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Document de travail

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N° 2007-25
Septembre 2007

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Export prices and increasing world competition: evidence from French, German, and Italian pricing behavior

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July 2007

Abstract

The paper compares the export price strategies of France, Germany and Italy using a large and common pool of manufacturing products and destination markets. Our results suggest that pricing-to-market (PTM) is not widespread among French and German exporters, whereas Italian one do adopt more often such a pricing strategy. The standard claim that product specific characteristics play a major role in determining PTM finds little support in our result, which find almost no regularity across products. On the other hand, the hypothesis of an homogeneous behavior across destination countries (even for the same products) is strongly rejected. This suggests that export price changes are mainly determined by source and destination market characteristics. Something similar applies to profit margins as well: the latter move rather homogeneously across products but differently across destinations. Within this heterogeneity, we find that on average profit margins have either remained stable or augmented in the last three decades, so that increased international integration seems not to have reduced firms market power.

JEL codes: D40, E30, F14, L16, L60

Keywords: export, pricing-to-market, international trade, firms behavior

1 Introduction

The paper investigates the pricing behavior of firms operating in foreign markets by looking at export prices set by French, German and Italian exporters for a large number of products and destinations. A large literature has established that firms often absorb part of exchange rate fluctuations in their own margins in order to limit the impact of such shocks on the price faced by foreign consumers. Moreover, this behavior is often

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found not to be homogeneous across destination markets, a phenomenon usually labeled as pricing-to-market (PTM). There are several different reasons to rationalize such pricing strategies by profit maximizing firms, among which the existence of different demand price elasticities, and of different market conditions (degree of competition) stand out.

We argue that firm decide to internalize part of exchange rate changes, i.e. to price-to-market only when they have not enough market power to pass them through to final consumers, a choice that can be easily rationalized in terms of the need to conquer or preserve market shares. Hence, a better understanding of PTM strategies of exporting firms can shed light on the external competitiveness of an economy. Our detailed comparison of French, German and Italian export prices represents the first contribution of the paper as it allows us to draw some inference on the competitive position of the three countries in the last three decades.

Most works on the issue focus only on some sort of estimates of the elasticity of export prices to the exchange rate; on the contrary, we make one further step and investigate also the dynamics of profit margins, i.e. the part of the price that does not depend neither on production costs nor on the exchange rate. This focus is new to the literature and is a second way of contributing to research on the topic.

More precisely, our empirical specification postulates that the export price is determined by a mark-up over the marginal cost. A fixed time effect over all destination markets proxies for the marginal cost or, better, for the average of all marginal costs faced by the firms locate in a give country exporting a given product. The difference between the marginal cost and the export price is then made up of two parts. The first depends on exchange rate variations and it is often referred to as signaling PTM. The second is a fixed effect depending only on the destination: this gives information about the profit margins of firms on that particular export market. Our empirical analysis is based on export unit values for a sample of 178 manufactured goods commonly exported by France, Italy and Germany to 35 destination markets (which are again common to the three source countries) over the last three decades (1973–2003).

Contrary to what is usually reported in the literature, PTM is not widespread among French and German exporters, and concerns around one third of products exported by Italian firms. Also, the standard claim that PTM behavior displays strong product specific features needs to be better specified: while we also find that PTM coefficients vary with products, our results suggests that export pricing is mainly determined by the characteristics of source and destination markets. This appears to be true both for the part of export price variation that responds to exchange rate changes and for profit margins.

The paper is organized as follows: next section contains a brief overview of the literature, while our empirical methodology is presented in section 2, and the data in section 4. A detailed discussion of results is offered in section 5, after which we perform some robustness tests in section 6. Finally, section 7 draws some conclusions and outlines possible future research.

2 A glance at the literature

The empirical literature has uncovered a widespread PTM behavior by exporting firms: this a pricing strategy aimed at selling the same product at different prices in different markets. Since the seminal work by Krugman (1987) exchange rate variations have been identified as one of the major causes of this behavior. Subsequent theoretical analysis has established that in presence of segmented markets and of a non constant elasticity of demand a monopolist shipping its products to several markets will adopt a PTM strategy (Goldberg, 1995; Bergin and Glick, 2005). More generally, when the exporting firm chooses voluntarily not to pass-through all exchange rate variations and so to stabilize prices in local (consumers) currency —either because of the need to defend its market share (as in Froot and Klemperer, 1989), or for reputation motives (as in Krugman, 1987)— then export to non integrated markets will translate into price differentials. Moreover, the variation in export prices expressed in the exporter's currency will have as a counterpart a variation of the profit margin of the opposite sign, which will depend on the exchange rate change.

This kind of behavior has been documented by leans of a number of empirical studies.[1] Complete pass-through of exchange rate changes into import prices is strongly rejected at short horizons, whereas in the long-run it becomes sensibly larger and approaches unity. An incomplete pass-through implies a PTM strategy, whereas when the import price moves one-to-one with the exchange rate there is no PTM. The empirical literature claims that the PTM behavior has a product specific dimension (Knetter, 1993; Gil-Pareja, 2000; Parsley, 2004), meaning that the degree of reaction of export prices to exchange rate variations is not uniform and varies sensibly with products exported by the same country. More in detail, PTM appears to be less diffused for differentiated products (Stahn, 2006). Some sort of consensus exists as well on the notion that export country characteristics matter, and in particular most studies find that US exporters do not adopt a PTM strategy (Mann, 1986; Knetter, 1993; Goldberg and Knetter, 1997; Gordon et al., 2002). Moreover, it seems that the degree of PTM depends negatively on the market share enjoyed in the destination market (Froot and Klemperer, 1989; Feenstra et al., 1996; Asplund et al., 2001) as well as on the size of the latter(Gaulier et al., 2006).

