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Car Price Differentials in Europe and the Effects of European Regulation

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ABSTRACT

The price of new cars in Europe varied widely between countries in the late twentieth century. This was most noticeable in the UK, where in 2000, car prices were around 20% higher than those found in some parts of continental Europe. In 2002 the European Commission implemented new regulations designed to liberalise the distribution system of cars, with the objective of increasing competition and reducing price differentials. This paper examines the role of regulation on car price differentials by using bi-annual data published by the European Commission on 12 popular car models in 5 countries over the period 2000-2006. The purpose is to identify the effects successful regulation should have on the car price differentials, and whether this has been reflected in the data.

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1. Introduction

The European car market had been constrained by heavy protectionism and nationalistic purchasing throughout much of the twentieth century. The free market introduced greater international competition, however, prices for similar products in different countries varied widely. Whilst the introduction of the Euro has increased transparency, some countries, such as the UK, continued to exhibit large price differentials at the end of the century. The European Commission has attempted to address this through regulation designed to generate greater international competition in the sales market for new cars. This paper intends to examine price differences through a detailed statistical analysis of European car prices, and evaluate the effectiveness of new regulation in achieving the EU objective of creating an integrated market with harmonised pricing.

During the late 1990's the prices of new cars in the UK compared to those in Europe became the subject of much debate. The UK had endured significantly higher prices for many products, and the term 'rip-off Britain' was coined in relation to this. In 1998, 88.1% of cars in the UK were more than 20% more expensive than the cheapest in Europe. At the same time, 0% of cars in Netherlands, 5% of cars in France and 17.8% of cars in Germany were more than 20% above the lowest price[1]. To this end, in 2002, the European Commission decided to update existing regulation in an attempt to increase cross-country competition between car dealers, in the hope of lowering price differentials across Europe.

Vertical agreements between manufacturers and dealers are the cornerstone of the new car distribution process. In the EU vertical price restraints are illegal. However, prior to 2002 manufacturers could grant territorial exclusivity to selected dealerships, under the proviso that any increase in efficiency as a result of this is passed onto the consumer. Selectivity implies that manufacturers choose dealers, usually through franchising, and that dealer is exclusive to one manufacturer. Exclusivity implies that a manufacturer appoints a dealer to a particular geographical area, and that is the only dealer from the

[1] Source: Salvador Gil-Pareja (2003) "Pricing to Market Behaviour in European Car Markets"

manufacturer in the area. This 'Block Exemption' was formalised in 1985. However, it has come under recent criticism concerning its anti-competitive effects, most prominently, the lack of cross-country and inter-dealer competition. Upon its 2002 review, the Block Exemption was modified to allow manufacturers to impose either selective or exclusive dealerships, but not both, with the proposal to increase national and international competition between the dealers of one manufacturer. The elimination of selectivity would encourage independent resellers to generate increased international trade of cars, or if territorial exclusivity is abandoned, dealers themselves would be able to increase the level of cross border trade.

Competition between dealers of the same manufacturer would be expected to increase internationally through the ability of consumers to purchase cars abroad, which was limited under the previous system, thus reducing international price discrimination. At a national level, the previous system limited competition between manufacturers, and arguably resulted in collusion between manufacturers to keep higher prices and increase profits.

Whilst several economic studies have been conducted in this field, few have examined the effectiveness of regulation after its introduction. Additionally, the continually changing car market and 'up-to-the-minute' nature of this subject means existing studies quickly become out of date as the price differentials evolve.

The Euro has introduced increased price transparency in participating countries, and the assumption would be that this should reduce price differentials. Although Euro-zone countries will be included, the analysis becomes more interesting by including the UK, as exchange rate volatility combined with the noted existing differentials makes it a prominent area for study, particularly in regard to the effectiveness of regulation.

Although this paper does not attempt to examine the precise workings of the European regulation, the intention is to use existing and up-to-date data on car prices in Europe to examine cross-country price differentials. By measuring price differentials by country,

and then evaluating the speed at which prices converge, the effectiveness of the regulation introduction can be examined, and compared with original predictions.

Unfortunately, it is difficult to attribute any price reductions entirely to regulation effectiveness, however, this paper does find evidence to support the assertion that it has helped to reduce price differentials in Europe, and there was an increase in total welfare for countries in which relative prices became lower.

2. Literature Review

Several papers have been published looking at the narrowing of car price differentials in Europe, and the reasons for this. Although the literature largely focuses on individual reasons, such as the effects of exchange rate or the law of one price, the methodology for empirically analyzing data is useful regardless of its exact requirement.

Goldberg and Verboven (2004)[2] examined the introduction of the Euro on car prices, suggesting that the elimination of exchange rate volatility and increased price transparency will lead to reduced incentives to generate international price differences. The simple regression framework employed by this paper, using dummy variables to capture country and time specific price differentials relative to a base country, can be modified and used to examine price differentials at different stages of the regulation process. Goldberg and Verboven (2004) were able to attribute a decline in the absolute price differential of about 1-2% to the introduction of the Euro, using data from 1993-2003[3]. As they only examine data up until 2003, the effects of the 'physical' introduction of the Euro are limited. However, their results are indicative of rapidly decreasing car price differentials after 2002, which might be attributed to either the Euro introduction or regulation.

[2] Source: Goldberg and Verboven (2004), "Cross Country Price Dispersion in the Euro Era: A Case Study of the European Car Market"
[3] The 'physical' introduction of Euro Currency occurred in 2002.

European Commission reports[4] published alongside their data, whilst providing little economic framework to back up their assertions, are more complementary towards the role of the 2002 regulation on reducing car price differentials. Interestingly, the Commission reports suggest the greatest degrees of price convergence occurred after 2003, not covered by Goldberg and Verboven and with a large reduction in the UK differential, which suggests that factors other than the Euro could be attributed to differential reductions. This highlights the importance of up-to-date data in examining price differentials in a continually changing market, and as literature using data from after 2003 is scarce, this paper could be valuable in its examination of the latest data on price convergence as well as the effects of regulation.

The importance of exchange rates in examining the cross country price differential is highlighted by Gil-Pareja (2003)[5], who looked at the effects of changes in the exchange rate on the pricing behaviour of manufacturers, finding that local price stability is strong regardless of exchange rates. Sticky prices in the UK following an appreciation of the pound against the Euro could result in seemingly lowered price differentials in the short term, which in the longer term could return to their original levels.

A later paper by Goldberg and Verboven (2005)[6] gets around the problem of continually adjusting exchange rates by incorporating a lagged exchange rate variable into their regression framework. This captures the changes in price differentials that may result from short term nominal rigidities. Using the framework of Levin and Lin (1992) on unit root testing in panel data, Goldberg and Verboven examined the speed of convergence, with the intention of rejecting a null hypothesis of a unit root (i.e. no convergence), which they were able to do. By employing a similar technique with the latest data, the extent to which the speed of price convergence has changed could be examined. A comparison

[4] Source: European Commission, (1993-2006), "Car price differentials within the European Union", *http://ec.europa.eu/comm/competition/car_sector/price_diffs/*
[5] Source: Salvador Gil-Pareja (2003) "Pricing to Market Behaviour in European Car Markets" (p960)
[6] Source: Goldberg, P.K. & F. Verboven, (2005) "Market Integration and Convergence to the Law of One Price: Evidence from the European Car Market", *Journal of International Economics*, v65, n1 (January 2005) pp49-73

with the results of Goldberg and Verboven would effectively provide an extension to their findings, and a useful check of the robustness of the new results.

They split their sample[7], finding that without exchange rate variables included, the speed of convergence increased over time, however, when exchange rates are included; there is a significant reduction in the speed of convergence. This indicates that any effect of decreased price differentials in the second period was merely a result of short term movements in the exchange rates. Although the introduction of the Euro will have negated many effects of exchange rate fluctuations impacting speed of convergence for the 2000-2006 data, the large changes found by Goldberg and Verboven indicate the importance of exchange rates in explaining price differentials, and accounting for this is essential for providing a thorough analysis.

Brenkers & Verboven (2002)[8] take a theoretical approach to the 2002 distribution system liberalisation. They view the introduction of policy as having no detrimental effect on either prices or welfare, providing potential outcomes to the 2002 European policy under two scenarios. Firstly, the previous system provided sufficient competition, whereby a small reduction in prices could occur. However, the "overall effects on consumers … on producers and total welfare would be modest" (p29). Second, the previous system offered limited competition, leading to a reduction in international price discrimination, as well as large welfare gains (p33). These scenarios are based on the assumption that previous policy attempts have largely failed to create price convergence, an assertion supported by Bhaskar (1984)[9] in his examination of the original 1985 regulation. By introducing empirical evidence to these theoretical papers, employing methods outlined above, the level to which new regulation has been effective can be assessed, and consequentially provide information on the effectiveness of the previous policies.

