeconomic volatility and to increase the cross-country correlation among the different members of the euro area, it should be the case that price developments are different in the euro area from the rest of the OECD.

- Second, we compare *price levels* across different regions by computing another statistic based on the level of unit values. However, for bilateral export prices to be comparable across firms, we have to control for product-specific price determinants. Our approach is to normalise bilateral unit values by the mean price charged by the firm over the whole set of destination markets (restricted to OECD countries, as stated above). We call this statistic the 'price deviation with respect to the OECD mean'. Averaging this over goods for a given country/region provides us with information about the average price gap with respect to the overall mean. This allows us to see if prices are higher or lower, on average, in a given country/region.

- Third, we also try to identify the impact of the euro on the dispersion of French export prices in the euro area. For this we use a third statistic that is very similar to the one used to compare price levels across countries. The only difference is that the bilateral unit value is normalised by the average price in the area under consideration. We look at the average price dispersion in the euro area and in the rest of the OECD by comparing, first, the average price gap of euro-area unit values

with respect to the euro-area mean and, second, the average price gap of unit values in the rest of the OECD with respect to the rest of the OECD mean. This comparison amounts to a comparison of the standard price deviation in each sub-sample[17].

Throughout the analysis, we try to separate composition effects from changes in pricing strategies. In particular, we will often compare results obtained from the whole sample of bilateral flows and sub-samples of 'intensive' and 'extensive' flows. An intensive flow is a bilateral flow (identified by a firm number, a product category and a destination market) that is present in the data over the whole period. The extensive sub-sample is the set of such bilateral flows that cover less than eleven years. This includes new bilateral relationships (ie new firms and new destination markets served by a given firm) as well as disappearing flows (ie when firms leave markets or products are removed from some markets). The comparison allows us to distinguish the price dynamic at the intensive and the extensive margins.

This definition of the intensive margin is somewhat restrictive: continuing flows that began during the period are not recorded at the intensive margin. This explains why, in our data, the size of the intensive margin sub-sample is relatively small. This is especially true of Hungarian data: over the whole period, only 0.53 percent of trade flows are recorded at the intensive margin. As this sample is not representative of the whole dataset, we will not proceed with the decomposition of Hungarian results into intensive and extensive margins.

4.2 Price changes

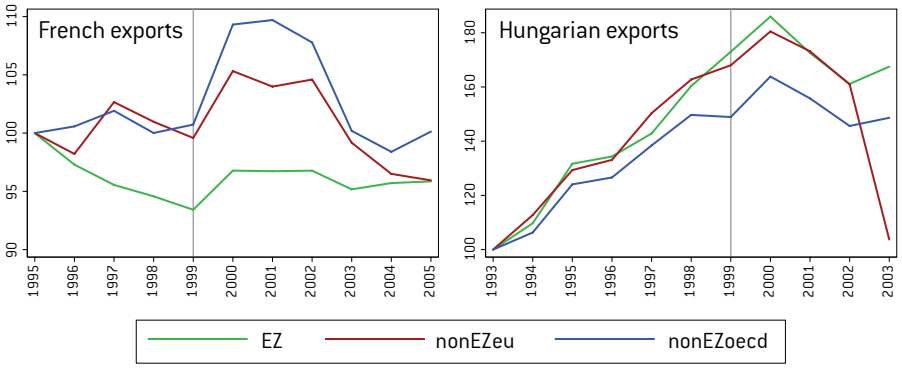
A first way to look at the price impact of the euro is to compare aggregate price developments in the euro area and in an appropriate control group. To this end, we compare Laspeyres price indices between the euro area and our two control groups, first on the whole sample, then on the sub-sample of flows that are continuously exported during the period (ie on the intensive margin). The Laspeyres price index is a geometric average of the price variations of trade flows weighted by the share of each flow in total trade (see Appendix B for details).

17. See Crucini, Telmer and Zachariadis (2005).

4.2.1 All trade flows

Figure 5 illustrates the evolution of aggregate export prices toward the euro area (the 'treated group') and non-euro area EU countries (the 'control group') as well as the rest of the OECD (non-euro area OECD), both in French and Hungarian data. Overall, aggregate French prices remain stable in the euro area, while they are much more volatile in the rest of the OECD. Interestingly, the relative stability of French prices in euro-area countries still holds when comparing them with non-euro area EU countries. An explanation for the price stability is thus likely to be found in the common currency.

Figure 4.1: Export price indices toward three types of destinations



Chained geometric Laspeyres price index, 100=1995. Export prices in current euro for France and in forints for Hungary.
Source: EFIGE. Note: EZ = euro area (euro zone).

This explanation is reinforced by the comparison of French and Hungarian export price developments. The right-panel of Figure 4.1 shows for Hungary price developments that are much more similar across regions. Price developments are still smoother towards the euro area but the gap with other OECD countries is less pronounced in Hungarian than in French data[18].

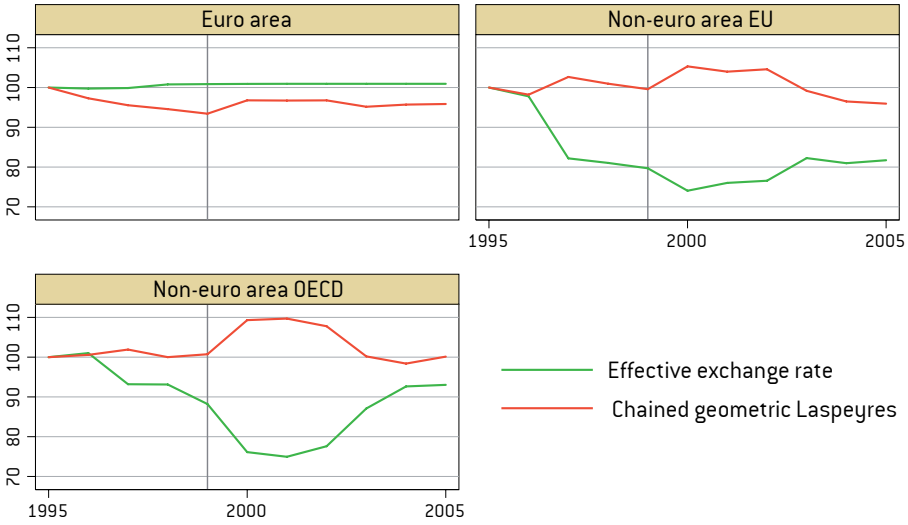
18. Note that Hungarian export prices towards the rest of the European Union strongly decrease between 2002 and 2003. The trend break for non-euro area EU destinations is clearly a consequence of the contract between Sweden and Hungary, whereby Sweden imports from and invests in Hungary in return for the Hungarian purchase of Swedish military aircraft.

Hence, we have:

Fact 8: The euro reduced the volatility of export prices in the euro area.

Why did this happen? Figure 4.2 shows that the answer is to be found in the fact that the euro has removed exchange-rate volatility between euro-area countries.

Figure 4.2: Correlation between export price changes and exchange-rate movements (France)



Chained geometric Laspeyres price index. Effective nominal exchange rates computed using Chelem data. 100=1995. Rest of the EU15: Denmark, Sweden and the UK. Rest of the OECD: Japan, Switzerland and the US. Source: EFIGE

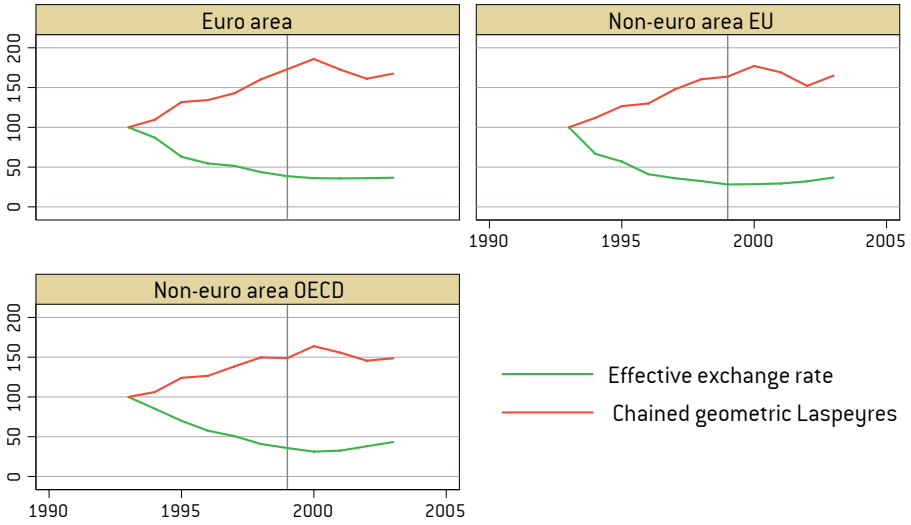
Figure 4.2 illustrates the correlation between the Laspeyres export price index and the effective nominal exchange rate of France vis-à-vis euro area countries (top left panel), non-euro area EU countries (top right panel) and non-euro area OECD countries (bottom panel)[19]. The clear negative correlation between exchange rates and price indices vindicates the 'pricing-to-market' (PTM) notion discussed earlier. During the second half of the 1990s, the French currency (the franc before 1999, the euro since) has tended to depreciate vis-à-vis its main non-euro area partners. This