In truth, the claim that product specific characteristics are (among) the main deter-

[1] See for instance Knetter (1989); Gagnon and Knetter (1995); Adolfson (1999); Gordon et al. (2002); Mahdavi (2002); Campa and Goldberg (2002); Gaulier et al. (2006). Goldberg and Knetter (1997) represents an excellent review of early work on the subject.

minants of PTM appears not to be very well founded. In particular, it is difficult to find product specific PTM coefficients that are independent of the source country; in other words, while one does see that the PTM coefficient differ for different products, one does not detect any true regularity common to different products exported from different countries.[2]

For what concerns price-cost margins, works focusing on export margins are very few. Theoretical models based on imperfect competition predict that increased competition due to economic integration leads to a cut in profits and therefore exerts a downward pressure on margins. Moreover, margins on foreign sales are supposed to be lower than domestic ones because of higher competition. Bernstein and Mohnen (1991) and Moreno and Rodríguez (2004) find results consistent with this view using data on Canadian and Spanish firms respectively.

3 Specification and empirical strategy

The empirical specification we will be following in the analysis builds on Knetter (1989) and embodies the basic idea that with imperfect competition the price set by the exporter is its own currency is a mark-up over marginal cost, with the former being determined by the elasticity of demand in each destination market. Hence, Knetter (1989) proposes a decomposition of the export price into the marginal cost and a mark-up made up of two parts: one depending on exchange rate variations and one being destination-specific. In order to actually use this framework, one should be able to measure either the marginal cost or the mark-up. Knetter (1989) solves this problem by adopting a fixed effect regression model of the form:

$$\ln p_{jt} = \theta_t + \lambda_1 + \ldots + \lambda_J + \beta \ln s_{jt} \tag{1}$$

where the time effect θ_t measures the marginal cost as it captures the part of the export price that is common across all destinations but varies over time. The residual variation in the data represents then the mark-up, which can be divided into a part driven by exchange rate variations, and one that is destination-specific. The fact that the mark-up depends on exchange rate fluctuations results from the decision by the exporter to stabilize prices in the buyer's currency by absorbing part of the price change due to exchange rate movements. This in turn implies an incomplete pass-through. Now, although the phenomenon under scrutiny is the same, a sort of habit has emerged in the empirical literature whereby studies analyzing the impact of exchange rate variation on *import* prices label the phenomenon

[2] In the first comparative study on the subject Knetter (1993) test the null hypothesis of equality across of PTM coefficients for Germany, Japan, the UK and US on a product by products basis. He cannot reject it, yet his study is limited to only 7 products that although 'comparable' are not strictly the same.

exchange rate pass-though, whereas those focusing on *export* prices name it *pricing-to-market* (see Goldberg and Knetter, 1997).[3]

Throughout the paper we will use a specification in first differences (as in Knetter, 1993) to account for the fact that series are nonstationary. Thus the model becomes an analysis of covariance model whereby export price variations are explained by a time specific effect common to all destinations (θ_t), a destination specific effect (λ_j), and a part resulting from exchange rate changes.[4] The main difference with respect to the specification adopted in Knetter (1993) is that we do not assume the mark-up to be constant over time, so that the destination specific terms appear also when the model is specified in first differences. It is worth stressing that neither equation (1) nor the following ones that we will actually estimate, aims at explaining *why* export prices move the way they do, or to look into the *determinants* of PTM. What the model allows one to do is rather a *decomposition* of export price changes into marginal costs shocks and mark-up changes.

Our empirical strategy is threefold: we start from a pooled regression where for each of the export countries we analyze the behavior of export prices over all products and all destination markets:

$$\Delta \ln p_{kjt} = \theta_{kt} + \lambda_1 + \ldots + \lambda_J + \beta \Delta \ln s_{jt} + \varepsilon_{kjt} \ . \tag{2}$$

Here p_{kjt} is the export price of product k sold in destination j at time t, while s_{jt} represents the bilateral exchange rate between the source country (France, Germany or Italy) and the destination j at time t. The λs are assumed to be destination specific, which implies that different products shipped to the same destination are characterized by the same (change in the) profit margin.[5] As it is clear, equation (2) provides us with an average behavior over all products and destinations; while this allows us to draw a first interesting comparison between the three export countries, it nonetheless hides important details on the difference across products and destinations.

As the literature often claims that PTM behavior by exporting firms is product specific, our second step entails applying the export price decomposition to each product separately, so that the estimating equation becomes:

$$\Delta \ln p_{jt} = \theta_t + \lambda_1 + \ldots + \lambda_J + \beta \Delta \ln s_{jt} + \varepsilon_{jt} \tag{3}$$

[3]The main difference in the two streams of the literature concerns the focus of the analysis, which concerns the behavior of exporting firms in multiple markets in the case of PTM, whereas ERPT is more focused on the effect of exchange rate shocks on domestic prices.

[4]As Knetter (1993) points out, the time effect captures primarily shocks to the marginal cost of the producer, but also changes in the mark-up that are common to all destinations.