[7] Sample split 1970-1989, 1990-2000, most integration efforts take place after 1990.

[8] Source: Brenkers, R. & F. Verboven (2002) "Liberalizing a Distribution System: the European Car Market", *www.iue.it/Personal/Motta/forum/Brescia2-4-04/verboven.pdf* [Note: Working Paper]

[9] Source: Bhaskar, K.N. (1984) Car Pricing in Europe*: a discussion of the effects of the European Commission's plan to harmonise car prices in its draft block exemption / by Krish Bhaskar and the Motor Industry Research Unit at the University of East Anglia*. Norwich. Motor Industry Research Unit, University of East Anglia

3. Data

The data used in this paper is appropriated to examine price differentials across countries and across time, and the extent to which the Block Exemption Regulation of 2002 can explain any changes in these differentials.

The principal source of car price data is taken from the European Commission – Competition reports on car prices[10]. This provides bi-annual reports on the pre- and post-tax price of the majority of car models sold in Europe since 1993. The reports adjust the price of a car given the slight differentiation between the same car models in different countries[11]. This 'quality-adjustment' allows an accurate comparison of the price of new cars over countries based on identical products. Additionally, all prices are given in Euros at a given exchange rate, which has been gained from the exact rate at the time, stated in the report of the Official Journal of the European Union[12]. This is useful in examining how changing exchange rates might affect price differentials.

The data from the European Commission is not faultless however. The role of bargaining over car prices (obtaining discounts on the list price of new cars), varies between countries. Without extensive country/time/model specific information on average discounts it is impossible to identify the role this plays on the actual price consumers pay for cars in Europe. Data on discounts is unlikely to be made available as manufacturers and dealers will wish to sell at close to the list price, and such information could encourage consumers to insist on pre-determined lower prices[13]. To this end, adjustments for discounting will not be made to the data; however, the potential role it plays could become more significant as price differentials reduce.

[10] In addition to Euro prices of all cars available, they provide information on the percentage difference of the price of a car in one country to the cheapest Euro-zone country, such that the cheapest Euro-zone country = 100%.
[11] e.g. most cars in the UK are priced to include 3-year warranties, while in continental Europe, 2-year warranties are more common. The European Commission adjusts for such discrepancies.
[12] Exchange rates taken from Official Journal of the European Union, available at http://eur-lex.europa.eu/en/index.htm
[13] Goldberg and Verboven (2004) estimated that differences in discounting across countries was too small in comparison to observed price differentials to significantly impact the high differentials observed in early sample periods, however, this may become more important as differential reduce.

As the data is quite large, it is important to remove sections to increase manageability, as well as removing duplicated results or unavailable information. Although the European Commission has information on many car models available in the EU, this analysis will focus on a selection of 12 models, chosen under several criteria[14]. The final model selections are shown in the Table 3.1.

Manufacturer	*Model*	*Country of Origin*	*Market Segment*	*Full Dataset Available?*
Audi	A4	Germany	Large Car	Yes
BMW	3-Series	Germany	Large Car	Yes
Fiat	Punto	Italy	Super-mini	Yes
Ford	Focus	USA/EU	Small Car	Yes
Honda	Civic	Japan	Small Car	Yes
Mercedes	C-Class	Germany	Large Car	Yes
Nissan	Micra	Japan	Super-mini	Yes
Opel/Vauxhall	Astra	USA/EU	Small Car	Yes
Peugeot	206	France	Super-mini	Yes
Renault	Clio	France	Super-mini	Yes
Toyota	Avensis	Japan	Large Car	Yes
Volkswagen	Golf	Germany	Small Car	Yes

Table 3.1, The Sample of Car Models

12 successive periods of the data will be used in this analysis. Taking the bi-annual data from late 2000 to early 2006 provides the most up to date data available[15], while balancing the time periods before and after the introduction of the regulation. This should hopefully facilitate a comparison of the extent of price differentials and convergence both before and after the regulation introduction. As was noted in the literature review, data after 2003 has been relatively unused, so this paper will look at a timeframe of price convergence which has not previously been examined

Finally, the dataset is reduced to just 5 countries, Belgium, Germany, France, Italy and the UK. These countries are all pre-2004 EU expansion countries, with 4 Euro countries,

[14] The models were chosen under the following criteria: Popular/high selling cars, only one model per manufacturer, 4 models in each of 3 market segments (super-mini, small car, large car), availability in all sample countries, consistency across sample period (e.g. model maintained without major changes), country of manufacturer (broadly representative; 3 Japanese, 4 German, 4 American, 2 French, 1 Italian [NOTE: some Japanese models manufactured in UK].

[15] Limited information has been taken from late 1999 and early 2000 to provide price differentials to the 6-month-ago and year-ago periods, as well as lagged prices (to account for serial correlation). Therefore, each of the 12 main time periods have appropriate information for comparison of price differentials over time.

and the UK outside the Euro[16], with similar GDP per capita and rates of taxation on cars[17]. While examining more EU countries, especially those outside the Euro, could be interesting, some smaller countries often have prices distorted by high taxation (Denmark) or are broadly similar to price levels in other countries, so these are excluded in the interest of manageability[18]. This results in a total of 720 observations to be included in the analysis, using a balanced panel data set.

A preliminary look at the data presents several interesting results. Firstly, there has been a reduction in prices, particularly for the UK between 2000 and 2006. Figure 3.2 shows that UK prices in 2000 were significantly higher than prices found in the other countries[19]. The prices for UK cars were consistently above 130% of the cheapest Euro-zone country, while other countries in the sample were consistently below 130%. It is predominantly high selling cars such as the Ford Focus, Nissan Micra and Peugeot 206 which exhibit the largest differential, whilst more 'exclusive' cars such as Audi, BMW and Mercedes show the smallest differentials.

[16] Goldberg and Verboven (2005) estimate these countries make up around 85% of the pre-expansion EU car market.
[17] Tax rates maintained over entire sample period at 21% in Belgium, 16% in Germany, 19.6% in France, 20% in Italy and 17.5% in the UK.
[18] Data from the new EU member countries is not available pre-2004, so therefore these countries are excluded.
[19] Figure 3.2 is derived by taking 100% as the cheapest Euro-zone country (including those not used in the sample) for each model.

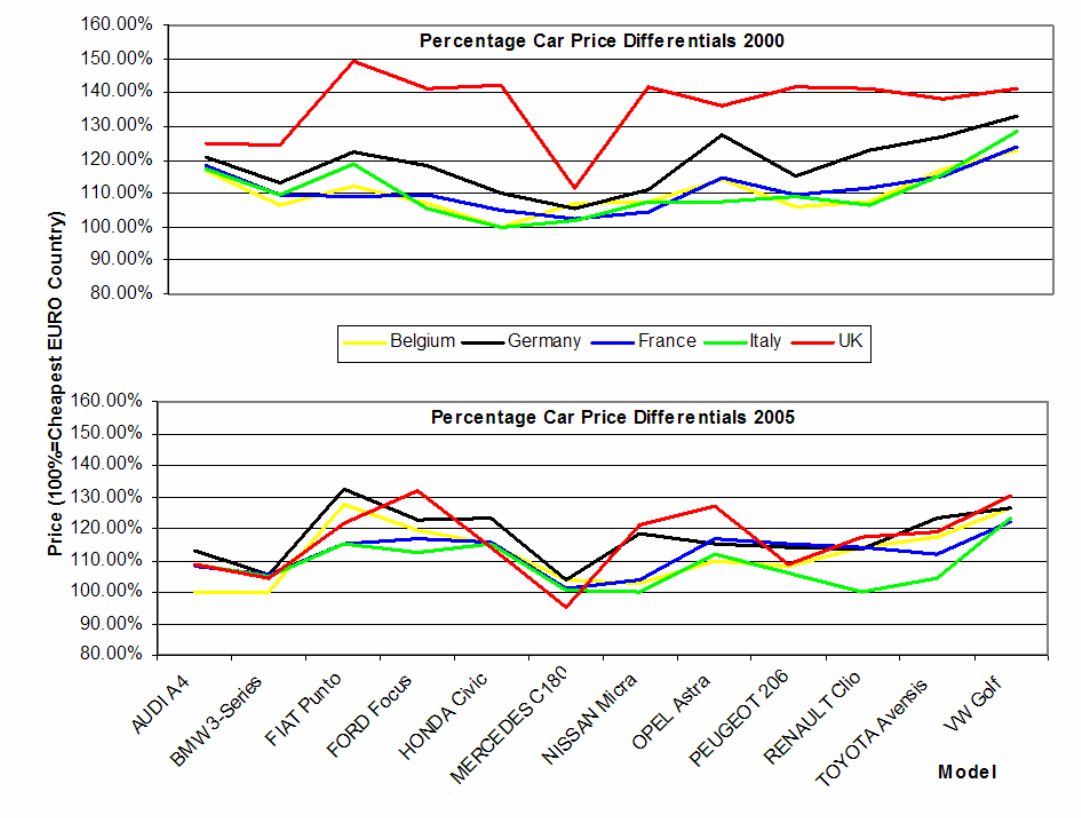

Figure 3.2, Car Model Price Differences between 2000 and 2005 (100%=Price in cheapest Euro-zone country)[20]