19. We only consider the US, Japan and Switzerland in the computation of the effective nominal exchange rate for the rest of the OECD. In 2000, they represented about 70 percent of French exports outside the EU. The weighting parameters used to aggregate bilateral nominal exchange rates are based on traded values as recorded in the customs data.

automatically improves the competitiveness of French products in foreign markets. French exporters take advantage of the competitiveness gain and increase their markup, which explains the price increase. However, export prices have tended to decrease since 2001, in parallel with the appreciation of the euro. The PTM interpretation of this is that exporters reduce their markups to smooth out the impact on their foreign sales of exchange rate variations[20]. Of course, these variations were eradicated with the arrival of the euro, removing the need for such smoothing.

Figure 4.3 reproduces the same stylised fact using Hungarian data. In this case, exchange-rate fluctuations with euro-area countries do not disappear after the introduction of the euro, and Hungarian exporters maintain their PTM strategies without any visible change between euro-area and non-euro area destinations. This confirms that the smoothed-out behaviour of French export prices toward euro-area destinations is related to the disappearance of exchange rate volatility.

Figure 4.3: Correlation between export price changes and exchange-rate movements (Hungary)



Chained geometric Laspeyres price index. Effective nominal exchange rates computed using Hungarian National Bank data. 100=1995. Rest of the EU15: Denmark and the UK. Rest of the OECD: Australia, Canada, Japan, Norway, Switzerland and the US. Source: EFIGE.

20. Note that the PTM mechanism is reinforced by the impact of exchange-rate movements on production costs. Firms that use imported inputs in their production process face increasing marginal costs when their money depreciates. This tends to increase their export prices as well. However, this cost effect also influences intra-euro area prices and is unlikely to explain the different behaviour of aggregate export prices to euro-area and non-euro area countries.

This gives our next fact:

Fact 9: After the introduction of the euro, the reduced volatility of export prices in the euro area has been due to the removal of exchange-rate volatility.

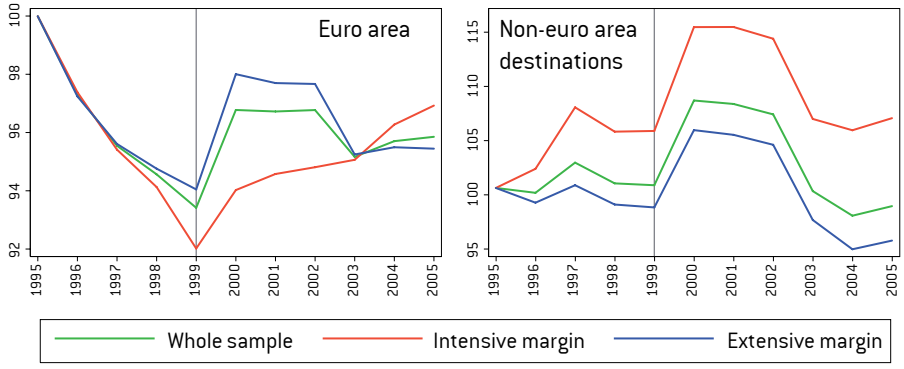
4.2.2 Intensive vs. extensive flows

Chapter 3 showed that the euro had a differential impact on the intensive and extensive margins of export volumes. We now check if the distinction is also significant for the behaviour of French export prices. Before proceeding, it is useful to recall the corresponding definitions as they are necessarily different from the ones used in the previous chapter. Here, the 'intensive margin' consists of the sub-sample of all bilateral flows (identified by a firm number, a product category and a destination market) that are present in the data over the whole period of analysis; the extensive margin consists of the sub-sample of bilateral flows that cover fewer than eleven years[21]. In other words, the 'intensive margin' refers to the prices of incumbent exporters that are always active in the market of a certain product in a certain country. The 'extensive margin' refers, on the other hand, to new or occasional exporters that are active only in a sub-set of years.

The Laspeyres price index can easily be broken down into an intensive and an extensive component. The total index can be shown to be the sum of an 'intensive' and an 'extensive' Laspeyres index, each weighted by the share of each sub-sample in the total export value[22]. Figure 4.4 illustrates this breakdown, for euro-area (left panel) and non-euro area (right panel) destinations. It reports both the aggregate Laspeyres price index and its two components. The behaviour of the three indices is broadly similar for non-euro area destinations, reflecting the kind of exchange-rate effects discussed in the previous section.

21. This exercise is limited to French data because the size of the Hungarian intensive sample is too small for results to be interpretable. Robustness of all results distinguishing between intensive and extensive samples has been checked using a different sample which keeps only the 'euro-relevant' period: 1998-2005. This new window implies that the extensive sample only includes flows which enter or exit after 1999, ie after the introduction of the euro. Also, the constraint on the intensive sample is less strict in this robustness check, as it reduces substantially the years of compulsory presence in the export market. Results shown in Figure 4.4 and Table 4.1 are very similar when using this alternative sample.
22. See details in Appendix B.

Figure 4.4: The margins of export price evolution



Chained geometric Laspeyres price index, 100=1995. Source: EFIGE.

The evolution of export prices to euro-area destinations differs substantially between the extensive and the intensive margins. The disconnect between them started in 1999. While the prices of intensive flows have been growing since then, the prices of extensive flows first go up, then down and finally up again, even showing some correlation with the evolution of export prices to non-euro area destinations. Accordingly, the aggregate export price fluctuations are mainly driven by fluctuations in the extensive margin.

We can thus say:

Fact 10: After the introduction of the euro, export price variations within the euro area have been mainly driven by the pricing choices of new exporters.

Comparison of the left and right panels of Figure 4.4 also suggests that the main differential impacts of the euro on export prices emerge in the disconnection of the intensive price margin, and in an increase in export prices to euro-area destinations relative to non-euro area ones, mainly due to the behaviour of the extensive margin. The same conclusions may be drawn from Table 4.1 detailing the percentage price variations depicted in Figure 4.4[23].

23. Table 4.1, columns 'All' give the annual price variation (in percentage points) of French exports towards euro-area members and towards the rest of the OECD. Columns 'Intensive' and 'Extensive' help understand the respective contribution of each margin to the aggregate price variations. Namely, columns 'Intensive' ('Extensive') give the variation of the French export price index attributable to price variations along the intensive (extensive) mar-

Table 4.1: Price variations (in percent)

	Euro area			Non-euro area OECD		
Year	All	Intensive	Extensive	All	Intensive	Extensive
1996	-2.70	-0.81	-1.90	-0.43	0.49	-0.92
1997	-1.79	-0.64	-1.15	2.65	1.58	1.07
1998	-1.026	-0.41	-0.62	-1.78	-0.59	-1.18
1999	-1.22	-0.69	-0.52	-0.16	0.02	-0.18
2000	3.59	0.65	2.94	7.38	2.52	4.86
2001	-0.05	0.17	-0.22	-0.28	0.00	-0.28
2002	0.05	0.07	-0.02	-0.85	-0.25	-0.59
2003	-1.66	0.08	-1.74	-6.29	-1.65	-4.64
2004	0.57	0.39	0.18	-2.15	-0.26	-1.89
2005	0.16	0.19	-0.04	0.86	0.28	0.58

Source: EFIGE.

Figure 4.4 and Table 4.1 both highlight the exceptional increases at the extensive margin experienced by French export prices to both euro-area and non-euro area destinations between 1999 and 2000. The increase may reflect the entry of new exporters after the euro launch, who initially quoted relatively low prices with the aim of gaining market share. This is confirmed by the finding that the price level of an average new exporter in 1999 was 30 percent lower than the price of an average firm exporting over the whole period of analysis. Once market shares are gained, the prices quoted by the new exporters rise so that in 2000 the gap with respect to persistent exporters shrunk to 22 percent.