[5]This assumption is mainly driven by technical reasons: letting λs be destination and product specific would generate a set of dummy variables too large to be handled and therefore prevents the estimation.

where the notation has the same meaning as before and is therefore self-explanatory. Equation (3) delivers an estimated β coefficient and a set of estimated λs for each product.[6]

Finally, we complete our investigation by pooling data by product and running separate regressions for each destination market. This latter specification provides us with a description of the average PTM behavior over all products for partner country. Hence, it represents a logical complement of the analysis by product and it grants us the possibility to analyze the presence of destination specific effects. When we run a regression for each destination, the exchange rate becomes a time specific effect, so that it is no longer possible to use time dummies to capture marginal costs. To obviate this, we adopt the same strategy as Gaulier et al. (2006) and proxy marginal costs by means of a time trend:

$$\Delta \ln p_{kt} = t + \lambda_1 + \ldots + \lambda_K + \beta \Delta \ln s_t + \varepsilon_{kt} \tag{4}$$

Also, in equation (4) the λs assume the function of product specific effects and therefore represent the part of export price variation that does not respond to exchange rate changes but is rather specific to each product.

Throughout the empirical analysis we drop observations characterized by an (annual) exchange rate variation larger (in absolute value) than 50 per cent: the rationale for this is the desire to focus on the pricing strategies of exporting firms under normal conditions, abstracting from extreme episodes possibly due to sharp devaluations or exchange rate collapses that are likely to have disruptive effects.

4 Data

The analysis is based on manufacturing 178 products exported from France, Germany and Italy to 35 destination markets between 1973 and 2003, as collected in the OECD *International Trade by Commodity Statistics* (ITCS). Export prices not being available, we employ export unit values obtained dividing the value of exports by their volume for each specific product. Unit values are good approximation of export prices only at highly disaggregated level: we therefore focus on 5-digit data, the finest level available using the SITC Rev. 2 classification (which is the only classification system allowing us to get consistent data from 1973 onward).[7]

As one of the goals of our paper is to provide a detailed and systematic comparison of PTM behavior between France, Germany and Italy, we have assembled a sample of products and destination markets that is *common* to the three exporting countries under

[6] The actual number of regressions (and hence results) for each source country can be smaller that 178 as we do not consider those with less than 100 degrees of freedom.

[7] Two problems remain. First, unit values changes reflect not only prices changes but also composition changes due to shifts in import demand. Second, unit values reflect also quality changes which are impossible to track.

consideration. The 178 products have been selected on the basis of their importance within the export structure of each source country, and basically represent the common pool of the most exported 200 manufacturing products. Destination markets have been selected to represent a significant portion of the main clients of the three exporting countries. Working on such a long time span poses some problems with respect to this, as favorite destination markets changed significantly in the last 30 years. In order not to limit ourselves to the first obvious and almost unchanged 10 partners, we have put together a list of 35 destination markets covering between 80 and 90 per cent of total export. We have tries to grant a broad geographic coverage including, beside the obvious European partners, the US and Japan, also a few South American and African countries, as well as some Asian markets whose importance has rapidly expanded in the last decade.

In addition to export unit values we build an exchange rate variable against the French franc, the Deustche mark, and the Italian lira starting from the domestic currency/US dollar rate taken from various versions of the Penn World Tables. For euro area member countries, the post-1999 exchange rate series is a notional figure obtained converting the euro/dollar rate back into the (dismissed) national currency using the permanently fixed conversion rate against the euro. A real exchange rate (used in the robustness analysis) is also built for most countries using producer price indexes IFM *International Financial Statistics*.[8]

5 Results

We move now to the core of the paper, where we present our results and try attach an economic interpretation to them. Unlike the other studies on the subject, we do not limit ourselves to study the estimated PTM coefficients (βs) of the different regressions, but exploit also the information on the λs, which we label profit margin even if in truth it represents the part of the variation in mark-up that is destination specific and does not respond to exchange rate variations. In what follows we will then present at first results concerning the PTM behavior (i.e. results on the estimated βs) for the three aforementioned specifications, and then move to describing results for the λs.

5.1 Pricing-to-market behavior

5.1.1 Pooled regression

Estimation results on the pooled dataset reveal a significant PTM behavior for the three export countries, although a clear heterogeneity emerges among them, with the value of

[8] Time coverage varies by country. French data refer to the producer price of intermediate goods, data for Thailand are from the Bank of Thailand, whereas for Taiwan they come from the Groningen Growth and Development Centre *60 industry database*.

the β being much larger for Italy than for France and Germany (see table 1). The small difference registered between the latter two countries is nonetheless statistically significant as a t-test rejects the null hypothesis of the two coefficients being equal.

Table 1: PTM behavior: pooled regression

		Chow stability test[a]	
country	estimated β	p-value	result
France	- 0.10***	0.29	cannot reject
Germany	- 0.17***	0	reject
Italy	- 0.44***	0.84	cannot reject

a. the breakpoint is assumed in 1990

Results reported in table 1 are consistent with the rejection of the hypothesis of complete pass-through that finds widespread validation in the literature (see for instance Goldberg and Knetter, 1997). Also, results appear in line with previous empirical evidence for the three countries under consideration: Falk and Falk (1998) estimate a coefficient of -0.18 over the period 1990–1994, while Stahn (2006) reports a PTM coefficient for Germany ranging between -0.03 and -0.19 over the period 1976–2004; results for Italy (Basile et al., 2006) give a β coefficient of -0.34. The higher value found for Italian exports is consistent with two possible phenomena, which are not necessarily mutually exclusive: on one hand this could mean that PTM is less often adopted by French and German exporters vis-à-vis their Italian counterparts, on the other hand a higher PTM coefficient may also result from the decision to pass-through a lower share of exchange rate variations to final consumers.[9]

To study whether the reaction of export prices to exchange rate variations has changed over time we perform a Chow test for stability postulating the existence of a structural break in 1990.[10] The null hypothesis of stability is strongly rejected in the case of Germany, whereas p-values for France and Italy are far from being significant.

