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The market integration process under different regulatory regimes: evidence from the European car sector^{*}

Jacint Balaguer^{**}

Abstract

In this paper we investigate the European car market integration process by analyzing the evolution of cross-country differences in the degree of *Pricing-to-Market*. The study takes into account the pricing behavior of United Kingdom exporters from 1999m1 to 2009m1. Our preliminary results indicate that international price discrimination is a source of price dispersion within the euro area, and this implies the presence of market segmentation and significant divergences in the market structures perceived by exporter firms. Nevertheless, a dynamic analysis shows that differences in cross-country *Pricing-to-Market* are significantly unstable and support variations in market structures perceived by exporters. When we include data generated since the Block Exemption Regulation (1400/2002) came fully into force, results support convergence in cross-country pricing behavior. This outcome clearly contrasts with the evidence obtained for some control products and the previous period. These findings are consistent with the fact that the corresponding liberalization of the car distribution system has played an important role in progressing toward market integration.

Keywords: Pricing-to-Market, market integration, automobile exporters, location clauses.

JEL Classification: F13, F14, F15

Resumen

En este trabajo investigamos el proceso de integración del mercado europeo de automóviles analizando la evolución en las divergencias del “Pricing-to-Market” a través de distintos países de destino de las exportaciones. El estudio toma en consideración el comportamiento de precios de los exportadores de Reino Unido durante el período 1999m1-2009m1. Los resultados preliminares indican la presencia de discriminación internacional de precios como fuente de dispersión de precios en el área euro, lo que implica la presencia de segmentación de mercados y divergencias significativas en las estructuras de mercado percibidas por las empresas exportadoras. No obstante, el análisis dinámico muestra que las divergencias en el “Pricing-to-Market” son inestables lo que implica variaciones relativas en las estructuras de mercado percibidas por los exportadores. Cuando en el análisis incluimos información estadística a partir de la implantación completa de las *Exenciones en Bloque* (1400/2002), obtenemos convergencia en el comportamiento de precios a través de los países. Este resultado contrasta claramente con la evidencia obtenida a partir de algunos productos de control y el período anterior. Los resultados son consistentes con que la liberalización del sistema de distribución haya jugado un papel relevante en el proceso de integración del mercado.

Palabras clave: “Pricing-to-Market”, integración de mercado, exportadores de automóviles, cláusulas de localización.

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^{**} J. Balaguer: University Jaume I. E-mail: coll@eco.uji.es

1. Introduction

Over the last two decades the European Commission has implemented a great body of regulatory legislation with the aim of facilitating market access for goods and promoting further market integration. This has been especially relevant in certain sectors on account of their economic importance and large repercussion on consumers. The motor vehicle sector is the one that has received the most attention, and even more so since the elimination of checks at internal borders in January 1993. Since then, the market has been monitored to check for differences in automobile prices across European Union (EU) countries.¹ The monitoring reports have revealed information that is useful to detect certain difficulties in car distribution and to propose corrective actions. The first group of reports shows that, in general, price dispersion (net of tax) has gradually been reduced. However, this global trend toward a reduction in price differentials disappeared around 1999. This was a worrying phenomenon because at that time price divergences on new cars continued to be substantially high even within the euro area.

In view of this situation, the European Commission sent different questionnaires out to interested parties (i.e. car manufacturers, associations of consumers and dealers) and commissioned several descriptive studies from external consultants.² The answers and documents thus obtained helped to reveal a series of shortcomings that hinder the internal market. An evaluation report was then published in November 2000 which pointed out that the main problems probably arose from the specific regulatory regime in the automotive sector. It was indicated that competition between distributors was not strong enough and that they remained too dependent on the control by producers. More specifically, the Commission's evaluation report identified the well-known "location clause" included in contracts between car makers and dealers as the main obstacle hindering competition among distributors. The clause prevented dealers from taking advantage of business opportunities by opening up outlets in EU countries where prices are higher. In order to accomplish more competition so that automobile consumers could benefit from the *European Single Market Program*, an in-depth reform of the approach to automotive sales was undertaken with the adoption of the *Block Exemption Regulation* (BER) 1400/2002. The change in the legal framework became fully operative in October 2005 with the abolition of "location clauses". The elimination of

¹ These took the form of bi-annual reports until May 2007, and from then on they have been published once a year.

² External studies and price reports are on the Commission's website at http://ec.europa.eu/competition/sectors/motor_vehicles/overview_en.html.

this “real barrier” possibly eased the way for the appearance of a process of reduction in market segmentation and greater similarity in the market structures across countries.

The cross-border integration of markets has attracted a great deal of attention not only from policy-makers, but also from academic economists. An increasing interest in researching this issue has arisen since the adoption of the euro in the eleven founding member states of the European Monetary Union in 1999. The key question is whether this “natural experiment” leads to further market integration for goods. In general, the hypothesis is based on the idea that the introduction of the euro implies greater price transparency within the region, which is in turn associated with lower arbitrage costs.³ However, there is no substantial evidence to support this hypothesis. This is at least the case of the automobile sector, where data collected until the early 2000s has been used.

Some representative works provide a complete empirical analysis of this question. On the one hand, Engel and Rogers (2004) considered a great variety of detailed products in several European cities (from 1990 to 2003) and obtained robust evidence in favor of a continuous reduction in consumer price dispersion throughout most of the 90s. This outcome contrasts with the results for the period after January 1999. Even after controlling for an important number of factors (those that might affect price deviations across European cities), the authors found that the introduction of the euro did not seem to matter. In this paper, as a possible explanation, it is suggested that the expected effect has still not been captured because research had to be carried out on a very small time window. A second possible answer that would make the results understandable is that most markets for consumer products were already highly integrated when the euro was introduced. Nevertheless, as the authors indicated, even under this assumption the car sector would be a clear exception in line with the paper by Goldberg and Verboven (2004). On the other hand, then, Goldberg and Verboven’s paper carries out an in-depth analysis of the possible convergence of car price dispersion in EU countries (from 1993 to 2003). It reveals that, at the beginning of the 2000s, cross-country price differences remained large and the introduction of the euro played a smaller role in price dispersion. Hence, price-setting for cars still depended significantly on each local structure rather than on overall market structure. These results are interpreted as a high degree of segmentation of the European car markets, which is in turn mainly attributed to legal obstacles hindering cross-border trade and the location of retail selling firms. As in Goldberg and Verboven (2001) and Goldberg and

³ Another mechanism that can promote it has also been investigated. Thus, the theoretical paper by Friberg (2003) indicates that alternative mechanisms, such as lower incentives for endogenous segmentation of markets, may have a bigger impact.

Verboven (2005), the authors claimed that the European Commission's specific efforts to increase integration within the car market are necessary. Together with the expediency of a policy for tax harmonization, the liberalization of the distribution system in the sector is also pointed to as being essential to improve market integration.