This price increase was eased by the depreciation of the euro and was reversed when in 2001 the euro started to appreciate. The ensuing loss of competitiveness of French exports induced more fragile French exporters either to reduce their prices or to abandon export markets altogether (seven percent of extensive flows between 2002 and 2003). Persistent exporters in the intensive margin were less sensitive to these changes in the competitive environment.

To summarise, we have:

Fact 11: The increase in export prices to the euro area on the introduction of the euro was associated with the entry of new exporters.

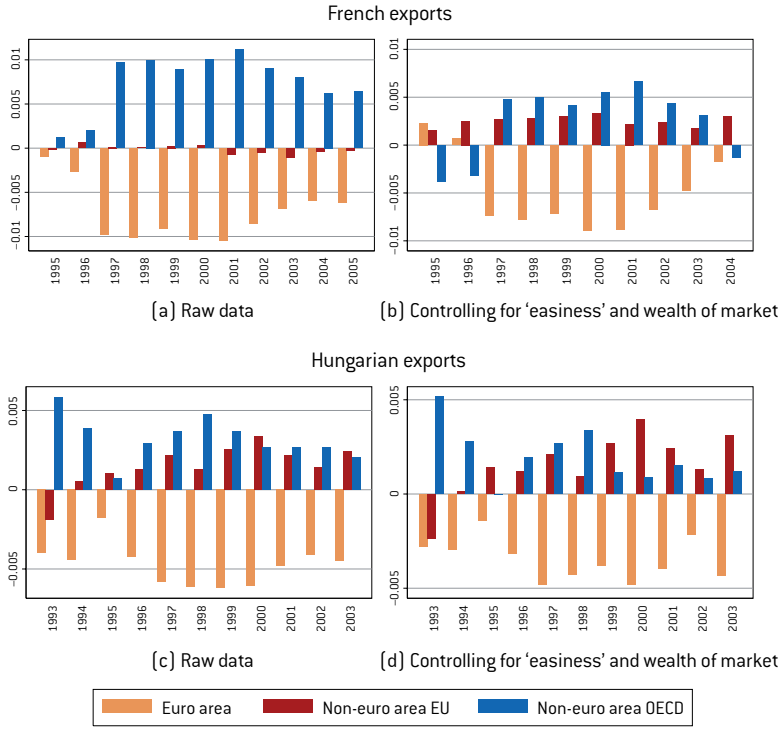
4.3 Price levels

Having shown that, following the introduction of the euro, French export price changes differed considerably for euro-area and non-euro area destinations, we now turn to the investigation of differences in average *price levels*. In so doing, we first construct a reference price for each firm, which is the average export price to all OECD countries. We then compute price deviations relative to the reference price for euro-area destinations, non-euro area EU destinations and non-euro area OECD destinations. We therefore obtain absolute firm-level price deviations with respect to the price set by an average exporter to all OECD destinations.

4.3.1 All trade flows

Results are presented in Figure 4.5, panel (a) for France and panel (c) for Hungary.

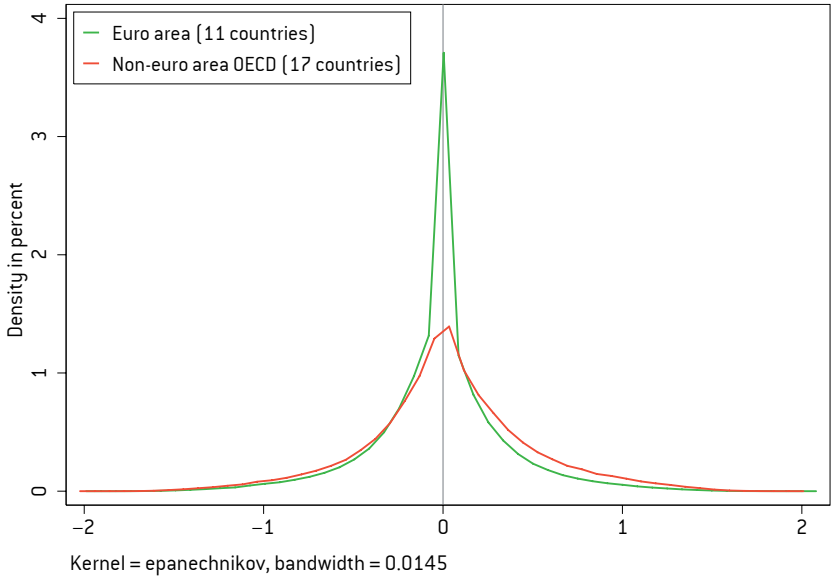
Figure 4.5: Average price differentials



Mean price deviation in % with respect to the OECD average. Price deviations corrected for distance and GDP per capita effects in panel (b). Source: EFIGE.

The first point to note is that the average deviations are very small, lying between -1 percent and one percent for France, and even less for Hungary. The reason is that these figures aggregate positive and negative price deviations, which offset each other. This can be seen in Figure 4.6, which illustrates the frequency ('kernel density') of price deviations measured in 2000 using the French sample. For both euro-area countries and the rest of the OECD, there are many positive and negative (sometimes large) price deviations. In both samples, the average price gap in the euro area is always negative, meaning that prices are on average smaller than the reference price, once individual price determinants are adjusted for. On the other hand, it is positive or close to zero for both non-euro area EU countries and non-euro area OECD countries[24]. The French export price level is about two percent higher in the rest of the OECD than in the euro area. The corresponding gap for Hungarian prices is smaller, around one percent, but still positive.

Figure 4.6: Distribution of price differentials with respect to the OECD mean, 2000



Distribution of the log of the price gap calculated as the log of a price (country, product and firm specific) divided by the average price of this good across OECD countries. Source: EFIGE.

24. One can verify this result in Figure 4.4 for France. The right tail of the 'kernel density' is thinner for the euro-area sample while positive price deviations are more likely in the rest of the OECD. This explains why, on average, prices are lower in the euro area.

A possible explanation for the lower aggregate price *level* in the euro area, which is nearly independent from the monetary integration process, is linked to the fact that euro-area countries are geographically closer to the exporter than other countries in the rest of the OECD. This should change aggregate prices because of composition effects: a larger number of firms are able to export to the euro area, where selection through trade costs is less tough. Therefore if different firms produce goods of different quality, only high-quality and high-price goods will be sold in more difficult markets, ie the rest of the OECD in the present case. We would therefore observe a lower level of average prices inside the euro area. Note that there are counter-arguments. Should firms be characterised by different levels of physical productivity rather than quality, then less productive firms that can export to the euro area but not to the rest of the OECD would have higher prices, not lower. This would be consistent with the evidence discussed in the previous section. Also if firms are able to price-discriminate, they would tend to set higher prices in easy markets, as explained above.

Panels (b) and (d) of Figure 4.5 present the average deviations when the 'easiness' and the 'wealth' of destination markets are adjusted for[25]. The introduction of wealth and easiness does not change the qualitative nature of our results, but average price differentials are further reduced.

To summarise, export prices are driven by (at least) two forces. First, easy markets result in lower prices and, second, rich markets result in higher prices. Euro-area destinations are both rich and easy for French and Hungarian exporters but, adjusting for these two characteristics, they still command lower export prices than non-euro area EU and non-euro area OECD destinations.

Hence, we state:

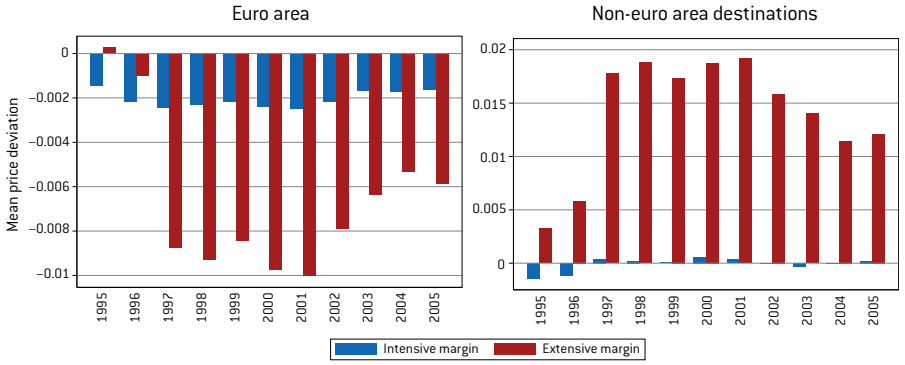
Fact 12: Export prices from euro-area countries are on average lower to other euro-area countries than to the rest of the OECD, even after adjusting for market size, proximity and wealth.