5.1.2 Regression by product

When we pool over all destination markets (and therefore estimate one equation for each product) we observe that the majority of estimated βs are not significantly different from zero. More specifically, table 2 shows that only 23 products over 151 display significant

[9] Gaulier et al. (2006) claim that German exporters are relatively not very inclined to adopt a PTM strategy.

[10] Beside cutting the sample in two piece of approximately equal length, 1990 represents also the year of German unification, which represented a major shock not only for Germany itself but also for its main trading partners.

PTM behavior for France, a number that grows to 41 over 164 for Germany and 41 over 156 for Italy. Hence, only a small share (ranging from 15 to 26 per cent) of products exported by the three countries is characterized by PTM behavior. The postulated (in the existing literature) product effect seems not particularly relevant in our sample, as for only 3 products we find significant PTM in all the three source countries (while for 53 products the estimated coefficient are simultaneously not significant).

Table 2: PTM behavior: regression by product

country	regressions	significant βs[a]	stability test[b]	poolability test
France	151	23 (18)	9 rejections	cannot reject
Germany	164	41 (34)	18 rejections	cannot reject
Italy	156	41 (40)	21 rejections	reject

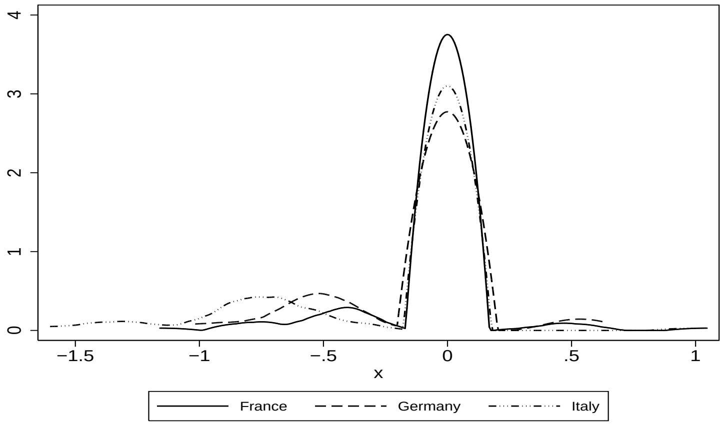
a. number of negative and significant βs in parenthesis

b. the breakpoint is assumed in 1990

The usual stability test is performed on each single regression and results suggests no structural break in most of the cases, not even for Germany. Last, we also run a Chow test for poolability to test the null hypothesis of equality of the βs across products: in other words we test whether the pooled specification (2) can be considered a good representation of the average behavior in each export country or, on the contrary, the constraint imposed by assuming an homogeneous PTM coefficients for all products delivers a distorted picture. The last column of table 2 suggests that poolability can only be rejected in the case of Italy, whereas the degree of heterogeneity across products is not enough to reject it for France and Germany. This finding as well questions the standard result of PTM being a product specific phenomenon. One possible explanation to this is the fact that most previous studies did not work on a common sample of products and destinations, and also that the number of products included in the studies was rather limited.

Figure 1 provides one with a good representation of the results obtained in the specification by product: it represents the distribution (in terms of a kernel density plot) of estimated βs for each exporting country. It is easy to see that the majority of coefficients are not significantly different from zero, and those who are significant have the expected negative sign. Moreover, the three distributions display a second much lower modal value for negative values the PTM coefficients, with the peak being leftmost for Italy, consistent with our previous findings. The comparison between the three distributions can be formalized by means of a Kolmogorov-Smirnov test, where the null hypothesis of equality of distributions is tested for each country pairs. Results (not reported but available upon request) tell that it is not possible to reject the null of equality when we compare the French and the German distribution, whereas this is the case when the comparison

Figure 1: Distribution of $\hat{\beta}$: regression by product



involves Italy and France (p-value 0.005) and Italy and Germany (although in this latter case one rejects at 10% but not at 5%). This suggests that the behavior of Italy does display an idiosyncratic behavior with respect to Germany and France, which are closer among themselves.

5.1.3 Regression by destination

Table 3 reports results obtained from the estimation of equation (4). We see that this time between 60 and 90 per cent of regressions are characterized by a significant PTM coefficient, and that the latter has always the expected negative sign. Italy displays the largest number of significant coefficients, consistently with the idea of its exporters adopting more often a PTM strategy. The presence of a structural break is detected in very few of the regression equations, supporting what we have found in the regression by product and suggesting that this is not a very relevant issue. On the contrary, poolability is strongly rejected by the data so that the PTM strategies adopted by French, German and Italian exporters appear to be strongly influenced by the characteristics of the destination market.