Figure 3.2 clearly shows how the UK price differential had largely disappeared by 2005; with UK prices now consistently below 130%. Although this does not explicitly prove that price convergence has taken place, as this may be the result of temporary shocks, the greater consistency in cross country price levels is clear. The four continental countries in the sample exhibit greater consistency in their price differentials. Although they do not always represent the cheapest price in the Euro-zone, they remain broadly similar at both the beginning and end of the sample period.

In addition to pricing tables published by the European Commission, Eurostat publishes pricing indices for individual countries. Although they do not show individual price differentials, they do indicate trends in the average price of cars over time. The

[20] Please note this graph is for illustrative purposes only, the x-axis items are not ordered in any way, as this presentation manor proved more effective than extensive bar graphs.

predominant observation is that while prices in Euro countries have risen throughout the period in line with inflation, prices in the UK have fallen, Figure 3.3 shows this graphically[21]. For almost the entire period of 2000-2005, UK indexed car prices were above the level found in 2005. While it does not indicate UK prices falling below those of the other countries, it does illustrate the anomaly that UK prices reduced in spite of increasing prices abroad, thus suggesting a reversal of traditional pricing policies throughout this period. Additionally, this looks at the changing of prices in pounds, rather than examining the effects of exchange rates on Euro adjusted data.

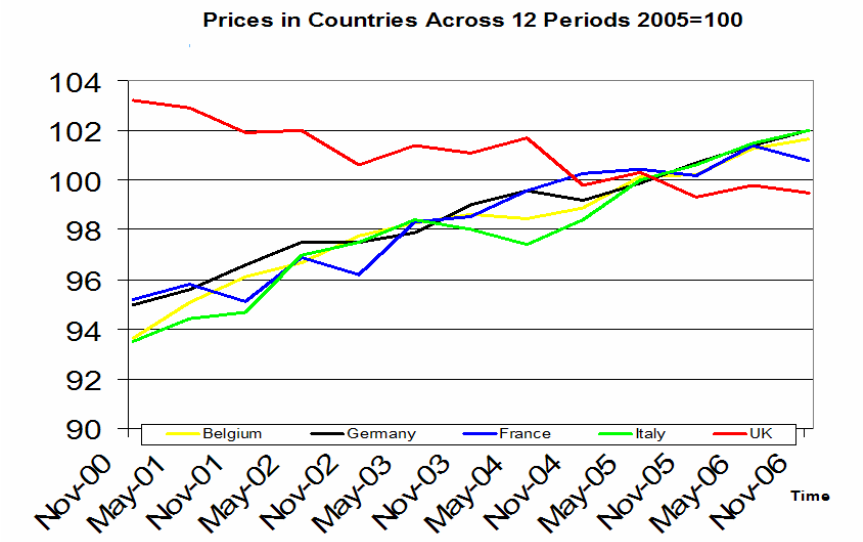

Figure 3.3, Indexed Results of Average Car Prices (2005=100)[22]

The importance of exchange rates is also evident from an initial analysis of the data. Gil-Pareja (2003) suggested that sticky prices in face of adjusting exchange rates could influence price differentials. Following the physical introduction of the Euro in 2002, there was a large appreciation compared to the pound[23]. Table 3.4 indicates that, using the European Commission data, this largely took place, unfortunately, between late 2002 and early 2003, around the time of regulation introduction. In Euro terms, the price of a

[21] Figure 3.3 used indexed data fitted to the month observed by the European Commission dataset for the period 2000-2006, with 100=price in 2005. These results are from Eurostat.
[22] The y-axis represents the indexed price of a car in 2005 as 100%, and the other results are derived from there.
[23] Using data from the European Union Journal, the € per £ exchange rate fell from 1.57 in late 2002 to 1.42 in early 2003, a drop of around 9%.

car dropped significantly for almost every model in the UK. However, the price in pounds remained relatively consistent, and in some cases, prices fell, this is shown in Table 3.5. Considering many of the cars were imported from Europe, an appreciation of the Euro should have made imports more expensive in the UK, but sticky prices cancelled out this effect[24]. Interestingly, by the second half of 2003, prices had not yet risen back to 2002 levels in Euros[25]. As there would be sufficient time to increase prices after a year, the fact that prices did not rise suggests that manufacturers and dealers had sufficient leeway for lower prices in the UK. From the econometric analysis, by incorporating the role of exchange rate adjustment into a regression, the effects of changing price differentials outside those artificially created can be examined in greater detail, and help with understanding the regulation effects.

Period	***Pound-Euro Exchange Rate*** **(Pounds in Euros)**	***Percentage Change***
2000b	1.69147	-
2001a	1.60643	-5.03
2001b	1.61734	0.68
2002a	1.61838	0.06
2002b	1.57035	-2.97
2003a	1.42898	-9.00
2003b	1.46274	2.36
2004a	1.48148	1.28
2004b	1.4374	-2.98
2005a	1.47874	2.88
2005b	1.47275	-0.41
2006a	1.45212	-1.40

Table 3.4, Pound-Euro Exchange Rates (2000-2006), and Percentage Change

[24] As car prices are often set well in advance, rapid adjustment would most likely not be possible in this case, so manufacturers would be forced to accept lower prices in the short term, either in the hope that exchange rates would adjust more favourably, or by increasing prices over time.
[25] Although some sterling rises can be observed, the trend remained to retain prices from before the appreciation of the Euro.

Model Price in Euros *(Price in Pounds)*	***2002a***	***2002b***	***2003a***	***2003b***
Audi A4	23,995 *(14,827)*	23,313 *(14,845)*	20,698 *(14,484)*	19,822 *(13,551)*
BMW 3-Series	23,352 *(14,429)*	22,919 *(14,595)*	20,860 *(14,597)*	21,353 *(14,598)*
Fiat Punto	9,353 *(5,779)*	8,485 *(5,403)*	8,323 *(5,587)*	8,516 *(5,822)*
Ford Focus	14,635 *(9,043)*	14,559 *(9,271)*	13,011 *(9,105)*	13,318 *(9,105)*
Honda Civic	14,358 *(8,872)*	14,358 *(9,143)*	12,678 *(8,872)*	12,978 *(8,872)*
Mercedes C-Class	22,788 *(14,081)*	22,125 *(14,089)*	20,250 *(14,171)*	20,739 *(14,178)*
Nissan Micra	10,151 *(6,272)*	9,847 *(6,270)*	9,566 *(6,694)*	9,792 *(6,694)*
Opel Astra	12,597 *(7,784)*	11,826 *(7,531)*	10,966 *(7,674)*	13,386 *(9,151)*
Peugeot 206	10,209 *(6,308)*	9,969 *(6,348)*	9,009 *(6,304)*	9,426 *(6,444)*
Renault Clio	10,209 *(6,308)*	10,790 *(6,871)*	8,796 *(6,157)*	9,152 *(6,257)*
Toyota Avensis	14,773 *(9,128)*	14,335 *(9,128)*	16,497 *(11,073)*	17,136 *(11,715)*
VW Golf	12,344 *(7,627)*	11,978 *(7,627)*	10,900 *(7,627)*	12,731 *(8,704)*

Table 3.5, UK Car Prices for Sampled Models in Euros (in Pounds)

The timing of the introduction of the European Commission regulation is important in identifying its effects on the dataset. Regulation 1400/2002 came into force in October 2002[26]. The purpose was to eliminate the "straightjacket" effects of previous regulations which limited competition and reduced incentives towards new and innovative forms of sales (e.g. online sales). This paper works under the hypothesis that successful introduction of regulation will reduce long-term cross-country absolute price differentials, and become indicative of a convergence in the price of cars. A reduction in price differentials, using the framework suggested by Brenkers and Verboven (2002), is indicative of previous restrictions to national and international intra-brand competition, and therefore suggests an increase in total welfare for consumers, and the elimination of tacit collusion. If little or no differential reduction is noticed, the assumption would be a small welfare gain as a result of the effectiveness (or ineffectiveness) of previous policies in regulating the market. An exact timing of regulation introduction is difficult to pinpoint. However, it could be expected that following its introduction, absolute price differentials could reduce immediately due to the threat of increased competition and the ability to purchase abroad. If no reduction is detected, it can be assumed that either the regulation has failed to increase competition in the market, or the current system provided sufficient international competition.