In this paper we are interested in complementing the existing literature by investigating whether the integration of European car markets is increasing after the full application of the new rules for distribution introduced by the BER (1400/2002). To this end, we considered the prices of cars related to a group of euro area member countries from January 1999 to January 2009. This will allow us to compare the sub-period in which the euro was introduced with the sub-period where, additionally, specific sectoral measures designed to increase competition were fully adopted. Taking into account the behavior of United Kingdom (UK) exporters, we will base the operational definition of market integration for goods on the degree of *Pricing-to-Market* (PTM).⁴

An important number of empirical studies have focused on the phenomenon of PTM behavior since Dornbusch (1987) and Krugman (1987) established the initial theoretical background. This phenomenon has helped to explain the incomplete fulfillment of *Exchange Rate Pass-Through*. Moreover, since PTM behavior is based on multiple transactions, it provides an alternative with which to test the relative version of *Law of One Price* (LOOP) in a cross-border framework. Evidence against an integrated region is obtained when markup adjustments induced by exchange rate variations differ across the export destination countries (and, consequently, the relative price in common-currency terms for a product varies over time). In practice, as determined with the typical test for LOOP, one remarkable advantage of PTM analysis is that it directly prevents the problems associated with comparisons of prices of goods produced and sold in different locations. This is because it involves the use of free on board (fob) prices which thus exclude differences in transportation costs, tariffs, local taxes and other distribution costs. Analyses based on PTM can therefore be a very suitable procedure when, as in this paper, we are interested in knowing the importance of cross-border segmentation.⁵

⁴ The phenomenon of PTM behavior refers to specific markup adjustments in response to variations in exchange rate against the destination markets. The policy acts as active international price discrimination across different destination markets.

⁵ The importance of the border effect on prices of goods is widely recognized in the international economics literature. Hence, for example, the influential paper by Engel and Rogers (1996) shows us in an intuitive way that, for a particular distance between two cities, divergences in consumer prices are much higher if the two cities belong to different countries.

As can be seen in the survey conducted by Golberg and Knetter (1997), an influential model for measuring the degree of PTM behavior was proposed by Knetter (1989). From the tradition of new industrial economics, where marginal costs are considered to be non-observable (Bresnahan, 1989), it represented a great advance in the empirical research on this phenomenon. With the intention of estimating PTM on levels and avoiding marginal cost information, the proposed regression model exploits the idiosyncratic variations in exchange rates across the export destination countries. As a way to analyze an alternative context where countries share a common currency (like the euro area) the short paper by Balaguer (2007) studies differences in PTM behavior across the export destination countries. In this framework, where there are no idiosyncratic variations in exchange rates, the induced markup adjustments across destination countries only arise from perceived divergences in market structures. The presence of cross-country PTM differences should therefore be interpreted as market segmentation and deviations in market structures, while the same degree of cross-country PTM behavior should be interpreted as being in favor of integration of markets.

To obtain a picture of the evolution of the market integration process, in this paper we will focus on the dynamics of cross-country PTM differences. Thus, variations in these differences over time can be attributed to changes in market structures (in relative terms). Although a great number of empirical papers based on PTM behavior have appeared in the literature, to our knowledge this is the first time that their dynamic evolution has been used to obtain a continuous picture of the market integration process. The rest of the paper is organized as follows. In section 2 we present some basic aspects of changes in the car distribution system in the EU. The econometric approach used is provided in section 3. In section 4 we describe the dataset. In section 5 we can see the empirical results. We start by presenting estimations of cross-country PTM deviations and the results of tests for constancy of coefficients over time from the modern methodology proposed by Elliott and Müller (2006). The results of the tests indicate that these deviations are clearly unstable. Since these preliminary findings are compatible with a process of market integration, we will carry out a deeper study based on the results of moving window regressions. A set of estimations about cross-country PTM differences will be useful to illustrate the evolution of market integration. A formal analysis of σ -convergence carried out later will allow us to infer whether markets have become more integrated after completing the reform of the car distribution system. The final section of this paper provides the summary conclusions.

2. An overview of the main regulation changes

Based on the idea that certain forms of vertical agreements between car manufacturers and dealers imply an improvement in productive efficiency, which amply compensates the possible disadvantages caused by restrictions in the choice of consumers, the block exemptions (compatible with Article 81(3) of the EU Treaty) provide a sector-specific regulatory framework for vehicle distribution and repair. The first BER was introduced in 1985 (Regulation 123/85). From then on and until a few years ago, some vertical distribution agreements included huge restrictions on retail competition. The main problem began when producers became free to combine selective and exclusive distribution systems. Under the combination of the two systems, on the one hand, manufacturers forbid authorized distributors (which are chosen on the basis of criteria such as the size and quality of the showroom and the quality of the personnel) to sell to non-authorized distributors. On the other hand, these distributors are only allowed to be allocated within certain sales territories.

At the end of the 90s, the European Commission became greatly concerned about the possibility that many car price differentials observed across the European countries were caused by the lack of competition among retailers. As the Commission indicated in a press release (IP/00/1306): “consumers in particular do not seem to derive from this distribution system the fair share of the benefits of the creation of a *European Single Market* in 1993”. At the beginning of 2000, in view of this situation, the Competition Commissioner Mario Monti said that a deep reform of the regime for car distribution was needed in order to “put the consumer in the driver's seat”. Taking into account data from earlier studies by independent consultants (i.e. Degryse and Verboven, 2000) and from agents’ experience with the BER of 1995 (1475/95), the Commission's evaluation report established that the producer had too much control over the dealer’s business. Specifically, it indicated that the combination of the two distribution systems was the main negative restriction hindering competition between dealers.

A thorough reform of the legal framework within the sector began in 2002 with the approval of the BER (1400/2002). This regulation introduced a number of substantial changes as regards agreements on the distribution of new vehicles. In short, it offered consumers more chances to choose where to have their cars repaired and serviced, and encouraged the development of innovative distribution methods such as internet sales and the existence of multi-brand dealerships. Moreover, the aim of the changes was to achieve greater price competition between dealers and to make cross-

border purchases easier. To achieve these last two objectives, the main measures became fully applicable after a transition period. Since November 2003 carmakers have had to choose between a selective and an exclusive distribution system in order to be exempted from Article 81(3) of the EU Treaty. However, in practice, until a few years ago car distribution continued to be tightly controlled by the manufacturers, who imposed strong limitations both to increase the intensity of competition in each of the areas and to diminish the possible regional differences in choices made by consumers. This is because contracts continued to include “location clauses”, which forbade dealers in a selective distribution system from setting up additional outlets anywhere in the EU. According to the Commission (press release IP/02/1073), these clauses continued to allow a near-identical reproduction of the motor vehicle distribution system that combined both selectivity and territorial protection.

As of October 2005 car manufacturers can no longer stop their authorized dealers from opening sales and delivery outlets wherever they choose within the EU. Dealers can thus operate outside their own countries and are free to set up outlets wherever a business opportunity presents itself. It is broadly recognized that abolition of the “location clause” was the most proactive reforming aspect within the new regulation to fight against carmakers holding onto their control.⁶ It is therefore possible that this measure has significantly reduced cross-border segmentation in motor vehicles.