Interestingly enough, there are 13 (out of the possible 34 common destinations) cases where a significant PTM coefficients is found for the three exporting countries simultaneously, plus 2 destinations for which PTM is not applied by any of them. Hence, in almost 50 per cent of the cases our analysis uncovers an homogeneous behavior by French, German and Italian exporters. Among the 13 aforementioned destinations characterized by a significant β, the coefficient is largest (in absolute value) for Italy.[11]

[11] A few instances occur where the estimated PTM coefficient is larger than 1, thus hinting to an over-reaction of export prices to exchange rate variations. This uncommon behavior is nonetheless quite rare

Table 3: PTM behavior: regression by destination

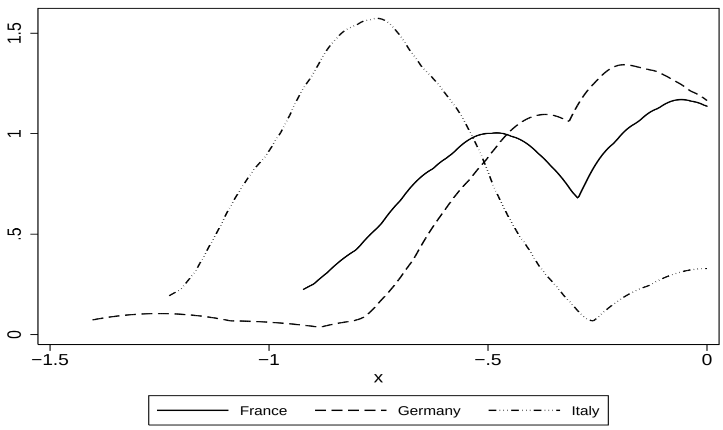
country	regressions	significant βs[a]	stability test[b]	poolability test
France	35	20 (20)	3 rejections	reject
Germany	35	21 (21)	1 rejection	reject
Italy	35	31 (31)	4 rejections	reject

a. number of negative and significant βs in parenthesis

b. the breakpoint is assumed in 1990

Figure 2 shows the kernel density estimate of the distribution of β coefficients for the three export countries. Once again one can appreciate the different behavior of Italy vis-à-vis France and Germany: the modal values is shifted to the left, thus corresponding to higher (in absolute value) PTM coefficients, and the corresponding peak of the distribution is higher than for the other two countries, thus suggesting that it occurs with higher frequency. As before, we also compute a Kolmogoro-Smirnov test for equality of distributions on the three country pairs and still find that the distribution of βs for Italy is different from those of the other two countries; on the contrary, we cannot reject the null of equality among the French and the German distribution.

Figure 2: Distribution of $\hat{\beta}$: regression by destination



5.2 The evolution of margins: lambdas

We move now to explore the dynamic of the profit margin, i.e. the part of the change in the export price that does not depend on exchange rate changes and that is destination (or product) specific.

and, also, is not new to the empirical literature and therefore does not spoil our results.

5.2.1 Pooled regression

Estimation results for equation (2) are reported in table 4: we find that only for France the growth rate of profit margins has been significantly different from zero for the vast majority of destination markets. Moreover, estimated λs are all positive testifying for an increase in the mark-up during the last three decades. An F-test on the equality of the λs cannot be rejected in the case of France, suggesting that the dynamic of profit margins has been homogeneous over all destinations. The picture is rather different for Germany and Italy, which are characterized by few significant λ coefficients: 7 out of 35 in the former case, only 2 for Italy. Also, the sign of significant coefficients is negative in the regression for Germany, whereas the two λs display different sign in the case of Italy. The small number of significant coefficients is probably the driving force behind the rejection of the null hypothesis of equality of the λs for Germany and Italy, although those few coefficients do have the same order of magnitude.

Table 4: Evolution of profit margins: pooled regression

country	significant λs	sign	F-test[a]
France	30/35	positive	cannot reject
Germany	4/35	negative	reject
Italy	2/35	mixed	reject

a. H_0: equality of λs within regressions

5.2.2 Regression by product

When we estimate equation (3) we end up with a set of 35 λs for each product. This results in almost 5500 estimated coefficients for each exporting countries and forces us to discuss results in aggregate terms and omit most of the details. To present our findings in the clearest possible form we consider each set of λs (i.e. each regression) as a single item and only investigate what happens inside each regression by means of an F-test on the equality of λs.

Table 5 presents, for each exporting country, the number of regressions actually estimated (which falls short of 178 because we dropped products with less than 100 degrees of freedom) together with the number of them characterized by none of the estimated λs being significant, the number of regressions with less than 10% of λs being significant and, finally, those with at least 75% of them being significant. In this latter case the table reports also (in parenthesis) the number of regressions characterized by positive λs.[12] As one can see by summing the three items, we observe a bimodal distribution in the sig-

[12] We have observed that when most of the estimated λs are significant, they display the same sign.

nificance of the estimated λs, whereby either the vast majority of them is significant or almost none of them is different from zero.

Table 5: Evolution of profit margins: regression by product

		significant λs[a]			
country	regressions	none	$< 10\%$	$> 75\%$[b]	F-test
France	151	105	28	15 (6)	5 rejections
Germany	164	90	44	20 (13)	5 rejections
Italy	156	56	47	41 (20)	25 rejections

a. each column reports the number of regressions characterized by none, less than 10% or more than 75% of the λs significantly different from 0

b. in parenthesis the number of regressions where at least 75% of the λs are significant and positive

Table 5 shows that most of the estimated λs are not significant, suggesting that the profit margins have not moved a lot beside over and beyond the change due to variations in production costs. In fact, if we sum the number of regressions for which less than 10% of the coefficients are significant with those characterized by none of them being different from zero, we can see that the share is as high as 88% for France, reaching 80% for Germany and still 66% for Italy. The latter country displays the largest number of regressions with most of the λs different from zero (41), half of which are positive. France and Germany as well display a dynamic of profit margins that changes sign depending of the specific products, with the share of negative and positive sign being almost equal. A first look at results from the F-test for the equality of λs within each regression suggests that the null hypothesis is not often rejected; nonetheless a closer look indicates that when most of the estimated λs are significant, rejection occurs between 25 and 50% of the times. Hence, some sort of price discrimination seems to actually occur: when profit margins display a nonzero rate of change, they move differently in the various export markets considered in the study.