[26] Source: European Commission, Regulation 1400/2002 and associated documentation.

4. Empirical Analysis

To examine the car price differentials, two major models can be used. The first employs a simple regression of price differentials against country dummies, and the interactions of these dummies with time dummies. The second model introduces the concept of a speed of convergence, showing the dynamic changes of car prices, over the whole sample, in sub-samples and for individual countries. By adjusting this model to include variability of exchange rates, as well as temporal interactions, it is possible to extrapolate the role of regulation on car price differentials.

The first model[27] is derived from the work of Goldberg and Verboven (2004). As a static framework, it does not directly indicate changes to car price differentials. However, it does show the average price differential of car models in the sample for each country and at each point in time. The regression is shown in Equation 4.1.

$$p_{i,k,t} = \alpha_1 Germany + \alpha_2 France + \alpha_3 Italy + \alpha_4 UK + \beta_1 2001a + \ldots + \beta_{11} 2006a + \gamma_1 Germany \times 2001a + \ldots + \gamma_{44} UK \times 2006a$$

Equation 4.1, Simple Regression Model[28]

The dependent variable of the regression is the price difference between the log price of a car in one country, and the log price of the same car in the base country at the same time. Belgium is chosen as the base country, as it is within the Euro area, has no major car industry to influence local pricing policies, and prices are among the lowest in the sample.

The right hand side of the equation entirely consists of dummy variables relating to countries other than Belgium, giving the percentage change in price compared to the

[27] This model is derived from the work of Goldberg and Verboven (2004), using a similar static framework, however, time periods and countries are not grouped in this analysis to examine precise price differentials for each individual country at each time.

[28] The β variables represent time specific dummies, with the year, "a" indicates May observations, while "b" indicates November observations. These all are expected to have zero coefficient as the price differential of Belgium to Belgium is always zero at every point in time.

price in Belgium in the base period, late 2000. By interacting the country dummies with time specific dummies for each of the remaining time periods, it is possible to show the price differential in each country in each time, relative to the price of cars in Belgium. Although this model does not explicitly identify convergence of prices, nor does it account for exchange rates, it does indicate the trends of car pricing in Europe.

The model can be calculated using an ordinary least squares process using the balanced panel data[29]. Many of the results found in the data were statistically insignificant from zero. However, this may be predominantly due to the small price differentials often observed amongst the Euro-zone countries, and the relatively small sample size compared to previous analyses. An adjusted R-Squared of 0.43 was found, estimating that the equation explains around half of the observations. This is a respectable result for such a varying dataset, as variables can easily become unexplainable by becoming deviated from the expected result as prices do not fall in line for all models.

The results from this regression are shown in Table 4.2. The figure represents the percentage price differential to Belgium at each time period. Germany has shown remarkably consistent price differentials over the entire sample period, with prices 4-9% above those found in Belgium. The data for France and Italy show that prices in these countries were relatively consistent with those in Belgium. Although the price differential was negative for both countries between 2001 and 2004, the trend towards the end seems to be prices rising again in line with Belgian prices. As Germany is within the Euro-zone, these results are relatively surprising, as price transparency, and easy opportunity for cross-border purchasing should result in greater similarity of prices. Following the introduction of regulation in 2002, any effect in these countries was minimal, and differentials actually increased for both Italy and France following 2002. In Germany, however, the continued reduction in prices is evident after 2002. After a small spike in early 2002, differentials have consistently reduced, as is shown by Figure 4.3.

[29] The detailed regression output can be found in Appendix 1.

The final column of Table 4.2 shows the price differential in the UK. In 2000, the estimated result was almost 21%, a result consistent with those found by Goldberg and Verboven (2004, 2005)[30]. Following 2000, there was a large drop in price differential to 12.7%. Following 2002, there was another large drop in price differential, from 7.8% above Belgium, to 3.9% below. As has previously been mentioned, exchange rates play an important role in reducing price differentials, which this model does not explain; therefore another model which accounts for such changes is needed.

	Germany	*France*	*Italy*	*UK*
2000b	7.4	0.6	0.2	20.8
2001a	7.0	-1.2	0.2	12.7
2001b	6.4	-0.9	-0.8	11.6
2002a	9.0	-1.2	-0.6	10.4
2002b	6.8	-1.6	-1.4	7.8
2003a	6.4	-2.5	-3.1	-3.9
2003b	5.5	-2.9	-2.9	-1.6
2004a	4.1	-1.0	-2.5	2.1
2004b	2.7	-1.3	-2.9	-0.4
2005a	4.5	0.0	-2.0	5.8
2005b	5.1	0.4	-3.1	4.0
2006a	4.3	-0.7	-1.7	2.3

Table 4.2, Percentage Difference from Base Country by Time

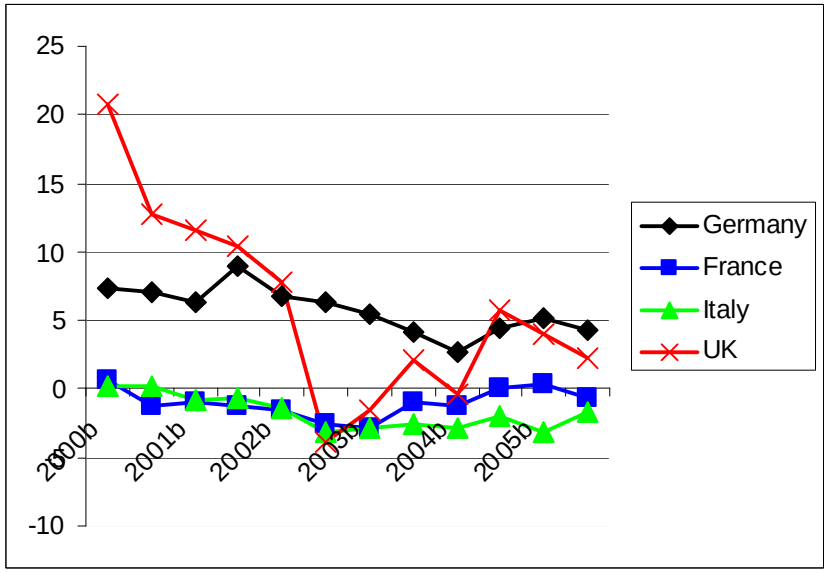

Figure 4.3, Price Differentials for 5 Countries over Time

[30] Goldberg and Verboven (2004) p498 – price differentials above 20% in some car models in 1998, however, also note that exchange rates were a factor in creating the original price differential. Goldberg and Verboven (2005) p67 – 1990-2000 average price differential 14% with exchange rates

A second model, adapted from Goldberg and Verboven (2005) examines the speed of convergence of prices, and incorporates the effects of exchange rates into the analysis. The estimate equation is based on the study by Levin and Lin (1992) examining unit roots in sets of panel data. The dependent variable is taken as the first difference in the log price of a car in one country relative to the base country[31]. The relationship examined is that between the first difference of the log price differential and the log price differential in the previous period. The idea is to show that a negative coefficient on the log price differential in the previous period is indicative of reducing price differentials.

$$\Delta p_{i,k,t} = \alpha_k + \beta p_{i,k,t-1} + \sum_{l=1}^{L} \gamma_l \Delta p_{i,k,t-l} + \varepsilon_{i,k,t}$$