At the time of writing this paper, the European Commission is carrying out a review of the market situation and has called for comments from interested parties (launched in 2007). This is because the BER (1400/2002) will expire in May 2010 and, therefore, it is necessary to advance in basic orientations for the regime of the future competition law. Following the most recent press release on the issue (IP/09/1168), the Commission points out that it “has not found indications of significant competition shortcomings in the EU primary market (sales of new vehicles) but rather structural overcapacity and falling real prices. The future competition law framework in this sector should therefore not impose regulatory constraints which might increase distribution costs and are not justified by the objective of protecting competition on the market”. In view of this situation, the Commission has announced that its intention is to extend the current regulation in order to provide a smooth transitory period of three years after May 2010. It is obvious that in-depth information about the impact of specific measures is needed to better orientate the after-period. Nevertheless, the

⁶ Therefore, it is not surprising that the European Council for Motor Trades and Repairs has vigorously opposed the prohibition of the clause after a transitory period following the passing of the law.

Commission has already communicated some general proposals. It proposes the alignment of the sectoral rules by applying the general competition rules on vertical agreements, although it also recognizes that it is necessary “to introduce safeguards in the form of guidelines against any possible closing off of new entrants, price discipline imposed by manufacturers or market segmentation through territorial protection or impediments to cross-border sales”. Ultimately, the purpose of the Commission is to ensure there is at least as much competition in these areas as there was under the BER (1400/2002).

3. The empirical model

To illustrate the specification used here, we suppose the example of a profit-maximizing firm that is selling in international markets, $i=1,...N$, which share a common currency. The set of first-order conditions for the exporter’s profits in domestic currency could be expressed (in logs) for each period $t=1,...T$ as a destination-specific markup:

$$\ln p_{it} - \ln c_t(w, Q) = \ln\left(\frac{\eta_{it}}{\eta_{it} - 1}\right) \quad (1)$$

where p_{it} represents the (fob) price of a product for each export destination market in terms of the exporter’s currency, c_t is the common marginal cost which depends on exchange rate variations via the imported input prices (w), and the total amount exported for N destination markets ($Q = \sum_{i=1}^N q_{it}$). Lastly, η_{it} represents the specific price

elasticity of the demand schedule perceived by the exporter for each foreign market i , which also depends on exchange rate variations between the exporter’s currency and the common currency shared by the destination markets. In this context, only cross-differences between perceived elasticities can generate idiosyncratic markup adjustments (which implies an active strategy of third-degree price discrimination).⁷ To measure the induced markup adjustments we begin by defining e_t as the exchange rate of the exporter's currency per unit of the buyer's currency. In line with Knetter (1989), from equation (1), we can obtain:

⁷ In a general framework, we can consider perceived elasticities as corresponding to residual demand curves (see, for example, Knetter (1989)).

$$\ln p_{it} - \ln c_t(w, Q) = \lambda_i + \beta_i \ln e_t + u_{it} \quad (2)$$

where λ_i captures the specific constant-markup for each destination market, and β_i is the idiosyncratic effect of exchange rate variations on the optimal export prices. Lastly, u_{it} are the regression disturbance terms.

Since we are interested in knowing whether there are divergences in perceived elasticities, we are concerned with the departure pricing strategy with respect to the average for the export destination markets. Let us therefore also consider empirical model (2) as a set of deviations from the respective mean of N observations (in which the unobservable marginal cost is no longer present):

$$\ln p_{it} - \overline{\ln p_{.t}} = (\lambda_i - \overline{\lambda_{.}}) + (\beta_i - \overline{\beta_{.}}) \ln e_t + (u_{it} - \overline{u_{.t}}) \quad (3)$$

where the destination effect $(\lambda_i - \overline{\lambda_{.}})$ controls for permanent differences between the specific markups and the average for the group of destination markets. The interpretation of the coefficients $(\beta_i - \overline{\beta_{.}})$ is straightforward. These coefficients reveal information about differences in the degree of PTM behavior with respect to the mean of the export destination markets. Thus, a non-zero coefficient would [indicate the](#) existence of market segmentation and different convexity of the demand schedule with respect to the mean of the destination markets. Alternatively, a zero value would be because there is no particular markup adjustment for market i . This would reveal the same perception of changes in the elasticities in market i and the mean for the group of markets. In the case of $(\beta_i - \overline{\beta_{.}}) = 0 \quad \forall i$ this should be interpreted as similarity across the overall perceived market structures. Obviously, this special situation can be obtained by eliminating the barriers, which facilitates market segmentation.

Moreover, we can establish a link between the sign of the coefficients in (3) and the relative convexities of perceived demand. This is because, according to Marston (1990), the optimal destination-specific markup that is charged will fall (increase) if, when the exporter's currency appreciates (depreciates) against the buyer's, the perceived elasticity of residual demand become more (less) elastic. This is the case of a demand schedule that is less convex than a constant elasticity demand (like a linear demand). Hence, a demand schedule that is less (more) convex for market i than the average of the group of markets would imply a positive (negative) value for $(\beta_i - \overline{\beta_{.}})$.

4. Dataset

We use a dataset referring to monthly exports from the UK for a sample period from January 1999 to January 2009 (henceforth, 1999m1-2009m1). We divide the analysis on pricing behavior into two types of automobile products (following the most detailed level of Combined Nomenclature sub-positions, that is, 8-digit classification level): gasoline-powered spark-ignition engines (87032319) and diesel-powered automobiles (87033219). From now on, we will refer to these types of automobiles as simply gasoline and diesel cars. We also consider non-automotive goods with the aim of controlling for a possible effect exerted by the creation of the euro area and other general European policies. In particular, we also take into account two popular products exported by the UK: malt Scotch whisky (22083032) and blended Scotch whisky (22083052). Together with gasoline and diesel cars, these whisky products are important UK exports. Thus, on the one hand, gasoline and diesel cars ranked first and second, respectively, on the list of UK vehicle exports to the EU over the period under consideration (out of a total of 279 products included in chapter 87). On the other hand, malt Scotch whisky and blended Scotch whisky also came first and second, respectively, on the list of UK beverages exported to the EU over the period under study (out of a total of 262 products included in chapter 22).