To compare the behavior of profit margins across different products we reason in terms of statistical distributions and consider the set of estimated λs associated with each product as a random draw from a population, and test the null hypothesis of the different samples coming from a unique population. This is done by means of a nonparametric Friedman test: the p-values of the tests (not reported) do not allow us to reject the null and therefore suggest that even for profit margins there is no clear product specific effect.

5.2.3 Regression by destination

Turning to the specification by destination we find, as we did with respect to PTM coefficients, that many more regression equations display significant λs. Recall that as specified in equation (4), λ coefficients are product specific, so for each of the 35 destination markets there is a set of 178 λs.

Table 6: Evolution of profit margins: regression by destination

		significant λs[a]			
country	regressions	none	$< 10\%$	$> 75\%$[b]	F-test
France	35	7	0	28 (28)	never reject
Germany	35	18	1	16 (16)	never reject
Italy	35	11	3	21 (21)	1 rejection

a. each column reports the number of regressions characterized by none, less than 10% or more than 75% of the λs significantly different from 0

b. in parenthesis the number of regressions where at least 75% of the λs are significant and positive

As table 6 reports, the specification by destination generates a clear-cut distinction between regressions characterized by significant coefficients and those where the latter are not significant. In other words, the feature by which either (almost) all of none of the estimated λs are significant gets amplified in the present context. We find that for France 80% of the regressions displays coefficients significantly different from zero, a share that goes down to 60% and 40% for Italy and Germany, but remains nonetheless higher than the corresponding figure in the regression by product. When significant, the change in the profit margin is always positive; in addition to that the null hypothesis of the various coefficients being equal among them within each regression cannot be rejected save once in the case of Italy.

The Friedman test is applied also to the estimated λs from the regression by destination and leads us to strongly reject the null hypothesis of the different sets of coefficients coming from the same population. In other words we find that the behavior of profit margins is not homogeneous across destination markets, something that is consistent with our previous results.

Table 7: PTM behavior: results using weighted OLS

Panel I – pooled regression

country	estimated β
France	-0.22***
Germany	-0.16***
Italy	-0.44***

Panel II – regression by product

country	regressions	significant βs[a]	stability test[b]
France	151	70 (66)	31
Germany	164	77 (70)	16
Italy	156	98 (96)	13

Panel III – regression by destination

country	regressions	significant βs[a]	stability test[b]
France	35	26 (24)	13
Germany	35	29 (28)	5
Italy	35	35 (34)	15

a. the breakpoint is assumed in 1990

b. number of negative and significant βs in parenthesis

6 Robustness analysis

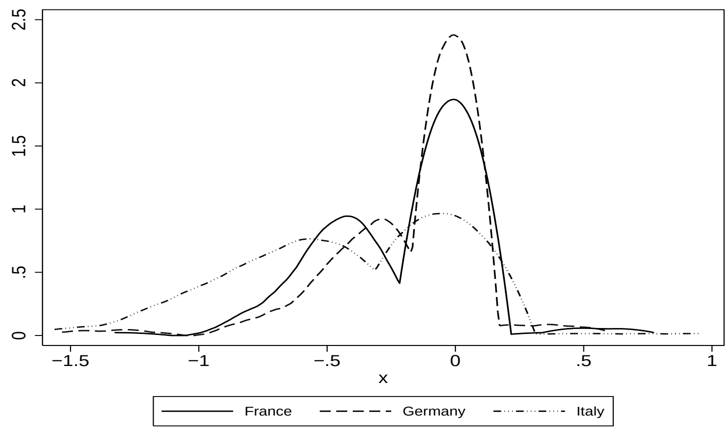
6.1 Weighted OLS

We test the robustness of our results by applying weighted OLS regression to our data (as in Gaulier et al., 2006). This allows one to control for the relative importance of each product and destination when estimating βs and λs. For each source country and each year, weights are based on the value of each bilateral flow normalized to the relevant total amount of trade in the dataset. Hence, denoting with X_{jkt} the value of export of product k shipped to country j in year t, weights for the pooled regression are just $\frac{X_{jkt}}{\sum_j \sum_k X_{jkt}}$, i.e. the value of export divided by total exports of all products to all destinations in time t. For the specification by product observations are weighted by total trade in each year and product (so that the denominator becomes $\frac{X_{jkt}}{\sum_j X_{jkt}}$), whereas in the regressions by destination total trade means the sum of all exports shipped to that destination in that year ($\frac{X_{jkt}}{\sum_k X_{jkt}}$).

Results for the PTM coefficients are reported in table 7. For what concerns the pooled regressions, the only relevant change is the inversion in the ranking between France and Germany, the latter now displaying the smallest coefficient (0.16 compared to 0.22 for

France and 0.44 for Italy). The difference lies mostly in the change experienced by the French coefficient as the other two estimated βs are almost identical to those reported in table 1: we continue to find that PTM is much more widespread among Italian exporters.