25. This is achieved by regressing the (log of) unit values on GDP over distance (a measure of the 'easiness') and income per capita of destination countries. The predicted residuals of this first-stage regression can be interpreted as the price corrected for 'easiness-of-market effects' and for 'wealth effects'.

4.3.2 Intensive vs. extensive flows

As in the previous section, we now ask whether the preceding results are driven by extensive or intensive trade flows. Figure 4.7 illustrates the average price gap with respect to the OECD mean for euro-area destinations (left panel) and for the rest of the OECD (right panel), distinguishing between intensive and extensive flows. Each sub-sample is weighted by the number of observations to obtain a correct decomposition of the results in Figure 4.5, panel (a). This explains why the bars referring to the intensive sample are smaller than those referring to the extensive one.

Figure 4.7: Average price differentials, intensive vs. extensive trade flows



Mean price deviation in % with respect to the OECD average, computed on intensive and extensive flows. Source: EFIGE.

The left panel of Figure 4.7 shows that prices are relatively low in the euro area, both at the intensive and the extensive margins. This indicates that Fact 10 is not driven by composition effects. However, prices on intensive flows towards the rest of the OECD are not systematically higher than the average. The relatively high price level in this region is thus driven by extensive flows.

This leads to:

Fact 13: In the euro area, export prices are on average lower than in the rest of the OECD, for both incumbent and new exporters.

4.4 Price discrimination

Has the introduction of the euro affected the magnitude of price discrimination across euro-area markets? To answer this question we compare the *dispersion* of French export prices to the euro area to their dispersion to the rest of the OECD. We also look within the euro area at price deviations across its destinations. Finally, we compare the results for France with those for Hungary.

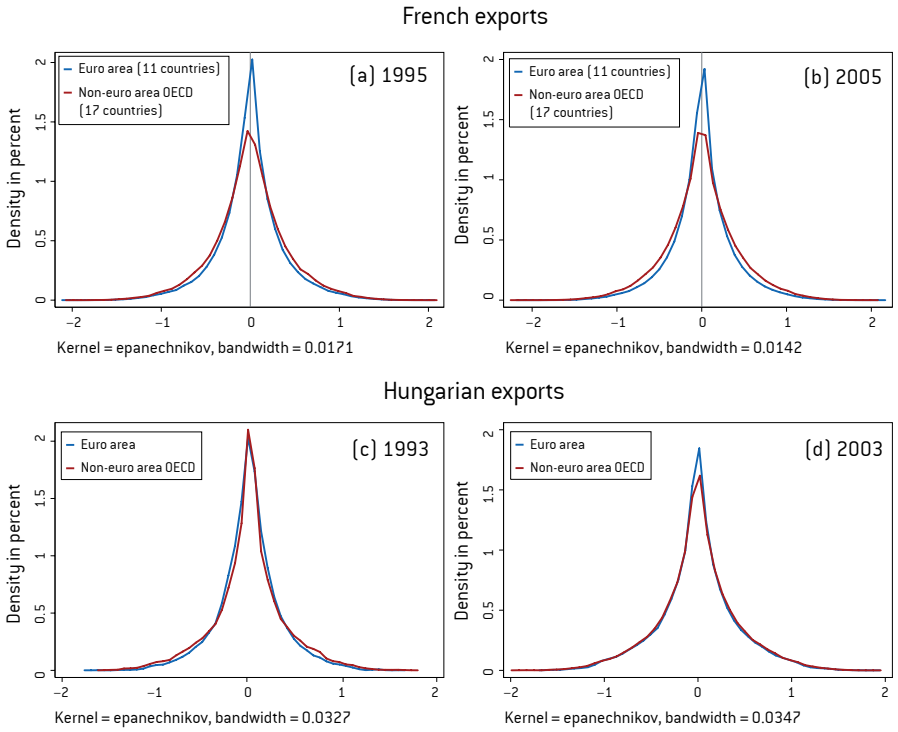
As explained in Appendix A, our measure of price dispersion is based on the average export price gap with respect to the firm-specific mean export price to each type of destination. This slightly differs from the price discrepancy computed in the previous section. Here, the reference price is the average for each specific destination type, while in the previous section the reference was the whole OECD. We use these price ratios to compare the dispersion of prices to euro-area destinations with that in an appropriate control group.

4.4.1 All trade flows

As a first description of price discrimination, Figure 4.8 (overleaf) illustrates the distribution of the (log of the) price deviation to euro-area destinations and to the rest of the OECD: for France in 1995 and 2005 (panels (a) and (b)); and for Hungary in 1993 and 2003 (panels (c) and (d)).

With deviations in log, the distributions are centred around zero. A positive (negative) deviation means a price above (below) the average price of the area. A distribution more concentrated around zero indicates a smaller dispersion of prices. In panels (a) and (b), distributions are more concentrated around zero in the euro area than in the rest of the OECD. This means that price differentials for French products across euro-area countries are on average lower than across countries of the rest of the OECD. Moreover, comparing the two panels, obtained respectively from 1995 and 2005 data, reveals that this gap has not been strongly affected by the introduction of the euro.

Figure 4.8: Distribution of price deviations



Distribution of the log of the price discrimination calculated as the log of a price (country, product and firm specific) divided by the average price of this good across the countries of the area under consideration. Source: EFIGE.

Panels (c) and (d) show that the gap in the magnitude of price dispersion between euro-area and non-euro area OECD destinations does not appear in the case of Hungary. In particular, the 'degree of price discrimination' – as measured by the (inverse of the) density of price gaps around zero – towards euro-area destinations is comparable for French and Hungarian exporters. However, price discrimination towards non-euro area OECD destinations is more pronounced for French than Hungarian exporters.

Accordingly, we have:

Fact 14: Exporters from the euro area price-discriminate less among markets in the euro area than among markets outside the euro area. Exporters from outside the euro area have no bias in terms of price discrimination between the two types of markets.

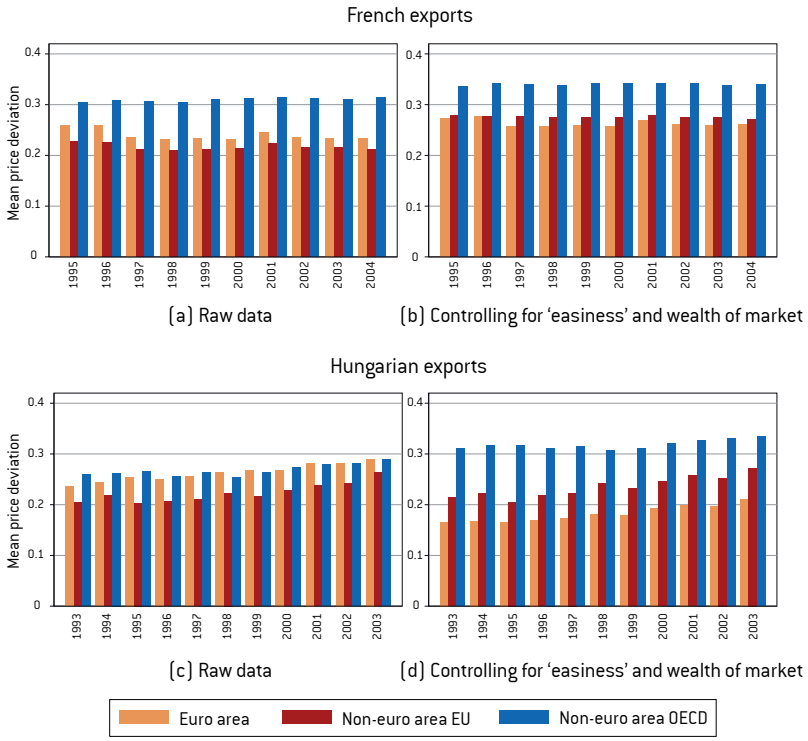
A possible explanation for this could be that French exporters have a stronger tendency to price-discriminate than Hungarian exporters. This would explain why the distribution of their price deviations is less concentrated than that of Hungarian exporters to the rest of the OECD. In the euro area, however, arbitrage costs are lower and French firms cannot price discriminate among destinations as much as they would like. This would explain why French export prices are more concentrated for euro-area destinations than for the rest of the OECD.