**Table 1: Percentage of exports by destination country
in relation to the euro area-11**

Class of automotive product	Destination- country	Jan.-Dec. 1999	Jan.-Dec. 2000	Jan.-Dec. 2001	Jan.-Dec. 2002	Jan.-Dec. 2003	Jan.-Dec. 2004	Jan.-Dec. 2005	Jan.-Dec. 2006	Jan.-Dec. 2007	Jan.-Dec. 2008	Average
Gasoline cars (87032319)	Germany	30.2	25.9	24.3	27.2	18.6	20.5	22.1	20.8	12.5	16.0	21.8
	Belgium-Lux.	7.2	9.5	13.7	13.7	20.6	22.2	23.1	22.8	27.8	22.8	18.3
	Italy	15.4	16.9	16.0	14.8	16.3	12.5	11.3	9.8	10.6	10.4	13.4
	Spain	10.9	11.0	13.0	9.7	9.8	13.8	13.8	12.4	12.2	11.7	11.8
	France	10.6	9.8	9.6	11.2	11.6	12.1	10.0	7.2	6.8	8.4	9.7
	<i>Total of group</i>	74.2	73.1	76.6	76.6	76.9	81.1	80.4	73.0	69.8	69.4	75.1
Diesel cars (87033219)	Spain	20.8	18.5	20.1	16.3	16.3	23.1	26.4	23.4	21.5	18.7	20.5
	Belgium-Lux.	7.0	7.0	8.2	8.8	16.4	16.8	29.2	40.3	34.2	34.9	20.3
	Italy	21.7	19.3	17.5	23.1	19.6	18.2	17.3	17.8	20.8	18.1	19.3
	France	21.1	21.8	22.3	24.3	24.0	20.5	14.3	7.9	7.5	9.6	17.3
	Germany	11.8	10.9	15.2	12.4	10.7	11.9	5.3	4.5	6.2	6.4	9.5
	<i>Total of group</i>	82.4	77.5	83.3	84.8	86.9	90.5	92.5	93.9	90.2	87.7	87.0

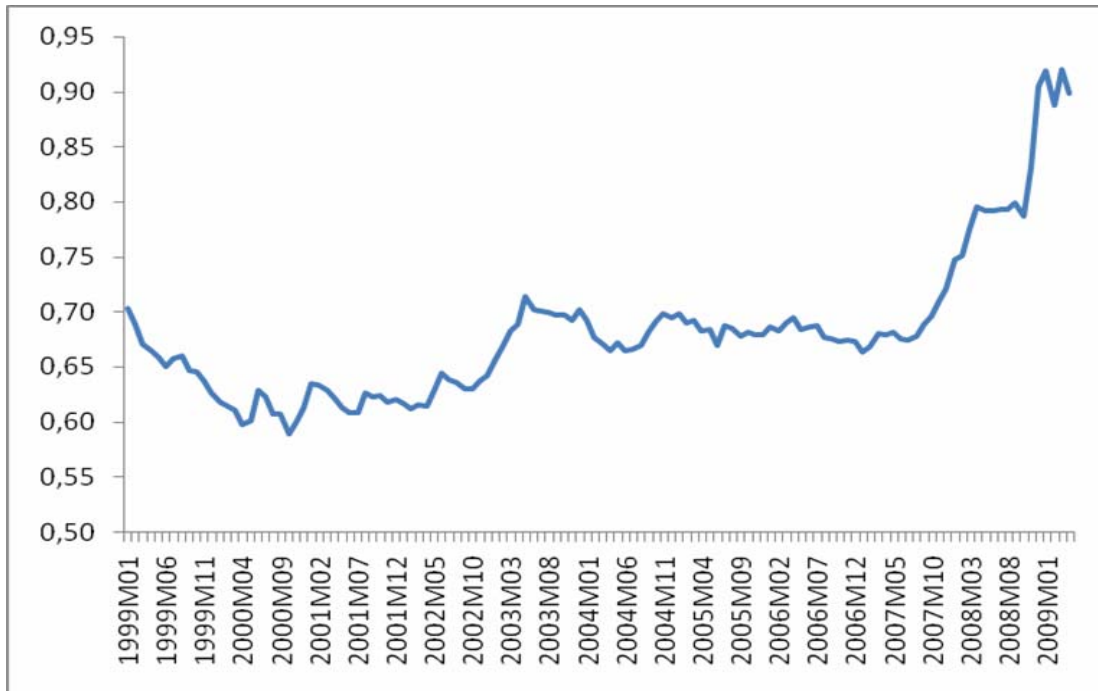
Elaborated from the COMEXT database.

Moreover, the analysis also considers the most important car export destination countries belonging to the euro area (which also coincide with most important destination countries in the EU). Specifically, we take into account the export flows to Belgium-Luxembourg, France, Germany, Italy and Spain. In Table 1 we report the percentage of UK exports for the destination countries under consideration in comparison to the total value of automobile product exports to the euro area-11. As we can see, the destination countries considered here represent an important share of the exports. Over a ten-year period, this group of countries accounted for an average of 75.1% of the total exports to the euro area-11 for the case of gasoline cars and 87% for diesel cars. Furthermore, for whisky products we also consider the most important destination countries in the euro area-11 which coincide with the automobile destinations. Specifically, we will refer to exports to Spain, France, Germany and Italy. Over the ten-year period that was studied, this group of countries represents 83.7% of the total exports to the euro area-11 for the case of blended whisky and 87.1% for malt whisky. Since whisky products are also regularly exported to the Netherlands and Portugal we will include these countries in a complementary regression analysis.

The prices corresponding to the automotive and the non-automotive products are approximated by unit value indices calculated using data collected from the open official Eurostat database for European exports (COMEXT).⁸ Furthermore, from the *Eurostat New Cronos* database, we also collect monthly data on bilateral exchange rates between the UK's currency (pound sterling) and the currency of the export destination countries (euro). As we can see in Figure 1, there are clear variations in the exchange rates over time (and which are quite large at the end of the sample period). This fact will help us to identify, for each sub-sample period, possible divergences in the induced markup adjustments.

⁸ The use of unit values is commonplace in the empirical literature on PTM. It is important to know that, although some differences in quality could exist among the destination countries, this should not represent a significant problem for our purpose. Even when the price data that are used are not sufficiently detailed to ensure that product qualities are identical for all export destinations, the model may reveal the presence of market segmentation by price discrimination in the sense meant by Stigler (see Goldberg and Knetter (1997)).

Figure 1: Monthly exchange rates (Pounds Sterling/Euro)



Source: Eurostat New Cronos database.

5. Commentary and analysis of results

5.1. Cross-country PTM estimations

We begin the empirical analysis by estimating equation (3) taking into account data from 1999m1 to 2009m1. In Table 2 we report the ordinary least squares (OLS) estimated coefficients associated with differences in PTM behavior, the cross-sectional test and the stability test related with each class of automobiles. As can be seen, several of the coefficients are statistically different from zero for both types of automobiles. These results reveal that markets still remained sufficiently segmented for firms to obtain more profits from differences in the market structures. Particularly, in the case of gasoline cars, we can reject zero coefficients for Belgium-Luxembourg and Spain (at the 5 per cent level of significance). While the estimated coefficients for Belgium-Luxembourg indicate that the markup adjustments induced by exchange rate variations are bigger than for the average of the group of countries, adjustments for Spain are clearly smaller. In the case of diesel cars, results suggest that the markup adjustments are also bigger for Belgium-Luxembourg and France, while they are smaller for Germany and Italy with respect to the average of the group of countries. As we have seen in section 3, these results could be interpreted in terms of convexity of

demand perceived by exporters. Thus, the estimates indicate that convexity is lower (than the average for the group of destination countries) in the case of Belgium-Luxembourg and France, while it is bigger for Germany and Italy. Furthermore, we also test for cross-country differences in PTM behavior (by considering cross-restrictions of a SUR equation system)⁹. Results of the Wald statistic allow us to confirm that, in general, PTM behavior and convexity of perceived demand are critically dependent on the export destination country. That is, differences in markup adjustments take place across destination countries and therefore the existence of market segmentation and heterogeneity in the market structures is not just an isolated fact.