$i = 1,\ldots,12 \quad k = 1,\ldots,5 \quad t = 1,\ldots,12$

Equation 4.4, Convergence Equation without Exchange Rates

This equation includes country specific dummy variables α_k, the aggregate car price differential in each country relative to Belgium. β is derived as the speed of convergence. An increasingly negative value for β would indicate a high speed of convergence[32]. This works under the null hypothesis that the panel data contains a unit root, i.e. H_0: (β=0), with the alternative that the data is stationary. If the panel is stationary, it indicates that individual shocks to prices will orbit a stationary price level, rather than continue to deviate from a convergent price, and therefore, convergence can be observed. Goldberg and Verboven (2005) tested the significance of β using a unit root test with panel data and individual specific intercepts derived from the work of Levin and Lin (1992)[33]. The lags, $\Delta p_{i,k,t-l}$ are used to account for possible serial correlation in the error term[34]. For small samples, the presence of individual fixed effects, such as α_k, causes downward bias in the coefficient of the lagged dependent variable, however, as the time dimension grows, the bias decreases sufficiently to not affect the asymptotic

[31] For a more detailed derivation of the dependent variable, see Appendix 2.
[32] For a more detailed analysis of the speed of convergence, see Appendix 3.
[33] For a more detailed discussion for Levin & Lin testing of Unit Roots with Panel Data, see Appendix 4.
[34] The number of lags is set to 3, as this is the number of lags consistently used in previous work.

distribution. As the Levin and Lin results on unit root testing apply to a least squares estimate, it is that technique which shall be used to examine the data[35].

In order to facilitate the most accurate comparison to the results of Goldberg and Verboven, the model is modified to take the absolute value of the price differential, as this presents results explicitly on convergence of prices. The price differential can therefore represent a price higher or lower than that found in Belgium, so every differential away from the Belgian price is always positive[36]. Additionally, rather than examine 6 monthly differentials, this examines the differential to the year ago period, to show annual changes, which seems most appropriate. Due to the extensive changes to the composition of the dependent variable, the regression is based around pre-created variables on the balanced panel dataset.

As the effects of exchange rates have been highlighted, including the effects of time lagged exchange rates in this regression seems logical. The purpose of this is to account for changes in the price differentials which may be the result of 'sticky' prices in the UK causing fluctuations in its Euro-derived price level. Proposed by Goldberg and Verboven (2005), the inclusion of a lagged exchange rate change variable is presented in Equation 4.5. The exchange rates obviously only relate to the UK, so their significance compared to studies using previous time periods is diminished. The variables $e_{k,t}$ represent the log price of the individual currency relative to the Euro.

$$\Delta p_{i,k,t} = \alpha_k + \beta p_{i,k,t-1} + \sum_{l=1}^{L} \gamma_l \Delta p_{i,k,t-l} + \sum_{m=0}^{M} \delta_m \Delta e_{k,t-m} + \varepsilon_{i,k,t}$$

$$i = 1,\ldots,12 \quad k = 1,\ldots,5 \quad t = 1,\ldots,12$$

Equation 4.5, Convergence Equation with Exchange Rates

The results for the regression including exchange rates variable is shown in Table 4.6[37].

[35] A different method, such as GMM, generalised method of moments was considered, however, difficulties relating individual specific terms in the inputting of this data made it preferable to use a similar technique to that of Goldberg and Verboven (2005) in so far as to maintain the comparison of the results.
[36] For a more detailed explanation of this transition, see Appendix 5.
[37] The detailed regression output can be found in Appendix 6.

The speed of convergence result $p_{i,k,t-1}$ has a t-statistic of -21.60, the critical values reported in Levin and Lin (1992)[38], N=50 (60 in actual panel), t=10 (12 in panel) are, -10.93 at 1%, -10.47 at 5% -10.23 at 10% significance level. It is therefore possible to reject the null hypothesis of no convergence (or unit root present). The value of -0.57 is 'more negative' (i.e. converging faster) than the -0.38 found by Goldberg and Verboven (2005) examining the period 1970-2000. This indicates that the speed of convergence has increased over time, and the annual reduction in price differentials is larger in 2000-2006. Additionally, the individual country specific dummies are all significant at the 1% level. It is possible to show the price differential in each country for the entire sample period by dividing the coefficient by $-\beta$. From this, the average price differentials for the countries were 6.2% in Germany, 4.2% in France, 4.8% in Italy and 8.8% in the UK. This indicates persistent price differentials throughout the sample period. However, to estimate the effectiveness of regulation, the sample must first be split to examine changing speed of convergence and differentials.

Dependent Variable $\Delta p_{i,k,t}$	*Base: Belgium*
$p_{i,k,t-1}$	-0.5733
	(0.0264)
Germany	0.0355
	(0.0046)
France	0.0242
	(0.0043)
Italy	0.0277
	(0.043)
UK	0.0504
	(0.0057)
Lags of $\Delta p_{i,k,t}$?	Yes (3)
Prod-country dummies?	Country dummies
Exchange Rates Dummies?	Yes (2)

Table 4.6, Results from 2000-2006 Annual Regression with Exchange Rates

By splitting the sample, it is possible to notice changes in the speed of convergence and national price differentials over time. Tables 4.7 and 4.8 display the results of splitting the sample in 2002 and in 2003; estimating these timings at the critical points of

[38] Critical values tables from Levin & Lin (1992) available in Appendix 4.

regulation introduction[39]. Although there has been a significant reduction in price differential, the speed of convergence has only changed slightly between the beginning and end of the sample. There is a clear reduction in the absolute price differential between the beginning and end of the sample. As Table 4.8 indicates, Germany saw a reduction in differential from around 7.4% to 5.6%, while France and Italy observed small rises. This shows that in Germany, following regulation, there was a 2% point reduction in price differential. Without exchange rates to be concerned about, this is indicative of regulation reducing the absolute price differential through the influx of new competition of the threat of it. The results for France and Italy show a rise in the absolute price differential, but importantly, after 2002, the price differential is roughly equal for all countries. Although the difference to Belgium is now slightly concerning, under the absolute differential framework, the distribution of the differentials is unknown, so some countries may have prices consistently below Belgium, and some above, but show as the same differential. Once again, the results for the UK are the most impressive. The UK price differential fell from 15.0% before regulation to 6.8% after. However, as has been noted previously, exchange rate changes can be heavily attributed to reduction in the absolute price differential.

[39] Table 4.8 displays individual country information in "percentage change" form, by dividing the coefficient by $-\beta$.

Dependent Variable $\Delta p_{i,k,t}$	*Before and After 2002*			*Before and After 2003*		
	2000b-2002a	*2002b-2006a*	*Change*	*2000b-2003a*	*2003b-2006a*	*Change*
Observations	240	480	240	360	360	0
$p_{i,k,t-1}$	-0.6686	-0.6083	0.0603	-0.6737	-0.5512	0.1225
	(0.0447)	(0.0436)		(0.0389)	(0.0616)	
Germany	0.0492	0.0339	-0.0153	0.0489	0.0281	-0.0208
	(0.0083)	(0.0053)		(0.0066)	(0.0065)	
France	0.0246	0.0282	0.0036	0.0267	0.0251	-0.0016
	(0.0078)	(0.0049)		(0.0061)	(0.0059)	
Italy	0.0257	0.0329	0.0072	0.0293	0.0290	-0.0003
	(0.0077)	(0.0050)		(0.061)	(0.0062)	
UK	0.1005	0.0416	-0.0589	0.0937	0.0372	-0.0565
	(0.0130)	(0.0060)		(0.0102)	(0.0068)	
Lags of $\Delta p_{i,k,t}$?	Yes (3)	Yes (3)	-	Yes (3)	Yes (3)	-
Prod-country dummies?	Country Dummies	Country Dummies	-	Country Dummies	Country Dummies	-
Exchange Rate Dummies?	Yes (2)	Yes (2)	-	Yes (2)	Yes (2)	-

Table 4.7, Results from 2000-2006 Split Regression Including Exchange Rates[40]