Panels (a) and (c) of Figure 4.8 illustrate the time evolution of the mean price deviations from the sample average for the three types of destinations: euro-area countries, non-euro area EU countries and the rest of the OECD. Mean price deviations are reported in absolute values, which amounts to treating positive and negative deviations from the average in a symmetric way. In other words, Figure 4.9 (overleaf) illustrates what are called the 'standard deviations' of the distributions of prices depicted in Figure 4.8.

Figure 4.9 panel (a) shows that on average there is a gap of 30 percent between the price of a French good exported to an OECD country and its average export price across the whole OECD. The gap is marginally smaller for exports to euro-area destinations (about 25 percent) and even smaller for those to non-euro area EU destinations (about 22 percent). By contrast, panel (c) shows that for Hungarian exports the mean price deviations to euro-area and non-euro area OECD destinations are very similar. Again, it seems that price discrimination by Hungarian exporters is not significantly different when exporting to the euro area or to other OECD countries.

At first sight, it seems surprising that the dispersion of export prices is higher to euro-area than to non-euro area EU destinations. Panels (b) and (d) of Figure 4.9 show that such a counter-intuitive result disappears once adjustments are made for the easiness and wealth of destination markets: mean export price deviations are smaller to euro-area than non-euro area EU destinations, and smaller to non-euro area EU than to non-euro area OECD destinations. This holds both for French and Hungarian exports.

Figure 4.9: Mean absolute price deviation, euro area vs. rest of the OECD



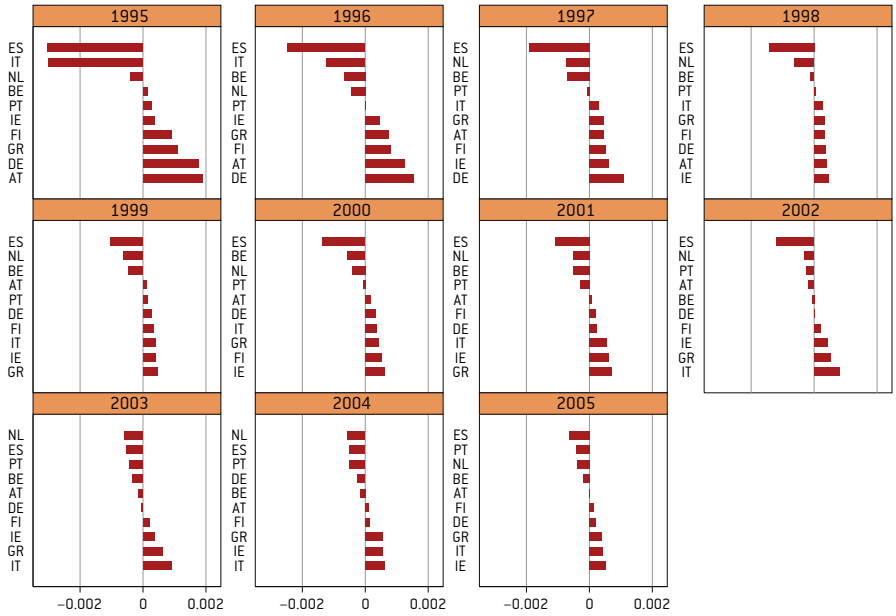
Mean absolute price deviation in % with respect to the sample average. Price deviations purged from GDP over distances and GDP per capita effects in panel (b). Source: EFIGE.

We summarise this finding as:

Fact 15: Taking into account the 'easiness' and the wealth of destination markets, price discrimination by European exporters is smaller towards euro-area countries than to the rest of the EU15 and even smaller than to the rest of the OECD.

This fact seems to hold throughout the period of observation. However, Figure 4.10 and Figure 4.11, depicting the distribution of *intra-euro area price discrepancies* over countries and time for French and Hungarian exporters respectively, reveal instead a process of gradual convergence. In these figures, each bar gives the average price deviation with respect to the euro-area average for the corresponding euro-area country. Both negative and positive country-specific deviations become smaller over time. At first sight, that seems especially true for French prices.

Figure 4.10: Price deviations with respect to the euro-area mean (France)

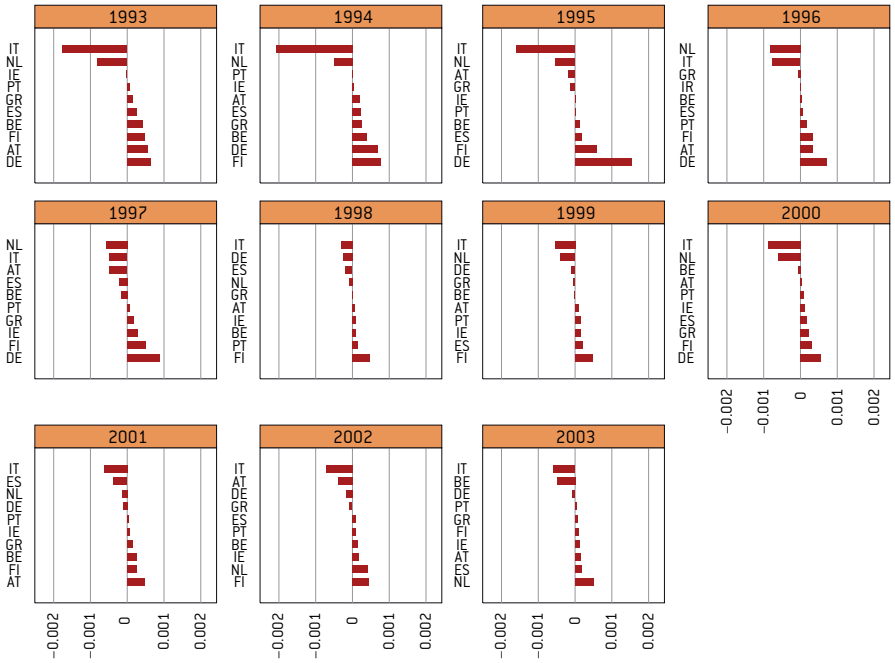


Average deviation from the euro area price. Source: EFIGE.

This suggests that the magnitude of price discrimination in the euro area follows a dynamic process. Has the introduction of the euro affected the process? To answer this question we follow the now-familiar treatment-vs.-control approach using non-euro area EU or non-euro area OECD countries as control groups. As in previous chapters, the non-euro area EU countries are probably the better control group as they have been subject to the same European integration process as euro-area countries. However non-euro area EU countries are a control group including a very small set of quite specific countries, which justifies the use of the non-euro area OECD control group as an alternative for checking the robustness of our results. Table 7 (overleaf) summarises the corresponding results[26].

26. Detailed results are presented in Appendix C.

Figure 4.11: Price deviations with respect to the euro-area mean (Hungary)



Average deviation from the euro area price. Source: EFIGE.

Table 4.2: Impact of the euro on French and Hungarian price discrimination

Control Group	Non-euro area OECD	Non-euro area EU
French exporters		
Mean price deviation euro area vs. control group *before* 1999	-5.1%	3.0%
Mean price deviation euro area vs. control group *after* 1999	-6.8%	1.6%
Hungarian exporters		
Mean price deviation euro area vs. control group *before* 1999	-1.5%	3.1%
Mean price deviation euro area vs. control group *after* 1999	-1.5%	3.1%

Note: calculations based only on statistically significant estimates. Source: EFIGE.

Table 4.2 shows that before 1999 price discrimination by French exporters in the euro area was about five percent weaker than in the rest of the OECD and three percent stronger than in the rest of the EU15. The same pattern characterises the

Hungarian data: about 1.5 percent weaker than in the rest of the OECD and three percent stronger than in the rest of the EU. The table also shows that after the introduction of the euro in 1999, price discrimination by French exporters in the euro area fall with respect to both control groups. It became about seven percent weaker than in the rest of the OECD and 1.5 percent stronger than in the rest of the EU15. There is, however, no (statistically significant) change in price discrimination by Hungarian exporters whatever the control group.

Overall, we can say:

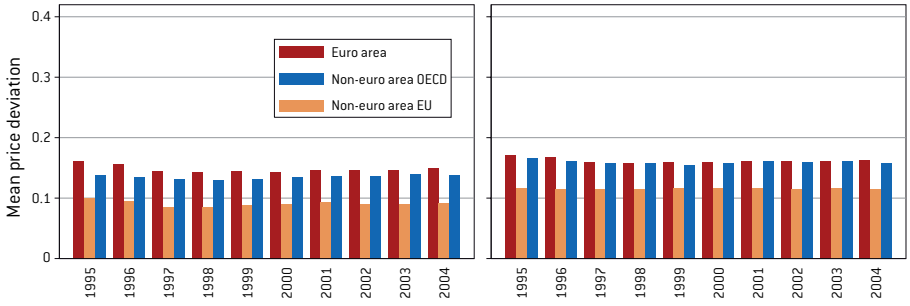
Fact 16: After the introduction of the euro, euro-area exporters reduced the dispersion of their export prices in the euro area relative to markets outside the euro area. This was not the case for exporters belonging to countries outside the euro area.