Nevertheless, the cross-country PTM deviations could be unstable over time. In order to test this hypothesis, we apply the procedure methodology recently proposed by Elliot and Müller (EM), where the null hypothesis is a stable linear model within the context of an unknown break process. Hence, no arbitrary trimming of the sample data is required. With this methodology we efficiently test the stable regression model represented by (3) against an alternative model in which exchange rate coefficients depend on time (that is, $(\beta_i - \bar{\beta})_t$). From the empirical results we can infer that differences in PTM are, in general, unstable. Except for Germany, in the case of diesel cars, we can reject constancy of individual coefficients (at the 5 per cent level of significance). This outcome indicates the presence of significant changes in cross-country PTM deviations over time. Obviously this is compatible with a process of convergence (or divergence) in the PTM behavior across countries and, ultimately, with a tendency toward more (or less) similarity across the market structures perceived by UK exporters.

In Table 2 we also present the estimated coefficients for two separate sub-periods. We refer to results obtained from data before and after the complete implementation of distribution rules under the BER (1400/2002). Results for the first sub-period (1999m1-2005m9) show that most of the estimated coefficients are also significant at the standard levels. Once again, these estimations show that markup adjustments for Belgium-Luxembourg are clearly bigger than the average for the group of countries for both types of cars. The results support the hypothesis that the opposite phenomenon takes place in the exports destined for France and Germany in the case of gasoline cars and for Italy as far as diesel car exports are concerned. Differences in

⁹ Model (3) can be efficiently estimated as a set of seemingly unrelated regressions (SUR) or, since the explanatory variable coincides for N equations, alternatively it can be estimated as independent regressions.

Table 2: Estimated coefficients, cross-sectional test and stability test

Sample: Destination countries (i)	Gasoline Automobiles						Diesel automobiles					
	1999m1-2009m1		1999m1-2005m9		2005m10-2009m1		1999m1-2009m1		1999m1-2005m9		2005m10-2009m1	
	$\beta_i - \bar{\beta}$	EM test	$\beta_i - \bar{\beta}$	EM test	$\beta_i - \bar{\beta}$	EM test	$\beta_i - \bar{\beta}$	EM test	$\beta_i - \bar{\beta}$	EM test	$\beta_i - \bar{\beta}$	EM test
<i>Belgium-Lux.</i>	0.163** (0.076)	-22.041***	0.868*** (0.142)	-23.479***	0.091 (0.130)	-8.309	0.293** (0.079)	-29.028**	0.631*** (0.131)	-25.759***	0.067 (0.128)	-12.179***
<i>France</i>	0.040 (0.073)	-37.897***	-0.674*** (0.127)	-35.610***	0.125 (0.076)	-6.706	0.217** (0.073)	-19.042***	-0.078 (0.111)	-16.203***	-0.087 (0.174)	-16.494***
<i>Germany</i>	0.085 (0.101)	-32.356***	-0.492*** (0.183)	-29.834***	0.489*** (0.155)	-21.297***	-0.196*** (0.076)	-6.344	-0.287 (0.152)	-7.603*	-0.100 (0.097)	-6.598
<i>Italy</i>	-0.059 (0.110)	-21.291***	0.327 (0.205)	-18.719***	-0.442*** (0.141)	-14.831***	-0.278*** (0.055)	-24.895***	-0.461** (0.114)	-18.149***	-0.010 (0.095)	-7.792*
<i>Spain</i>	-0.229*** (0.058)	-19.110***	-0.028 (0.116)	-8.116*	-0.274*** (0.100)	-9.891**	-0.042 (0.067)	-24.244***	0.114 (0.126)	-20.256***	0.131 (0.097)	-9.095**
<i>Cross-sectional test</i>	22.57***		72.51***		36.06***		36.05***		21.50***		3.05	

coefficients across the group of European countries are also confirmed, for both sorts of vehicles, by means of the Wald test. Furthermore, from the EM test, we can also infer that coefficients are unstable in this first sub-period.

With regard to the second sub-period considered (2005m10-2009m1), we only find that the estimated coefficients are significantly different from zero (at the standard levels) for some destination countries of gasoline cars. More particularly, the degree of PTM behavior is bigger with respect to the group average in Germany and it is lower for Italy and Spain. Surprisingly, for diesel automobiles, no coefficients are statistically significant in the five destination countries. These results are reinforced by the Wald test. While we can reject equality of coefficients across destination countries for gasoline cars, we cannot reject the fact that coefficients are equal to zero for diesel cars. Hence, in this last category of exported products, there is no evidence in favor of market segmentation and divergences in market structures. A possible explanation for this result is that diesel car markets are already highly integrated. Nevertheless, because several individual coefficients are seen to be unstable, it cannot be claimed that car markets are already highly integrated within the whole of the sub-period. Variations in coefficients are compatible with a gradual convergence in pricing strategies over the sub-period, which would reveal the success of the changes in the competition regime.

5.2. *Moving window regressions*

In order to study the evolution of the differences in cross-country PTM behavior, we carry out moving window regressions from equation (3). Our estimations start in 1999m1, iterating forward month by month until 2009m1. This will allow us to create a continuous picture of the evolution of differences in PTM across the five destination countries. Since, at each new iteration, the methodological procedure adds observations and excludes the older point of time, a sample window-size should be defined. We begin by choosing 82 monthly observations as our central window-size for regressions. In this way, the first sample period concludes in a time in which new rules for distribution under the BER entered fully into force (in 2005m10). Thus, since the consecutive moving window regressions will include a new time observation from this date, the evolution of estimations will provide the dynamics of car market integration. As a complement, we also carry out moving window regressions adding and removing 12 monthly observations from this window-size. Obviously the results of the estimations through a bigger window-size (92 observations) are also interesting because they provide the evolution in a longer-term perspective, while estimations through a

smaller window-size (70 observations) capture the possible short-term changes in a better way.