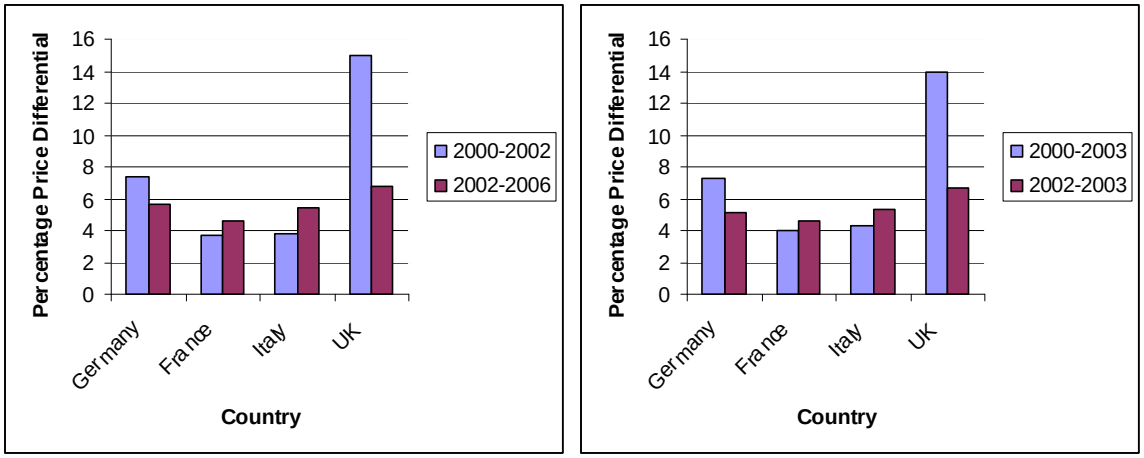

Figure 4.8, Graphical Plot of Percentage Price Differential[41]

[40] Results are significant at the 1% level, for further discussion, see Appendix 6. [Speed of Convergence 2003b-2006a not significant, potentially due to small sample size].

[41] Please note that the second period represented in the second graph is 2003-2006, not 2002-2003 as shown.

Dependent Variable $\Delta p_{i,k,t}$	*Before and After 2002*			*Before and After 2003*		
	2000b-2002a	*2002b-2006a*	*Change*	*2000b-2003a*	*2003b-2006a*	*Change*
Observations	240	480	240	360	360	0
$p_{i,k,t-1}$	-0.6686 (0.0447)	-0.6083 (0.0436)	-	-0.6737 (0.0389)	-0.5512 (0.0616)	-
Germany	7.4	5.6	-1.8	7.3	5.1	-2.2
France	3.7	4.6	0.9	4.0	4.6	0.6
Italy	3.8	5.4	1.6	4.3	5.3	1.0
UK	15.0	6.8	-8.2	13.9	6.7	-7.2
Lags of $\Delta p_{i,k,t}$?	Yes (3)	Yes (3)	-	Yes (3)	Yes (3)	-
Prod-country dummies?	Country Dummies	Country Dummies	-	Country Dummies	Country Dummies	-
Exchange Rate Dummies?	Yes (2)	Yes (2)	-	Yes (2)	Yes (2)	-

Table 4.8, Results from 2000-2006 Split Regression, Adjusting Country Variables for Long Term Price Differential including Exchange Rates

The speed of convergence provides the only realistic framework for the exchange rate adjusted convergence of prices, as the country specific intercept relate primarily to the absolute differential. Under the assumption that introducing regulation designed to integrate the market should increase the speed of convergence, given the greater ability of consumers to actively take advantage of any price differential by purchasing from abroad, any short term changes (e.g. exchange rate shock) should be eliminated more quickly, and prices should fall into line again. The results of the split regression do not conform to this assertion, as following regulation introduction, the speed of convergence fell slightly. However, as manufacturers pricing decisions are not linear, any adjustment arising from a large change in price differential should be reduced more quickly as consumers might be more willing to take advantage of different prices elsewhere, however, with small price differentials, they may be unwilling to do so. Therefore, once price differentials become low, the incentives to bring differentials in line diminish as the profits from engaging in arbitrage have vanished.

It is difficult to ascertain the true effect of regulation purely from the speed of convergence. However, considering the high speed in the face of massively reduced differentials and the non-linearity of pricing policies; the results on speed of convergence are remarkable. Goldberg and Verboven (2005) found that by accounting for exchange rates, the reduction in the speed of convergence in the face of reducing absolute differentials was quite large; even in periods of increased integration efforts. The fact that the convergence rate has been maintained in spite of small differentials is indicative of regulation having the effect of maintaining significant convergence in the face of expected declines. Assuming regulation has been effective, this represents a welfare gain for the UK, indicating that previous cartelisation and segmentation of the distribution system has, to some extent, become broken down by regulation. Prior to the introduction of regulation, through the large differentials, there is evidence of a lack of intra-brand and international competition in the car markets and by increasing the competition, the regulation has successfully continued to reduce differentials.

Dependent	Splitting Into 4 Equal Periods			
Variable $\Delta p_{i,k,t}$	*2000b-2001b*	*2002a-2003a*	*2003b-2004b*	*2005a-2006a*
Observations	180	180	180	180
$p_{i,k,t-1}$	-0.669	-0.619	-0.445	-0.559
	(0.048)	(0.067)	(0.076)	(0.101)
Germany	0.048	0.045	0.019	0.029
	(0.009)	(0.009)	(0.008)	(0.010)
France	0.021	0.030	0.021	0.024
	(0.009)	(0.008)	(0.007)	(0.010)
Italy	0.024	0.032	0.022	0.029
	(0.009)	(0.008)	(0.007)	(0.010)
UK	0.152	0.080	0.026	0.042
	(0.017)	(0.018)	(0.009)	(0.010)
Lags of $\Delta p_{i,k,t}$?	Yes (2)	Yes (3)	Yes (3)	Yes (3)
Prod-country dummies?	Country Dummies	Country Dummies	Country Dummies	Country Dummies
Exchange dummies?	Yes (2)	Yes (2)	Yes (2)	Yes (2)

Table 4.9, Results from 2000-2006 Split Regression (2)

Dependent Variable	Splitting Into 3 Equal Periods		
	2000b-2002a	*2002b-2004a*	*2004b-2006a*
$\Delta p_{i,k,t}$			
Observations	240	240	240
$p_{i,k,t-1}$	-0.669	-0.613	-0.604
	(0.045)	(0.059)	(0.080)
Germany	0.049	0.035	0.032
	(0.008)	(0.007)	(0.008)
France	0.025	0.029	0.028
	(0.008)	(0.006)	(0.008)
Italy	0.026	0.035	0.031
	(0.008)	(0.006)	(0.008)
UK	0.101	0.041	0.046
	(0.013)	(0.013)	(0.008)
Lags of $\Delta p_{i,k,t}$?	Yes (3)	Yes (3)	Yes (3)
Prod-country dummies?	Country Dummies	Country Dummies	Country Dummies
Exchange dummies?	Yes (2)	Yes (2)	Yes (2)

Table 4.10, Results from 2000-2006 Split Regression (3)

$$\Delta p_{i,k,t} = \alpha_k + \alpha_k * post200x + \beta\, p_{i,k,t-1} + \beta\, p_{i,k,t-1} * post200x$$
$$+ \sum_{l=1}^{L} \gamma_l \Delta p_{i,k,t-l} + \sum_{m=0}^{M} \delta_m \Delta e_{k,t-m} + \varepsilon_{i,k,t}$$
$$i = 1,\ldots,12 \;\; k = 1,\ldots,5 \;\; t = 1,\ldots,12 \;\; x = 2,3$$

Equation 4.11, Convergence Equation including Exchange Rates and Post Regulation Dummies

To check the results from splitting the sample, post regulation dummies were included in the specification, shown in Equation 4.11, and interacted with the speed of convergence and country dummies. Unfortunately, these cannot conclusively show that price convergence is occurring with this model structure as the relevant test statistics are not now known. However, these results provide few surprises. Following 2002 and 2003, there was virtually no change in the speed of convergence, and the UK saw the largest reduction in price differentials. Although Table 4.12 brings little new information, it does show that following regulation, German prices decreased by 2%, UK prices reduced by

7.3%, well in line with the results found by splitting the sample, confirming the robustness of those tests.