4.4.2 Intensive vs. extensive flows

Once more, the analysis based on the sample of all trade flows may mask interesting developments in the intensive and extensive sub-samples. In particular, as long as some firms entered or exited the group of exporters to a certain destination after 1999, the variations in mean price dispersion highlighted in the previous section are not necessarily computed on the same number of countries and products. Accordingly, it is not clear whether the variations in Table 4.2 are related to changes in exporters' pricing strategies (intensive margin) or rather to compositional changes in the groups of exporters to different destinations (extensive margin). This section disentangles the two cases by reproducing the analysis of the previous section for the intensive flows sub-sample.

Figure 4.12 (overleaf) reproduces the evidence from Figure 4.9, panels (a) and (b), but with the sample restricted to intensive flows. Since the intensive margin includes only the flows present across the whole period of observation, the deviation from the mean at the firm and product level is computed on the same number of flows each year. To ease comparisons, the same scale is used for both figures. This shows that the standard price deviation is strongly reduced once focusing on intensive flows.

Figure 4.12: Mean absolute price deviation, euro area vs. rest of the OECD (intensive sample)



(a) Raw data (b) Controlling for easiness of market and wealth

Mean absolute price deviation (in %) with respect to the sample average. Price deviations purged from GDP over distance and GDP per capita effects in the panel (b). Source: EFIGE.

There are two possible explanations for this finding. First, results in Figure 4.9 may be biased by composition effects, with firms entering/exiting the export markets during the period being more prone to adopting discriminatory pricing strategies. Second, the finding may reflect differentiation of pricing strategies within firms. For instance, it may be the case that firms entering a new market systematically set lower prices to gain market share.

Figure 4.12 also shows that at the intensive margin it is no longer the case that price discrimination is less pronounced in the euro area. The standard deviation of export prices to euro-area destinations is comparable to that for non-euro area OECD destinations and it is higher than to non-euro area EU destinations. This result holds even after controlling for the easiness and the wealth of destinations.

Table 4.3 reproduces Table 4.2 for the intensive sub-sample for French exports. It highlights that, in the intensive sub-sample, the introduction of the euro reduced price discrimination in the euro area: after 1999 mean export price deviations to euro-area destinations fell both with respect to non-euro area OECD and non-euro area EU destinations.

Table 4.3: Impact of the euro on French price discrimination (intensive sample)

Control Group	Non-euro area OECD	Non-euro area EU
French exporters		
Mean price deviation euro area vs. control group *before* 1999	0%	5.1%
Mean price deviation euro area vs. control group *after* 1999	-1.0%	0%

Note: calculations based only on statistically significant estimates. Source: EFIGE.

To summarise, Table 4.3 shows that mean price dispersion in the euro area has fallen at the intensive margin. Comparison with Table 4.2 suggests that the fall at the intensive margin accounts for 60 percent of the overall reduction of price dispersion to non-euro area OECD destinations. Moreover, the introduction of the euro led to a convergence in mean price dispersion between euro-area and non-euro area EU destinations. Accordingly the residual difference between these two types of destinations reported in Table 4.2 is due to adjustment along the extensive margin, ie entry and exit of exporters.

This leads to:

Fact 17: The reduction in price dispersion of euro-area exporters to euro-area markets after the introduction of the euro is mainly due to weakened price discrimination by incumbent exporters.

4.5 Summary

This chapter has investigated the impact of the euro on the pricing behaviour of exporting firms. Our findings suggest that the introduction of the euro affected the pricing strategies of European firms in several ways.

- The fixing of exchange rates inside the euro area has eliminated an important source of price volatility. Before monetary integration, exporters from the euro area had an incentive to absorb part of the exchange-rate shocks into their profit margins in order to stabilise local currency prices. Such behaviour induced volatility in export prices, which has disappeared since exchange rates have been irrevocably fixed. This does not mean, however, that exporters have become insensitive to fluctuations in the exchange rate of the euro. The evidence suggests that the recent appreciation of the euro has forced some firms to adjust their prices in

order to cope with the increased competition from exporters outside the euro area. Nevertheless, the impact of exchange-rate shocks is less pronounced and mainly affects more fragile firms.

- Our findings also suggest that prices toward euro-area countries are on average lower than prices for exports toward countries outside the euro area. The price gap may be observed for the whole observation period, but it seems to have increased following the introduction of the euro. The reasons for this relative price decrease are not clear from a theoretical viewpoint. One possibility is that the reduction in transaction costs attributable to the elimination of conversion costs translates into lower (relative) prices.

- We have further shown that the common currency has helped to reduce the extent of price discrimination from French firms exporting within the euro area. This suggests that the euro has indeed reduced arbitrage costs in product markets, fostering price convergence in the euro area. Extrapolating further, this is consistent with the view that monetary integration helps in synchronising business cycles.

5 Overall summary and policy recommendations

The limited impact of the common currency on aggregate trade flows masks major microeconomic gains. These gains may be channelled either through price compression or a richer variety of final and intermediate products. While there is convincing evidence to support the former, the evidence for the latter is mixed.

We have highlighted the following main findings.

First, in terms of hidden gains from product variety, we have found that the introduction of the euro has had:

- A small positive additional effect on the overall number of products exported ('extensive margin');
- A larger positive differential effect on the average value of exports per product and per firm ('intensive margin');
- No trade diversion effect towards the euro area along either margin.

Second, in terms of hidden gains from price compression we have found that after the introduction of the euro:

- The volatility of export prices has fallen in the euro area, mostly thanks to the removal of exchange rate volatility;
- Export price variations in the euro area have mainly been driven by the pricing strategies of new exporters;
- Export prices are lower inside than outside the euro area owing to the pricing strategies of both incumbent and new exporters;
- Euro-area exporters have narrowed the dispersion of their export prices to markets in the euro area relative to markets outside the euro area, mainly thanks to reduced price discrimination within the euro area by incumbent exporters.

That the microeconomic gains produced by the euro seem to be mainly attributable to price compression rather than enhanced product variety provides a final finding that:

- The real appreciation of the euro has diverted member countries' exports away from euro-area markets due to adjustment along the intensive margin, ie the appreciation of the euro has affected average value of exports per product per firm.

Interestingly, real GDP growth in destination markets has attracted euro-area exports mainly through the extensive margin, ie through the number of products exported.

Our findings suggest that the introduction of the euro has indeed increased price transparency and price competition in the euro area. However, the impact in terms of richer product variety has been more limited. This also explains why the trade effects of the euro have been subdued at the aggregate level.

There is little evidence that the euro had any additional effect, with respect to other EU policies, on the decision of European firms whether or not to export. There are two ways of reading this result. On the one hand, it may be that the single market has already achieved its full potential in terms of firms' participation, so that the introduction of the common currency did not make much difference. On the other hand, it may also be that several obstacles to the full accomplishment of European integration are still in place notwithstanding the euro and other EU policies. However, the fact that EU exporters are still a very small fraction of EU firms or, equivalently, that most firms still serve only their domestic markets, strongly militates in favour of the second explanation.

Evidence collected by the European Commission is consistent with this interpretation[27]. Two-thirds (66 percent) of EU retailers only sell in their domestic market but a surprisingly high number of them (48 percent) consider they are prepared to sell to consumers in different member states. One out of five retailers (18 percent) even thinks it is prepared to make cross-border sales to 10 or more member states whereas only one out of ten actually does so.

The major obstacles to cross-border trade identified by the majority of retailers are:

27. DG Health and Consumer Protection, 'Business attitudes towards cross-border sales and consumer protection', Flash Eurobarometer 186, December 2006.

- the perceived insecurity of transactions (61 percent);
- different national fiscal regulations (58 percent);
- the difficulty to resolve complaints and conflicts cross-border (57 percent);
- the differences in national laws regulating consumer transactions (55 percent);
- the difficulties in ensuring an efficient after-sales service (55 percent);
- the extra costs arising from cross-border delivery (51 percent).