The panels shown in the left and center of Figure 2 illustrate, by different sample window-sizes, the evolution of the coefficients for both classes of cars. In general, we find a considerable degree of similarity in the evolution between the estimated coefficients for the same destination countries. For example, when a window-size for a sample of 82 observations is considered, the Pearson correlation between estimations for gasoline and diesel cars is 0.76 in the case of Belgium-Luxembourg, and 0.66 in the case of Germany. This relationship can be due to the fact that variations in the number of dealers for both types of car engines usually coincide. The possible divergences in pricing behavior for the same country should therefore be attributed fundamentally to differences in the evolution of consumer preferences for each sort of product. This is the case of Italy, where graphs for both types of products reflect a clear asymmetry between the dynamics of pricing behavior for gasoline and diesel cars.

The three panels on the right in Figure 2 summarize the evolution of cross-country divergences in PTM behavior. As we can see, there is a strong relationship for both sorts of automotive products in the estimated evolution of cross-sectional dispersion in PTM. Specifically, the values of the coefficient correlation are 0.96, 0.82 and 0.65 for window-sizes of 94, 82 and 70 monthly observations, respectively.

The shapes of the graphs for both types of cars seem compatible with the hypothesis of convergence in PTM behavior across countries. This is quite notable, at least in the last part of the sample, for diesel cars. In particular, for this type of cars, the graph related to lower window-sizes (70 observations) suggests that convergence has taken place rapidly in the most recent period. In this same period, cross-sectional dispersion in PTM seems to be practically zero. This interesting result is consistent with a high degree of similarity in market structures and is in line with the outcome obtained for the last sub-period (presented above in Table 2).

The panels obtained from the window-sizes related with 82 and 70 observations show that cross-sectional dispersion of the estimated coefficients increases slightly when we take into account data from 2008 in the case of gasoline cars. This specific result is in agreement with descriptive data from the latest car reports published by the European Commission, where the increase in observed price dispersion is attributed to the impact produced by the global economic crisis. In this context, shocks in demand (arising from, for example, blows to consumer confidence) can affect the relative market structures of European countries in different ways.

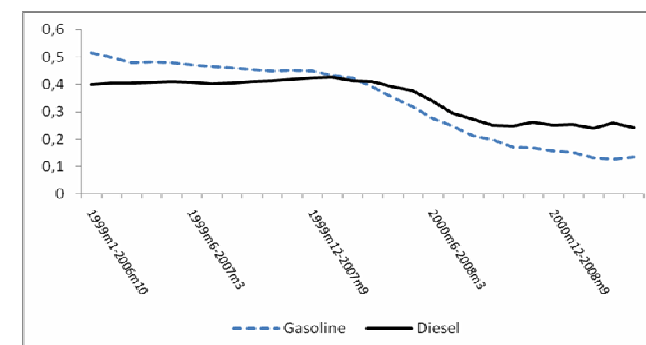
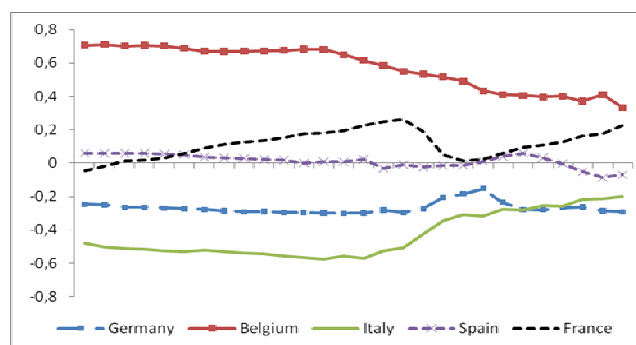
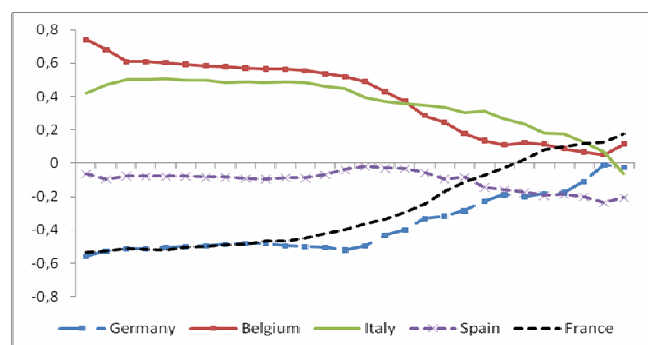
Figure 2: Evolution of estimations of Pricing-to-Market differences with respect to the average of the group of countries

Gasoline automobiles

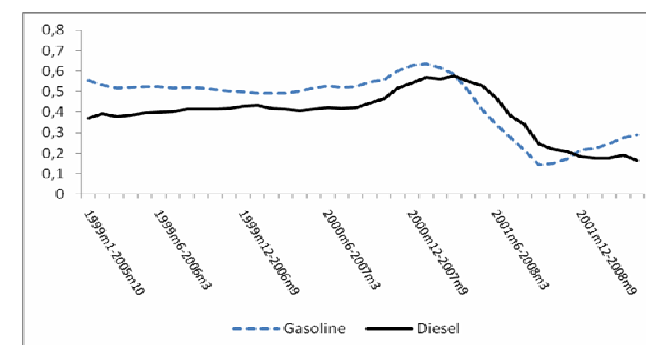
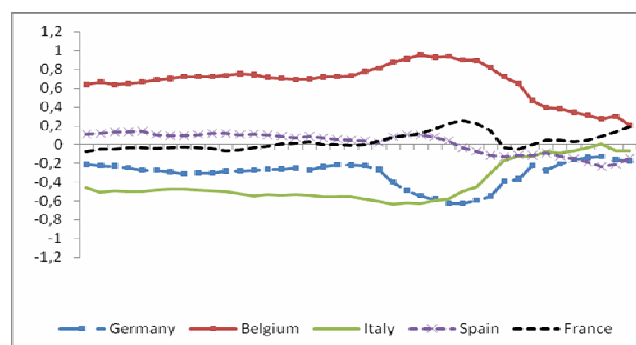
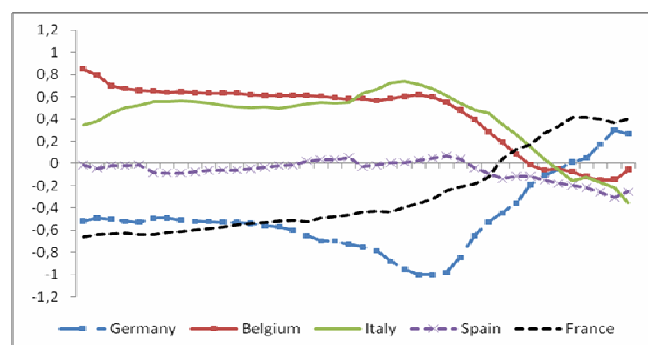
Diesel automobiles