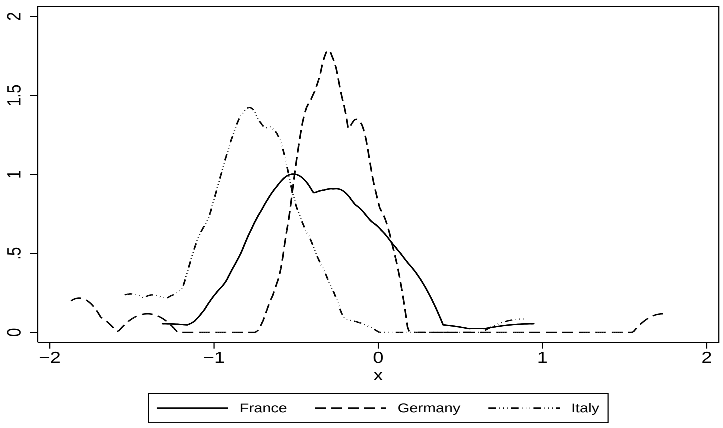
Figure 3: Distribution of $\hat{\beta}$: weighted regression by product



The specification by product (panel II of the table) yields many more significant coefficients than before. We still find a rather similar behavior for Germany and France for which around 45% of regressions display a significant coefficient; this share goes up to above 60% in the case of Italy. Almost all βs have the expected negative sign, and stability is not often rejected (only around 10 to 20% of the times). Figure 3 reports the kernel density estimate for the distribution of the estimated βs: the difference between Italy and the other two countries is more marked than before (see figure 1), especially for what concerns the right peak around zero, which is much lower and thick, and the "fatness" of the left tail. As before, a Kolmogorov-Smirnov test on the equality of the distributions rejects the null of equality when Italy is compared with the other two countries, whereas it cannot reject equality between the French and German distributions.

Finally, panel III contains results form the specification by destination. Here again weighted OLS result in more significant PTM coefficients: in particular we find that all estimated βs are significant for Italy, 26 out of 35 for France and 29 for Germany. The distributions of the coefficients is depicted in figure 4: contrary to our previous findings weighted analysis yields quite different distributions for France and Germany. Formal testing carried out by means of a Kolmogorov-Smirnov test confirms the visual impression and this time it leads to reject the null of equality between the two distributions, so that none of them is equal to another. Italy is still characterized by a distribution shifted to the left and displaying a thicker left tail. Nonetheless we still find a lot of symmetry in the PTM strategy adopted by exporters operating in the three exporting countries. In fact the number of destinations characterized by a significant PTM coefficient irrespective of the source of exports reaches 21 out of 34 potential markets. Among these, in 13 cases the Italian coefficient is the largest (in absolute value).

Figure 4: Distribution of $\hat{\beta}$: weighted regression by destination



Overall the picture that emerges with respect to PTM behavior is similar to that we had obtained using plain OLS estimation. Coefficients are more often significant, but still there is a big gap between the specification by product, where less than one half of the regressions displays a nonzero β, and that by destination, which appears to be more informative.

Table 8 summarizes results on the dynamics of the profit margins obtained using weighted OLS regression analysis. For what concerns the pooled regression, panel I of the table suggests that on average profit margins have not moved in any significant beyond the change dictated by exchange rate changes and cost shocks.

The specification by product tend to confirm this impression as between 97 and 98% of regressions are characterized by either none or less than 10% of the λs being significant. On the other hand, in panel III we see that running one regression for each destination market (and pooling over all products) yields many significant results. For France we have 25 regressions with at least 75% of the λs being significant and positive; this number is similar to the German figure (22), though the sign of the coefficients varies depending on the destination and is positive in 13 cases. Italy displays the highest share of regressions with significant coefficients (30) and, as for France, most of the destination markets are characterized by growing profit margins.

Finally, while for what concerns the specification by product a Friedman test does not allow us to reject the hypothesis that different λs come from the same population, this homogeneity is strongly rejected in the case of the regressions by destination. Once

Table 8: Evolution of profit margins: results using weighted OLS

Panel I – pooled regression

country	significant λs	sign
France	0	–
Germany	0	–
Italy	3	positive

Panel II – regression by product

		significant λs^{a}			
country	regressions	none	$< 10\%$	$> 75\%^{b}$	F-test
France	151	127	22	1 (0)	25 rejections
Germany	164	154	7	3 (2)	37
Italy	156	150	2	3 (1)	16

Panel III – regression by destination

		significant λs^{a}			
country	regressions	none	$< 10\%$	$> 75\%^{b}$	F-test
France	35	7	2	25 (25)	25
Germany	35	12	1	22 (13)	28
Italy	35	3	1	30 (29)	24

a. each column reports the number of regressions characterized by none, less than 10% or more than 75% of the λs significantly different from 0

b. in parenthesis the number of regressions where at least 75% of the λs are significant and positive

again our results confirm the claim that export pricing strategies tend to be determined primarily in a destination specific fashion rather than on the basis of product specific characteristics.

6.2 Real exchange rates

So far we have been investigating the role of *nominal* exchange rate changes on export prices. We claim that this is the most rational choice as we wish to separate cost shocks from destination specific (demand) effects. Some authors have nonetheless used real exchange rate changes (for instance Penkova, 2005; Gaulier et al., 2006) so that we have decided to follow this path as well in order to test the robustness of our results (Parsley, 2004).

Table 9 reports results concerning the PTM coefficients for the three different specifications. The pooled regression gives roughly the same results, although this time the German coefficient is no longer significantly different from zero. On the contrary the esti-

Table 9: PTM behavior: results using real exchange rates

Panel I – pooled regression

country	estimated β	stability test
France	-0.09***	reject
Germany	-0.01	reject
Italy	-0.34***	reject

Panel II – regression by product

country	regressions	significant βs[b]	stability test[a]	poolability test
France	151	31 (23)	11	reject
Germany	164	23 (10)	15	reject
Italy	156	36 (32)	24	reject

Panel III – regression by destination

country	regressions	significant βs[b]	stability test[a]	poolability test
France	29	11 (10)	3	reject
Germany	29	18 (17)	2	reject
Italy	29	25 (24)	4	reject

a. the breakpoint is assumed in 1990

b. number of negative and significant βs in parenthesis

mated βs for France and Italy are very close to those reported in table 1 above. Another difference lies in the fact that a Chow stability test leads us to reject the hypothesis of structural stability for all the three countries.