These obstacles indeed lie behind the puzzling persistence of 'border effects' observed in intra-EU trade: all else equal (notably for given sizes of, and bilateral distance between, trading regions), trade flows are much smaller between than within countries.

Therefore, having introduced a common currency, the European integration agenda should still give top priority to dealing with classic obstacles to single market access such as divergent product, service and consumer rules within the EU.

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Appendix A: Data

In this paper we use the individual database of export flows provided by the customs authorities to CEPII. The dataset covers the 1995-2005 period, which allows us to study export prices before and after the introduction of the euro. Data are disaggregated by firm and product, at the 8-digit level of the Combined Nomenclature (CN8). The raw data cover 305,661 firms and 13,507 products for a total exported value of €3.16 trillion.

Our measure of export prices is based on unit values, defined as the ratio of value over quantity of each bilateral flow:

$$P_{fkjt} = \frac{Val_{fkjt}}{Qty_{fkjt}}$$

where f, k, j and t respectively designate a firm, a CN8 product, a destination market and a year between 1995 and 2005. Using firm and product data is particularly useful when working on unit values because this price proxy is known to be biased by composition effects (see Kravis and Lipsey (1974) for instance). The more disaggregated trade data are, the more accurate the price proxy.

First, we reduce the sample to keep only the OECD destinations. Since we want to compare export prices toward the euro area with that of an appropriate control group, we use countries of comparable development level. The resulting sample includes 205,688 firms declaring a total export value of €2.59 trillion.

Even when working at the firm and product level, it may be the case that export unit values are biased. For instance, misdeclarations by French firms or reporting errors by the customs authorities are likely to be transmitted into unit value errors. To account for this, we first apply an outlier treatment procedure to the raw data. Namely, we compute the median unit value for each product declared by a given firm in a particular year. We then delete unit values that are five times higher or lower than the firm- and product-specific median. At this stage, the database contains 14,177,234 observations, over eleven years (1995-2005), covering 28 countries

(OECD less France and Luxembourg, which is merged with Belgium in the customs data), 205,688 firms and 13,466 products. The total export value is €2.53 trillion.

The crude unit values we compute at the firm-product level are not directly comparable. Two methods allow aggregation of these individual prices. The first one used in Section 4.2 is based on the time variation of individual prices. The construction of price indices aggregates price ratios of the form:

$$\frac{P_{fkjt}}{P_{fkjt-1}}$$

The aggregation is done across firms, products and destinations. In log, each ratio measures the annual price growth of a specific product and can be compared with the price change of another good.

The second method consists of normalising unit values by a 'reference' price that is specific to each firm and product. This allows one to control for firm-specific determinants of prices and focus the analysis on the cross-section of destinations served by a single firm.

In Section 4.3, the reference is the mean price in the OECD and the aggregation is done on the following price ratios:

$$\frac{P_{fkjt}}{\frac{1}{N_{fkt}}\sum_{j?} P_{fkjt}}$$

where $Nfkt$ is the number of OECD countries importing good k of firm f in year t. Each ratio can be interpreted as the price gap of good k sold by f in country j with respect to the mean price of the same good, sold by the same firm in the OECD. A ratio higher (lower) than one means that the price in country j is relatively higher (lower) than in other OECD countries. Averaging across goods sold in a particular area indicates whether French exports are on average cheaper or more expensive in this area, in comparison with the whole OECD.

The statistic used in Section 4.3 is similar to the previous one. However, the reference price is the price in the area under consideration rather than in the whole OECD. The price ratios at the root of the aggregation are defined as:

$$\frac{P_{fkjt}}{\frac{1}{N'_{fkt}}\sum_{j?} P_{fkjt}}$$

where *r* is the considered region, ie euro area, rest of the EU15 or rest of the OECD. Again, a ratio higher (lower) than one indicates whether the price in country *j* is higher (lower) than the average in the considered area. Taking the absolute value and averaging across goods sold in the area amounts to measuring the standard deviation of prices in the area.

These price ratios are first averaged to get stylised facts concerning the impact of the euro on the development of prices, the level of price and the magnitude of price discrimination. In Section 4.4, we also use a more rigorous regression analysis based on a difference-in-difference (DIID) strategy.

The DIID strategy compares the evolution of price dispersion in the euro area with that of an appropriately defined control group. This allows us to control for global trends in pricing behaviour that are unconnected with the introduction of the euro. The control group has to be as similar as possible to the treatment group (the euro area). We successively take the rest of the OECD and the EU countries outside the euro area (ie Denmark, Sweden and the United Kingdom). The latter group is better because these countries have experienced the same economic policies aimed at increasing market integration as euro-area members. However, the number of countries composing the reference group is small which may induce a bias.

In the DIID methodology, the variable of interest (the absolute price deviation here) is regressed on an intercept and three binary variables. The first dummy variable, called euro, is set equal to one for euro-area countries. The second one (Post99) takes a value of one in the years following the introduction of the euro[28]. Last, the third dummy (euro×Post99) interacts with the euro and Post99 binary variables. It is thus equal to one for euro-area countries since the introduction of the euro.

The interpretation of the estimated coefficients is as follows. The constant gives the average size of price discrimination for countries outside the euro area before 1999. The Post99 dummy corresponds to the general trend of price discrimination after 1999. The euro dummy captures the characteristics shared by all euro-area countries that should make price discrimination lower within this set of countries over the pre-1999 period. Last, the euro×Post99 dummy captures the impact that the introduction of the euro has had on price discrimination toward euro-area members.

28. Here, we consider that the introduction of the euro takes place in the beginning of 1999, ie when European exchange rates were irrevocably fixed. An alternative date for the treatment could be January 2002, when bank notes and coins were introduced. We ran the DIID regressions with this treatment date. However, results are less accurate in this case because the treatment period is considerably reduced.

Appendix B: Laspeyres index

The geometric Laspeyres index (gL) is a geometric average of the price variations of trade flows weighted by the share of each flow in total trade.

The general formula is the following:

$$gL = \prod_k \left(\frac{p_{k,t}}{p_{k,t-1}} \right)^{w_{k,t-1}}$$

or in log:

$$\ln gL = \sum_k w_{k,t-1} \ln \left(\frac{p_{k,t}}{p_{k,t-1}} \right)$$

Where wk,t-1 is the share of good k in the total value of trade measured in period t-1:

$$w_{k,t-1} = \frac{v_{k,t-1}}{\sum_k v_{k,t-1}}$$

We decompose this price index into two elements: the extensive and the intensive margins. The intensive margin (I) refers to the share of the aggregated price evolution triggered by trade flows recorded in the data over the whole period. The extensive margin (E) refers to the aggregated price evolution due to trade flows appearing or disappearing during the period.

Equation B.2 can be rewritten as:

$$\ln gL = \sum_{k \in E} w_{k,t-1} \ln \left(\frac{p_{k,t}}{p_{k,t-1}} \right) + \sum_{k \in I} w_{k,t-1} \ln \left(\frac{p_{k,t}}{p_{k,t-1}} \right)$$

Defining the weight wM,t-1 of each margin in the total trade:

$$w_{M,t-1} = \frac{\sum_{k \in M} v_{k,t-1}}{\sum_k v_{k,t-1}}, \quad M \in \{E, I\}$$

equation B.3 becomes:

$$\ln gL = w_{E,t-1} \sum_{k \in E} \frac{w_{k,t-1}}{w_{E,t-1}} \ln \left(\frac{p_{k,t}}{p_{k,t-1}} \right) + w_{I,t-1} \sum_{k \in I} \frac{w_{k,t-1}}{w_{I,t-1}} \ln \left(\frac{p_{k,t}}{p_{k,t-1}} \right)$$
$$= w_{E,t-1} \ln gL_E + w_{I,t-1} \ln gL_I$$

In a nutshell, the geometric Laspeyres index is the sum of the geometric Laspeyres indices computed on each margin, weighted by the share of the margins in the total value of trade.

Table B1 gives the evolution of these weights over time.

Table B1: Repartition of flows between extensive and intensive margins

	Euro area				Non-euro area OECD			
Year	Share in value (%)*		Number of flows		Share in value (%)		Number of flows	
	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive
1995	29.5	70.5	27,932	368,566	31	69	65,896	530,051
1996	29.9	70.1	27,932	391,623	31.5	68.5	65,896	546,329
1997	30	70	27,932	439,096	30.2	69.8	65,896	691,886
1998	30.1	69.9	27,932	451,930	30.9	69.1	65,896	717,402
1999	29.2	70.8	27,932	474,497	30	70	65,896	759,319
2000	27.8	72.2	27,932	498,519	28.8	71.2	65,896	771,107
2001	27.8	72.2	27,932	500,011	29.7	70.3	65,896	757,302
2002	26.7	73.3	27,932	504,220	30.1	69.9	65,896	766,472
2003	28.1	71.9	27,932	470,230	30.3	69.7	65,896	780,409
2004	28.2	71.8	27,932	525,697	28.6	71.4	65,896	825,952
2005	26.1	73.9	27,932	528,761	26.7	73.3	65,896	845,747

* Share in the total exported value
Source: EFIGE.