Cross-sectional dispersion

Window-size: 94



Window-size: 82



Window-size: 70

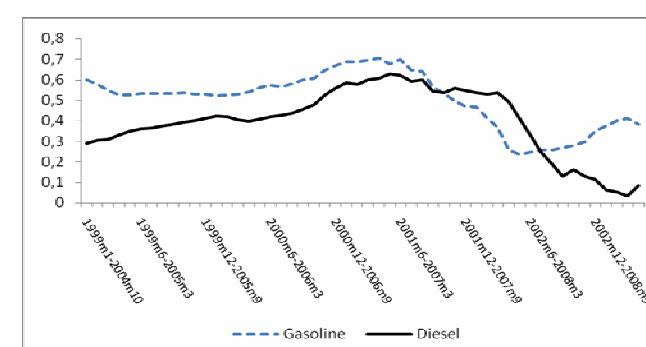
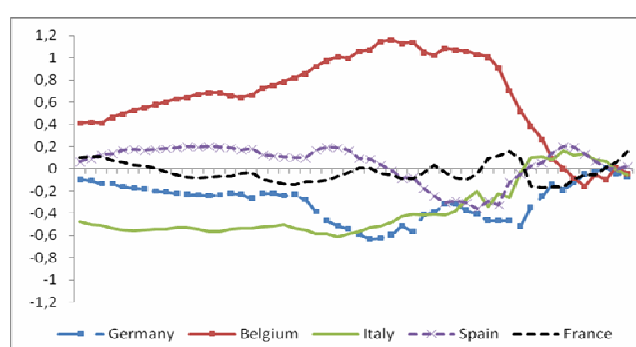
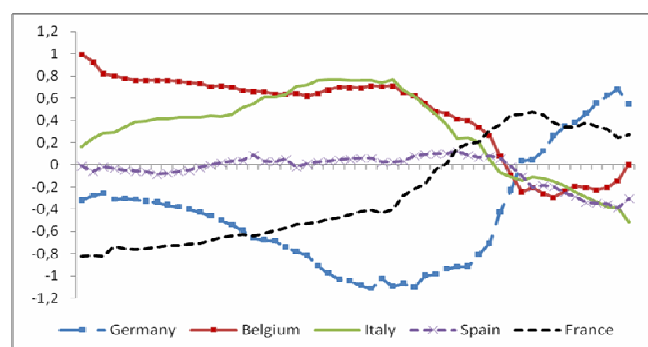


Table 3: Cross-sectional test

First sample period Last sample period (obs. of window)	Gasoline automobiles		Diesel automobiles	
1999m1-2006m10 2001m4-2009m1 (94)	67.75***	25.91***	29.03***	32.16***
1999m1-2005m10 2002m4-2009m1 (82)	71.56***	38.85***	22.73***	11.90**
1999m1-2004m10 2003m4-2009m1 (70)	67.82***	40.72***	11.98**	3.34

The asterisks *** and ** indicate that the null hypothesis of equality of country coefficients is rejected at the 1% and 5% significance levels, respectively. The Wald statistic follows a Chi-square distribution with 5 degrees of freedom. Regressions were performed with *Stata* 10.

Lastly, as complementary information, we additionally provide results from tests for cross-sectional differences in PTM in the first and last sample period of the moving window regressions that were performed (represented in the graphs in Figure 2). As we can see in Table 3, results for the case of gasoline automobiles support the presence of a very significant dispersion in PTM behavior across countries for both sample periods, regardless of the window-size that is considered. In the case of diesel automobiles, a significant dispersion is also obtained except when we test coefficients obtained from the regression where the most recent sample period is used (2003m4-2009m1). This last result, which is compatible with the one obtained for the second sub-period analyzed in Table 2 (2005m10-2009m1), may be due to the fact that these markets are already highly integrated. Nevertheless, in order to ascertain whether changes in competition rules have made a contribution to any extraordinary extent, we will conduct a formal analysis of cross-sectional convergence.

5.3. Analysis of convergence

With the aim of examining whether cross-country dispersion of PTM falls over time once the changes in the car distribution rules in European countries have been completed, we take up the concept of σ -convergence suggested by Barro and Sala-i-Martin (1992). A fundamental advantage of applying this concept is that it would also directly imply the presence of β -convergence. However, the fulfillment of convergence according to this last approach does not necessarily imply σ -convergence as we can see, for example, in Young et al. (2008). Let us now express the σ -convergence regression as an estimated dependent variable (EDV) model:

$$\hat{\sigma} = \alpha_0 + \alpha_1 t + \varepsilon_t \quad (4)$$

where $\hat{\sigma}$ is the estimated cross-sectional dispersion of PTM behavior, t is the time variable and ε_t is the regression disturbance term. Since the dependent variable is based on estimated coefficients, ε_t includes a sample error which is a heteroskedastic component (because there is a difference between the true value of the cross-sectional dispersion and its estimated value). As usual in the EDV model, we apply OLS with White's consistent standard errors to correct for heteroskedasticity. Obviously, in this model the presence of σ -convergence would imply that parameter α_1 will be negative.

As our dependent variable we consider the estimated coefficients obtained from moving window regressions with a fixed window-size of 94 and 82 monthly observations. Thus, in both cases, the evolution of the cross-sectional dispersion (of the estimated coefficients) indicates the effect generated by the sequential inclusion in the regression of a new monthly observation after 2005m10 (while the oldest observation in the previous sample data is removed). By proceeding in this way the period free of “location clauses” will have an increasingly greater relative weight. In Table 4, we present some results concerning the estimations of σ -convergence in EU car market structures. In the first column of this table we indicate, for a given window-size, the start and the end sample period used to estimate the dependent variable in the regression. When the EDV is obtained from previous moving window regressions which sequentially incorporate new time observations from 2005m10 (window-size of 94 and 82 observations), the results are clearly in favor of convergence over time. This is so for both sorts of automobiles (at 5% significance level).

Additionally, a pooled data regression for both automobile categories is also presented (where a fixed-effects estimator is used and standard errors are adjusted for clustering in each type of cars). This excludes possible convergence in PTM caused by particular aspects that affect diesel or gasoline cars in a specific way. The pooled convergence regressions could be more precise to capture the common effect of car distribution rules because they represent the common evolution in cross-country PTM differences for both types of cars. Independently of the selected window-size, results clearly support convergence. Nevertheless, since it is possible that common evolution is caused by a general policy in the countries under consideration (like the effects derived from monetary union), we also conduct a control analysis.