Panel II of the table summarizes results obtained from the regression by product. Once again there is compelling evidence about the fact that pooling across all different destinations washes away most information and generate a rather blurred picture. Few coefficients are in fact significant (between 14 and 23 per cent), with Italy still displaying the highest percentage. The general picture is very close to the one obtained using nominal exchange rates and therefore confirm our previous discussion.

In panel III of table 9 we find results from specification (4), i.e. from the regression by destination country. The number of export markets falls short of 35 due to the fact that for a handful of countries we could not find a reliable PPI and therefore no real exchange rate series was calculated. Generally speaking results are again very similar to the original ones, although the share of significant PTM coefficients is now lower for each source country. Italy still displays the highest share followed by Germany and France, with almost all of the estimated β having the expected negative sign. Moreover, we continue to find symmetry in the PTM behavior of the three countries: 8 destinations (out of 28) are in fact characterized by a significant β independently of the source country, and in other 3 cases the estimated β is always not different from zero. As before, the Italian PTM coefficient is the highest of the three.

Table 10: Evolution of profit margins: results using real exchange rates

Panel I – pooled regression

		Chow stability test[a]	
country	significant λs	sign	F-test[a]
France	4	negative	accept
Germany	26	negative	reject
Italy	0	–	accept

Panel II – regression by product

		significant λs[b]			
country	regressions	none	< 10%	> 75%[c]	F-test
France	151	129	11	8 (2)	6 rejections
Germany	164	80	46	30 (11)	8 rejections
Italy	156	74	42	30 (19)	20 rejections

Panel III – regression by destination

		significant λs[b]			
country	regressions	none	< 10%	> 75%[c]	F-test
France	29	7	0	22 (20)	never reject
Germany	29	17	2	10 (8)	1 rejection
Italy	29	14	1	14 (13)	never reject

a. H_0: equality of λs within regressions b. each column reports the number of regressions characterized by none, less than 10% or more than 75% of the λs significantly different from 0

c. in parenthesis the number of regressions where at least 75% of the λs are significant and positive

Moving now to the dynamic of profit margins, the foremost change in the results contained in panel I of table 10 vis-à-vis those reported in table 4 above is that most estimated λs are no longer significant for France (and those significant are negative), whereas the opposite occurs for Germany who now displays many negative and significant coefficients. The regression by product (panel II) yields almost the same results as with nominal exchange rates and therefore still conveys the usual picture. Similarly, results from the specification by destination (panel III) are similar to those reported in section 5.2: profit margins display a positive and significant rate of growth for 75% of French export destinations, 30% of German, and 50% of Italian ones. Moreover, we still cannot reject the null hypothesis of the estimated λs being equal for the various products exported to each destination market.

7 Conclusion

The paper compares the export price strategies of three large European countries (France, Germany and Italy) using a large and common pool of manufacturing products and destination markets. Contrary to what is often reported in the literature, our results suggest that PTM is not widespread: this is especially true for French and German exporters. We find that on average Italian exporters adopt more often a PTM strategy and we interpret this as a sign of the weaker competitive position of that country in international markets, due to its specialization in traditional, lower-end products (see Faini and Sapir, 2005).

The specification by product does not add much, vis-à-vis the pooled regression, to our understanding of the phenomena under scrutiny: coefficients are seldom significant, so that pooling over all destinations for each single product seems to wash away most of the information contained in the data. Consistently with the previous literature we find that regression analysis for different products yields different PTM coefficients; nonetheless we find no regularity in terms of products when we compare the behavior of French, German and Italian exporters. Hence, we claim that product specific characteristics do not play a major role in determining the PTM behavior of exporting firms. On the other hand, the specification by destination is much more informative and it appears that export price changes are mainly determined in a destination specific fashion. Pooling across products exported to each destination market yields significant PTM coefficients more than 60% of the times.

Something similar applies to profit margins as well, with the specification by destination yielding many more significant estimates. Margins appear to move rather homogeneously across products, pointing to the fact that the price of exports shipped to the same destination tend to move in an homogeneous way. On the contrary, the hypothesis of an homogeneous behavior across countries (even for the same product) is strongly rejected. Within this latter heterogeneity, we find that on average profit margins have either remained stable or augmented in the last three decades, so that increased international integration seems not to have reduced firms market power. In conclusion we claim that export price changes are mainly determined on the basis of the characteristics of the source and of the destination markets.

Further research is needed to investigate and better determine the actual determinants of different pricing strategies of exporting firms. Our results, hinting to the interplay of source and destination country characteristics need to be further extended and systematized, with a particular focus on explaining the different behaviors we have documented in the present work.

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Appendix A Destination markets in the sample

Argentina	Germany[b]	Poland
Australia	Greece	Portugal
Austria	Hong Kong	Russia
Belgium-Luxembourg[a]	Hungary	Singapore
Brasil	India	Spain
Canada	Ireland	Sweden
China	Italy	Switzerland
Czech Republic	Japan	Taiwan
Denmark	Korea	Thailand
Egypt	Mexico	Turkey
Finland	Netherlands	UK
France	Norway	USA

a. considered as a single entity

b. up to 1990 West Germany only