Appendix C: Price discrimination

Table C1: Impact of the euro on French price discrimination

Dependant variable	Deviation from the mean			
	(1)	(2)	(3)	(4)
Post99	0.010 [a]	0.006 [a]	0.007	-0.002
	(5.3)	(3.1)	(1.44)	(-0.98)
Euro	-0.051 [a]		0.030 [a]	
	(-6.38)		(3.87)	
Euro*Post99	-0.017 [a]	-0.015 [a]	-0.014 [b]	-0.006 [c]
	(-6.29)	(-4.94)	(-2.51)	(-2.14)
Constant	0.286 [a]	0.251 [a]	0.205 [a]	0.233 [a]
	(43.26)	(328.54)	(33.97)	(270.62)
fixed effects	no	pc	no	pc
control group	rest of the oecd	rest of the oecd	rest of the EU15	rest of the EU15
Observations	5,490,417	5,490,417	4,451,939	4,451,939
R^2	0.013	0	0.001	0
rho		0.326		0.281
Clustered t-statistics in parentheses [c] p<0.1, [b] p<0.05, [a] p<0.001				

Table C2: Impact of the euro on Hungarian price discrimination

Dependant variable	Deviation from the mean			
	(1)	(2)	(3)	(4)
Post99	0.016 [a]	0.002	0.008	-0.008 [b]
	(4.97)	(0.58)	(0.95)	(-2.22)
Euro	-0.015 [c]		0.031 [a]	
	(-2.01)		(4.14)	
Euro x Post99	0.003	-0.002	0.011	-0.007
	(0.73)	(-0.54)	(1.43)	(1.67)
Constant	0.247 [a]	0.252 [a]	0.202 [a]	0.244 [a]
	(38.73)	(198.97)	(29.89)	(174.71)
fixed effects	no	pc	no	pc
control group	rest of the oecd	rest of the oecd	rest of the EU15	rest of the EU15
Observations	175,114	175,114	108,534	108,534
R^2	0.002	0.000	0.003	0.000
rho		0.482		0.473
Clustered r-statistics in parentheses [c] p<0.1, [b] p<0.05, [a] p<0.001				

Table C1 presents DIID results for French data and Table C2 presents results for Hungarian data. In both tables, the first two columns correspond to the regressions using non-euro OECD members as a control group, whereas the last two columns consider the rest of the EU15. For each sample, we first run a 'naive' regression where the DIID dummies are the only right-hand side variables. Results are presented in columns (1) and (3). We also control for unobserved determinants of price dispersion using fixed effects for each product-country combination (pc). Results are provided in columns (2) and (4).

The constant lies between 0.203 and 0.286 in all regressions. This means that, outside the euro area and before 1999, prices deviate by around 2 percent to 29 percent from the sample mean. Before the introduction of the euro, price discrimination by French exporters is 5 percent weaker in the euro area than in the rest of the OECD (first column, euro line of Table C1), but 3 percent higher than in the rest of the EU (third column). The same pattern features Hungarian data, but the magnitude of the discrepancies are smaller, -1.5 percent when the control group is the rest of OECD and +3 percent with the rest of the EU. Finally, the implementation of the euro has had a negative impact on price discrimination by French exporters while it has not affected Hungarian pricing strategies. In quantitative terms, deviations from the mean price in the euro area are about 1 percent smaller after the introduction of the single currency

in French data. This result is robust to the different specifications we use. Overall, these DIID regressions suggest that the price dispersion was already smaller in the euro area than in the rest of the OECD before 1999. Moreover, the fixing of exchange rates in 1999 increased the gap in French data.

Table C3 reproduces the DIID regression of Table C1 on the intensive sub-sample. Note that the intensive margin includes only the flows present across the whole period. Therefore, the deviation from the mean at the firm and product level is computed on the same number of observations each year.

The constant lies between 0.112 and 0.168 meaning that, before 1999 and outside the euro area, the average price deviation is between 11 percent and 17 percent. This is much below the average price deviation in the whole sample (between 20 percent and 29 percent). In this sample, price discrimination is not significantly lower in the euro area than in the rest of the OECD (first column, euro line), but is still higher in the rest of the EU (third column, euro line). Finally, the introduction of the euro marginally reduced the price dispersion in the euro area with respect to the rest of the OECD (columns (1) and (2), euro×Post99 line). The impact remains negative with respect to the rest of the EU15, but is not significantly different from zero (columns (3) and (4), euro×Post99 line).

Table C3: Impact of the euro on price discrimination (intensive sample)

Dependant variable	Deviation from the mean			
	(1)	(2)	(3)	(4)
Post99	0.007	0.004 [b]	0.009	0.001
	(1.58)	(2.59)	(1.08)	(0.88)
Euro	-0.006		0.051 [b]	
	(-0.34)		(2.61)	
Euro x Post99	0.010 [c]	-0.005 [b]	0.012	-0.002
	(0.73)	(-2.57)	(1.29)	(1.21)
Constant	0.168 [a]	0.164 [a]	0.112 [a]	0.155 [a]
	(13.13)	(271.80)	(6.79)	(239.65)
fixed effects	no	pc	no	pc
control group	rest of the oecd	rest of the oecd	rest of the EU15	rest of the EU15
Observations	849,653	849,653	709,033	709,033
R^2	0.001	0.000	0.006	0.000
rho		0.350		0.330
Clustered r-statistics in parentheses [c] p<0.1, [b] p<0.05, [a] p<0.001				

Appendix D: Within-firm trade margins

As emphasised in the core of the text, there are actually two members of the euro area (France and Belgium) for which individual firm data is systematically available at a level of detail necessary to address the kind of decomposition we use here. Based on this data, Berthou and Fontagné (2008b), and Nitsch and Pisu (2008) ask what has been the impact of euro introduction on the decision to enter foreign markets, on the variety exported to each market, and the value of each shipment. In doing so, they rely on different approaches as regards the control group issue. Instead of considering that the best control group is the three non-euro area EU countries (Denmark, Sweden, United-Kingdom), Berthou and Fontagné control unobservable characteristics of destination markets with firms x market fixed effect. In contrast, Pisu and Nitsch limit their sample to EU15 countries. In both cases, however, the authors take advantage of information on individual characteristics of exporters to control for observable characteristics such as size and productivity.

Results of estimations are presented in Table D1. Concerning French firms, business surveys are only available for firms above 20 employees. Since such surveys must be matched with customs data when one controls for the productivity of exporters, this can be done only on a restricted sample of exporters in the French case. We accordingly present separately the results for the full sample and for the sample of firms above 20 employees in the French case. There is no such restriction in the Belgian case.

For Belgian firms, a positive impact of euro introduction on the number of exporting firms (to euro-area destinations) is observed. Also, the number of exported products by firm increases. All in all, the two dimensions of the extensive margin of Belgian exports (number of exporters, number of exported products) have been positively impacted by euro introduction. On the contrary, there is no effect on the value of the shipments – the intensive margin of Belgian exports.

For French firms, the euro effect on the decision to export is not observable. On the contrary, there is a marked positive impact on the number of exported products by incumbent exporters. A positive impact on the intensive margin of French exports is observed, but restricted to the firms above 20 employees.

Table D1: Impact of euro introduction on the components of the (within-firm) trade margins

	Decision to export to euro area (1)	Number of exported products to euro area	Exported value by product to euro area
French firms (1995-2003), full sample	0	++ (2)	0 (2)
French firms (1995-2003), above 20 employees (4)	0	++ (2)	+ (2)
Belgian firms (1996-2005) (4)	++	+ (3)	0 (3)

(1): Conditional FE logit estimate.
(2): Conditional FE Poisson estimate.
(3): Random effects estimation, controls for unobservable industry characteristics.
(4): Individual productivity controlled.
Note: Control for firm-destination unobservable characteristics and for time in all estimations.
Source: Adapted from Berthou and Fontagné (2008-b), Nitsch and Pisu (2008).

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