Table 4: EDV convergence regressions

From start sample period to end sample period (obs. of window)	Gasoline- automobiles	Diesel- automobiles	Automobiles (pooled data)	Blended Whisky [a]	Blended Whisky [b]	Malt Whisky [a]	Malt Whisky [b]	Whisky (pooled data) [a]	Whisky (pooled data) [b]
From 1999m1-2006m10 to 2001m4-2009m1 (94)	-0.0165*** (0.0008)	- 0.0078*** (0.0007)	-0.0121*** (0.0010)	- 0.0118*** (0.0007)	-0.0139*** (0.0014)	0.0072*** (0.0018)	0.0083*** (0.0012)	-0.0023 (0.0017)	-0.0028 (0.0022)
From 1999m1-2005m10 to 2002m4-2009m1 (82)	-0.0084*** (0.0012)	-0.0040** (0.0015)	-0.0062*** (0.0010)	- 0.0087*** (0.0006)	-0.0101*** (0.0016)	0.0122*** (0.0017)	0.0151*** (0.0013)	0.0017 (0.0016)	0.0025 (0.0022)
From 1999m1-2003m9 to 2000m12-2005m9 (58)	-0.0018 (0.0016)	0.0092*** (0.0011)	0.0037** (0.0015)						
From 2001m1-2005m10 to 2004m4-2009m1 (58)	-0.0063*** (0.0011)	- 0.0125*** (0.0020)	-0.0094*** (0.0012)						

Robust standard errors are between parentheses. The estimates that are statistically different from zero at the 1%, 5% and 10% significance levels are marked with ***, ** and *, respectively. In the same way, these asterisks also indicate that the null hypothesis for equal country coefficients is rejected at the 1%, 5% and 10% significance levels, respectively. The Wald test statistic follows a Chi-square distribution with 5 degrees of freedom. A fixed effects estimator is used for the pooled data where standard errors are adjusted for clustering in each class of products. Considered destination countries: [a] Spain, France, Germany and Italy; [b]: Spain, France, Germany, Italy, Netherlands and Portugal. Regressions were performed with *Stata* 10.

On the one hand, we use a control group of non-automotive products which are subject to the general policy framework in the euro area countries but not to the specific policy for cars. Our control products are blended whisky and malt whisky which, together with the diesel and gasoline automobiles, constitute some of the most important products regularly exported by the UK to most of the countries considered in this study. In the last six columns of Table 4 we can see the results for the two types of whisky (and the different number of destination countries). While the estimated coefficients for blended whisky converge, in the case of malt whisky we obtain a contrary outcome. Moreover, the pooled estimation for both whisky products supports the claim that there is no common factor that reinforces a convergence process.

On the other hand, we divide the sample into a control period (with restrictive rules for car distribution) and a period from 2005m10 (with complete liberalization for distribution under the current BER). A convergence analysis by EDV is performed from the estimated coefficients obtained from moving window regressions with a smaller window-size (58 monthly observations). The results differ for each sample period. Prior to full liberalization of the distribution system, there is no significant evidence of convergence for gasoline cars, while evidence of divergence does exist for the case of diesel automobiles. In contrast, a significant convergence is obtained for the period in which the new rules for car distribution had been fully adopted (for both gasoline and diesel cars). Furthermore, the results of regressions with pooled data for both automotive products contrast significantly between the older and the modern period. While for the first period there is evidence of divergence in cross-country PTM, in the second period convergence is clear. Hence, empirical results support the hypothesis that there is a common factor that reinforces the convergence process.

6. Concluding remarks

In the present paper we use export prices (net of tax and transport costs) to study the market integration process in the European automobile sector by analyzing PTM behavior. The paper is based on the idea that as market integration for a particular product improves, then differences in PTM behavior across export destinations become smaller. From this operational idea we follow an empirical procedure with the intention of obtaining a picture of the evolution of European market integration for cars. More specifically, our investigation is focused on evaluating the success of full liberalization of car distribution under the BER (1400/2002). We examine whether further cross-border market integration in the EU has really been promoted by the specific reform of

competition rules for car sales, which entered into force in October 2005 after the abolition of the well-known “location clauses”. With this purpose in mind, we used a dataset corresponding to gasoline and diesel automobile exports from the UK throughout the period from 1999m1 to 2009m1.

Our preliminary results revealed that, in general, PTM behavior is critically dependent on export destination markets for both sorts of cars. This phenomenon implies a significant segmentation of markets and dissimilarity between their structures. The outcome is in line with previous research which also obtains differences in induced markup adjustments for the automobile industry in different contexts and study periods (i.e. Gagnon and Knetter (1995), Gil-Pareja (2003), Balaguer et al. (2004), and Balaguer (2007)). Nevertheless, from the methodology recently proposed by Elliot and Muller (2006), we found that cross-country PTM deviations are significantly unstable throughout the period that was analyzed. To determine whether the absence of stability can be attributed to an evolution toward integration of market structures after the completion of changes for distribution, we conducted a deeper analysis based on estimations of moving window regressions.

Moving estimations (with different window-sizes for the sample period) were represented with the aim of providing a comprehensive picture of the evolution in cross-country PTM differences. We found that evolution of cross-sectional dispersion for estimations is quite similar for both types of automobiles throughout the whole of the period under consideration. This is obviously compatible with the existence of common rules for distribution of automotive products.

The estimated PTM differences are used at a later stage to implement a formal analysis of convergence across countries based on the demanding criterion of σ -convergence. This analysis was applied to the period in which the euro had been introduced but “location clauses” were still included in contracts, and for the period where all the distribution rules under BER (1400/2002) had been fully adopted. We found that cross-country PTM differences are significantly reduced for both types of cars when only data from October 2005 is considered. This result contrasts sharply with the absence of convergence when data for the previous period is used. Moreover, we conducted a control analysis by applying the σ -convergence approach for an additional pair of closely related products. As in the case of the analysis of the older period for cars, the purpose was to obtain possible general effects deriving from the introduction of the euro. A lack of PTM convergence across countries was also obtained for the pair of control products.

We think that the evidence obtained in favor of convergence in PTM behavior across European countries after October 2005 should be attributed fundamentally to the reduction of “real barriers” produced within the context of changes in the rules for distribution. One important reason that can be concluded in this sense is that, in the context under analysis, variations in PTM differences over time cannot be attributed to the presence of a sticky-consumer-price effect originated by fluctuations in exchange rates across destination countries. As Engel and Rogers (2001) indicate, in a situation where price convergence arises from a reduction of “real barriers”, the welfare of the region is clearly improved.

In sum, the present paper clearly supports the hypothesis that complete liberalization of the distribution system in accordance with the BER (1400/2002) has had a significant impact on the integration of European car markets. From this outcome and previous empirical research in this area, we can conclude that although currency unions can play, in general, an important role in promoting goods market integration in the long run (i.e. Parsley (2001), Engel and Rose (2002)), in some conditions it might not be sufficient. Therefore, complementary sectoral measures conducive to removing location restrictions can be of great help to increase integration of markets. Our findings agree with the predictions made by Goldberg and Verboven (2001) from their study focused on the European car market when they indicated that, in spite of the benefits of the European Monetary Union, “...without further measures to increase European integration, it will not completely eliminate existing cross-country price differences”. Fortunately, in recent years the European Commission has been implementing additional measures such as the abolition of “location clauses”, which seem to have increased the integration of markets considerably. We hope that our findings will contribute by suggesting what type of regulations may successfully promote market integration.

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Ivie

Guardia Civil, 22 - Esc. 2, 1º
46020 Valencia - Spain
Phone: +34 963 190 050
Fax: +34 963 190 055

Website: <http://www.ivie.es>
E-mail: publicaciones@ivie.es