Dependent Variable $\Delta p_{i,k,t}$	*Post2002 Interactions*	*Post2003 Interactions*
$p_{i,k,t-1}$	-0.6644	-0.6757
	(0.0304)	(0.0309)
$p_{i,k,t-1}$ *post200x	0.0000	0.0000
	(0.0061)	(0.0058)
Germany	0.0503	0.0490
	(0.0075)	(0.0063)
Germany*post200x	-0.013	-0.0128
	(0.0090)	(0.0084)
France	0.0232	0.0266
	(0.0072)	(0.0059)
France*post200x	0.0071	0.0034
	(0.0088)	(0.0083)
Italy	0.0243	0.0292
	(0.0072)	(0.0059)
Italy*post200x	0.0111	0.0058
	(0.0089)	(0.0084)
UK	0.0930	0.0879
	(0.0105)	(0.0100)
UK*post200x	-0.0488	-0.0443
	(0.0112)	(0.0099)
Lags of $\Delta p_{i,k,t}$?	Yes (3)	Yes (3)
Prod-country dummies?	Country Dummies	Country Dummies

Table 4.12, Regressions of Interacted Time Dummies for post2002 and post2003

5. Conclusion

Assuming appropriate adjustment for differing mark-up costs between countries, car price differentials in the early 2000s were large. Italy and France saw prices close to those found in Belgium, prices were slightly higher in Germany, and UK prices were significantly higher. In less than six years, many of the differentials have been eliminated, and the UK prices became in line with the other countries. Although initial evaluation suggested that following the introduction of regulation, price differentials, particularly for the UK reduced significantly, further investigation noted an appreciation of the Euro, which, in the face of non-adjusting UK prices in £'s artificially created much of this drop. Although increases in price transparency, from the introduction of the Euro might go some way to explaining this, regulation could be a contributory factor.

Once exchange rates are accounted for, the results prove to be significant for convergence of prices both before and after the introduction of regulation, by using a test for a unit root. It would be assumed that increasing speed of convergence should be noted following successful integration as the result of regulation, however, this is not observed. This can be reconciled somewhat by the combination of non-linear pricing policies, and large differential reductions. Under these circumstances, maintaining a high speed of convergence is less likely, however, the results only show a small reduction in price differentials, indicating regulation might play an important role in maintaining a high speed of convergence in a market which has become increasingly integrated, and prevent deviation from this.

As there are multiple reasons for reducing differentials, results regarding the effectiveness of regulation are not particularly strong. However, this paper has attempted to account for other variability in the price differential, and concluded that following regulation introduction, despite large reductions in price differentials, the speed at which prices converge has exceeded the expectations. The European car market has become increasingly integrated over the early 20th century, the large differential reductions generate a welfare gain for the UK and Germany, as the price consumers pay becomes more in line with other countries. Despite many other mitigating factors, European

regulation has had some success helping to reduce price differentials, and maintaining a high level of convergence.

6. Limitations and Extensions

The speed of convergence proposal from Levin and Lin (1992) could be extended. An alternative test is proposed by Im, Pesaran and Shin (1995, 1997, 2003) under which the β is allowed to vary (by country) in the form β_k. Under this scenario, the null hypothesis can be rejected for countries in which convergence occurs, and can be negative for some countries, while Levin and Lin results will always show a negative value. A different framework could provide information on the country specific convergence speed.

By looking at the groupings of car models (super-mini, small car etc,) the role of consumers wishing to maximise their expected utility based on budget constraints with multiple choice of models could also be examined. The role of welfare maximisation, by taking the changes in consumer surplus as indication of the effectiveness of regulation, the allocation effects of changing prices could be looked at, and the alteration in welfare for specific markets. From this, the role of efficiency amongst producers in the car market could be looked at, and the potential implications of lacking efficiency in the face of large price reductions.

Many other extensions, such as the role of regulation on the car servicing side, which it also aimed to integrate; the second hand market; the role of haggling; country specific regulation could be included. Reliance on the European Commission to provide adjustments may also be taking into account, by examining any over-emphasis on mark-up differences through a hedonic regression to find the constituent characteristics of the construction of individual prices. Furthermore, by incorporating more car models and countries into the analysis, a more accurate picture of price evolution could be obtained. The natural extension to any up-to-date analysis is to examine the latest data. A brief look at data from March 2006, not available at the time of writing, is included in Appendix 7.

Of particular interest might be the rising UK price differential observed in Table 4.9, perhaps due to short term shocks, or potentially, failure in the regulation to have any significant long term effects.

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7. Appendix

The Appendix provides detailed results not essential to the understanding of the rest of the paper. This shows the detailed regression outputs for each model used, and additional tables for reference purposes. It also contains procedural re-workings of datasets to facilitate cross-study comparisons of results in the main project, particularly those used in the 'Speed of Convergence' analysis to obtain data analysis similar to that used by Goldberg and Verboven (2005).

Appendix 1 Detailed Output Results of Simple Framework p30

Appendix 2 Derivation of the Dependent Variable for Second Model p31

Appendix 3 Derivation of the Speed of Convergence for Second Model p32

Appendix 4 Levin & Lin (1992) Unit Root Testing with Panel Data p33

Appendix 5 Derivation to Goldberg & Verboven Technique of Convergence p36

Appendix 6 Detailed Output Results of 'Speed of Convergence' Framework p38

Appendix 7 A Brief Overview of Late 2006 Data (Released March 2007) p47

Appendix 1
Detailed Output Results for Simple Framework (Equation 4.1)

The following is the E-Views output using a Least Squares regression on panel data for the model shown in Equation 4.1.

$$p_{i,k,t} = \alpha_1 Germany + \alpha_2 France + \alpha_3 Italy + \alpha_4 UK +$$
$$\beta_1 2001a + ... + \beta_{11} 2006a + \gamma_1 Germany \times 2001a + ... + \gamma_{44} UK \times 2006a$$

Equation 4.1, Simple Regression Model

Independent Variables	*Coefficient*	*Standard Error*
Germany	0.0738	(0.0144)
France	0.0063	(0.0144)
Italy	0.0024	(0.0144)
UK	0.2079	(0.0144)
2001a	0.0000	(0.0144)
2001b	0.0000	(0.0144)
2002a	0.0000	(0.0144)
2002b	0.0000	(0.0144)
2003a	0.0000	(0.0144)
2003b	0.0000	(0.0144)
2004a	0.0000	(0.0144)
2004b	0.0000	(0.0144)
2005a	0.0000	(0.0144)
2005b	0.0000	(0.0144)
2006a	0.0000	(0.0144)
Germany×2001a	-0.0037	(0.0250)
France×2001a	-0.0186	(0.0250)
Italy×2001a	0.0005	(0.0250)
UK×2001a	-0.0812	(0.0250)
Germany×2001b	-0.0094	(0.0250)
France×2001b	-0.0155	(0.0250)
Italy×2001b	-0.0102	(0.0250)
UK×2001b	-0.0915	(0.0250)
Germany×2002a	0.0016	(0.0250)
France×2002a	-0.0186	(0.0250)
Italy×2002a	-0.0083	(0.0250)
UK×2002a	-0.1037	(0.0250)
Germany×2002b	-0.0058	(0.0250)
France×2002b	-0.0225	(0.0250)
Italy×2002b	-0.0168	(0.0250)
UK×2002b	-0.1300	(0.0250)
Germany×2003a	-0.0093	(0.0250)
France×2003a	-0.0278	(0.0250)
Italy×2003a	-0.0337	(0.0250)
UK×2003a	-0.2473	(0.0250)
Germany×2003b	-0.0184	(0.0250)
France×2003b	-0.0349	(0.0250)
Italy×2003b	-0.0316	(0.0250)
UK×2003b	-0.2238	(0.0250)
Germany×2004a	-0.0325	(0.0250)
France×2004a	-0.0164	(0.0250)
Italy×2004a	-0.0270	(0.0250)

UK×2004a	-0.1873	(0.0250)	
Germany×2004b	-0.0468	(0.0250)	
France×2004b	-0.0191	(0.0250)	
Italy×2004b	-0.0309	(0.0250)	
UK×2004b	-0.2123	(0.0250)	
Germany×2005a	-0.0288	(0.0250)	
France×2005a	0.0064	(0.0250)	
Italy×2005a	-0.0228	(0.0250)	
UK×2005a	-0.1504	(0.0250)	
Germany×2005b	-0.0233	(0.0250)	
France×2005b	-0.0028	(0.0250)	
Italy×2005b	-0.0329	(0.0250)	
UK×2005b	-0.1681	(0.0250)	
Germany×2006a	-0.0306	(0.0250)	
France×2006a	0.0071	(0.0250)	
Italy×2006a	-0.0194	(0.0250)	
UK×2006a	-0.1847	(0.0250)	
R-squared	0.478449	Mean dependent var.	0.018368
Adjusted R-squared	0.432685	S.D. dependent var.	0.066265
S.E. of regression	0.049911	Akaike info criterion	-3.078759
Sum squared resid.	1.646623	Schwarz criterion	-2.703515
Log likelihood	1167.353	Durbin-Watson stat	1.407859

Table A1.1, EViews Regression Output

	Germany	*France*	*Italy*	*UK*
2000b	0.0738	0.0063	0.0024	0.2079
2001a	0.0701	-0.0123	0.0019	0.1267
2001b	0.0644	-0.0092	-0.0078	0.1164
2002a	0.0898	-0.0123	-0.0059	0.1037
2002b	0.0680	-0.0162	-0.0144	0.0779
2003a	0.0645	-0.0215	-0.0313	-0.0394
2003b	0.0554	-0.0286	-0.0292	-0.0159
2004a	0.0413	-0.0101	-0.0246	0.0206
2004b	0.0270	-0.0128	-0.0285	-0.0044
2005a	0.0450	-0.0001	-0.0204	0.0575
2005b	0.0505	0.0035	-0.0305	0.0398
2006a	0.0432	-0.0071	-0.0170	0.0232

Table A1.2, Difference from the Base Country (Individual Time Specific)

Appendix 2
Derivation of the Dependent Variable for Second Model

The dependent variable is taken as the first difference in the log price of a car in one country relative to the base country.

From Goldberg and Verboven (2005)

$q_{i,k,t}$ denotes the log price of car *i* in country *k* at time *t*.

$p_{i,k,t}$ denotes the log price of the same product relative to a base country,

(i.e. $p_{i,k,t} = q_{i,k,t} - q_{i,B,t}$, with $p_{i,B.t} = 1$, for all *i* and *t*).

From this, it is possible to use the *p* to construct the dependent variables in the regression. The dependent variable is given as the change in log-price difference relative to the previous period.

So it is $\Delta p_{i,k,t} = p_{i,k,t} - p_{i,k,t-1}$ with $p_{i,k,t} = q_{i,k,t} - q_{i,Belgium,t}$.

Appendix 3
Derivation of the Speed of Convergence for Second Model

β is derived as the speed of convergence, as $\Delta p_{i,k,t} = p_{i,k,t} - p_{i,k,t-1}$,

so $\beta = \frac{p_{i,k,t} - p_{i,k,t-1}}{p_{i,k,t-1}}$, so an increasingly negative value for β would indicate a high speed of convergence, as, if no convergence is occurring, the values for $p_{i,k,t}$ and $p_{i,k,t-1}$ would be constant, so a convergence of 0 would be observed. A speed of convergence of 1 would indicate a halving of the log price differential.

Appendix 4
Levin & Lin (1992) Unit Root Testing with Panel Data

The unit root testing method originating from Levin and Lin, and adapted by Goldberg and Verboven provides adequate results for the speed of convergence of prices. The alternative specification proposed by Im, Pesaran and Shin (1995, 1997, 2003) allows the value of β to vary by country in the form β_k, thus allowing for differing lags for different cross-sectional variables, in this case, countries. Levin and Lin therefore have a homogeneity constraint, indicating that either a unit root is detected for all observations, or not detected at all. The Levin and Lin approach is preferable in an analysis of car price differentials as the speed of convergence will apply to the entire sample rather than individual subsets. Although previous data has emphasised the importance of the UK price differential individual speed of convergence results would be of less importance compared to individual absolute price differentials which are examined in detail.

The Levin and Lin model is taken in the general specification shown in equation 4.1.

$$y_{i,t} = \beta y_{i,t-1} + \alpha_i + \varepsilon_{i,t}$$

The inclusion of fixed effects allows for different means for different individual countries under the null hypothesis of stationary. Under the null hypothesis of a unit root, the fixed effects are absorbed into the initial value.

The OLS estimator for this is calculated as

$$\overline{y_i} = \frac{1}{T}\sum_{t=1}^{T} y_{i,t}$$

$$\hat{\beta} = \frac{\sum_{i=1}^{N}\sum_{i=1}^{T}(y_{i,t} - \overline{y_i})(y_{i,t-1} - \overline{y_i})}{\sum_{i=1}^{N}\sum_{i=1}^{T}(y_{i,t-1} - \overline{y_i})^2}$$

A drawback of both Levin and Lin or IPS tests is that both assume there is no co-integration between pairs of countries in the sample. In this real world example it should

be that any two or more non-stationary time series could produce a linear combination which is stationary. This could potentially lead to over-rejecting the null hypothesis of a unit root (i.e. non-stationary).

The table below (Table A4.LL), taken from Levin & Lin (1992) provides the appropriate critical value results for rejecting the null hypothesis of a unit root with the panel data.

Table 5: Unit Root Test Critical Values, Individual-Specific Intercepts

	t = 5					t = 10				
N	1.0%	2.5%	5%	10%	50%	1.0%	2.5%	5%	10%	50%
1	-2.16	-2.11	-2.06	-1.97	-1.50	-2.68	-2.54	-2.41	-2.25	-1.55
2	-2.87	-2.77	-2.69	-2.57	-2.02	-3.33	-3.18	-3.02	-2.82	-2.05
5	-4.10	-3.96	-3.84	-3.69	-3.08	-4.51	-4.31	-4.13	-3.90	-3.07
10	-5.40	-5.24	-5.10	-4.94	-4.30	-5.77	-5.54	-5.35	-5.11	-4.25
15	-6.37	-6.21	-6.06	-5.89	-5.24	-6.72	-6.48	-6.28	-6.04	-5.16
20	-7.19	-7.02	-6.87	-6.69	-6.04	-7.51	-7.27	-7.06	-6.82	-5.94
25	-7.90	-7.73	-7.58	-7.40	-6.74	-8.21	-7.96	-7.76	-7.51	-6.63
50	-10.68	-10.51	-10.35	-10.17	-9.51	-10.93	-10.69	-10.47	-10.23	-9.33
75	-12.82	-12.64	-12.48	-12.30	-11.64	-13.02	-12.77	-12.56	-12.31	-11.42
100	-14.61	-14.43	-14.27	-14.09	-13.44	-14.78	-14.53	-14.32	-14.07	-13.17
150	-17.63	-17.45	-17.29	-17.11	-16.45	-17.73	-17.49	-17.27	-17.02	-16.12
200	-20.18	-19.99	-19.83	-19.65	-18.99	-20.22	-19.98	-19.76	-19.51	-18.61
250	-22.43	-22.24	-22.08	-21.89	-21.22	-22.42	-22.17	-21.95	-21.70	-20.80
300	-24.47	-24.28	-24.11	-23.92	-23.25	-24.41	-24.16	-23.94	-23.69	-22.79

	t = 25					t = 50				
N	1.0%	2.5%	5%	10%	50%	1.0%	2.5%	5%	10%	50%
1	-3.11	-2.87	-2.67	-2.43	-1.56	-3.24	-2.99	-2.76	-2.49	-1.56
2	-3.69	-3.44	-3.22	-2.96	-2.01	-3.78	-3.51	-3.27	-3.00	-2.02
5	-4.76	-4.49	-4.26	-3.98	-2.99	-4.80	-4.53	-4.28	-4.00	-2.96
10	-5.94	-5.66	-5.42	-5.14	-4.12	-5.96	-5.67	-5.43	-5.13	-4.06
15	-6.84	-6.56	-6.32	-6.03	-5.00	-6.84	-6.56	-6.31	-6.00	-4.93
20	-7.60	-7.32	-7.07	-6.78	-5.75	-7.59	-7.30	-7.05	-6.74	-5.66
25	-8.27	-7.98	-7.74	-7.45	-6.41	-8.25	-7.96	-7.71	-7.39	-6.31
50	-10.89	-10.60	-10.35	-10.06	-9.02	-10.83	-10.54	-10.28	-9.96	-8.87
75	-12.91	-12.62	-12.36	-12.07	-11.02	-12.81	-12.52	-12.26	-11.94	-10.85
100	-14.61	-14.32	-14.06	-13.77	-12.71	-14.48	-14.19	-13.92	-13.61	-12.52
150	-17.46	-17.17	-16.91	-16.61	-15.56	-17.28	-16.98	-16.72	-16.41	-15.32
200	-19.86	-19.57	-19.31	-19.01	-17.96	-19.64	-19.34	-19.07	-18.77	-17.68
250	-21.98	-21.69	-21.43	-21.13	-20.08	-21.72	-21.41	-21.15	-20.84	-19.76
300	-23.89	-23.61	-23.35	-23.04	-22.00	-23.59	-23.29	-23.03	-22.72	-21.64

	t = 100					t = 250				
N	1.0%	2.5%	5%	10%	50%	1.0%	2.5%	5%	10%	50%
1	-3.30	-3.04	-2.80	-2.52	-1.56	-3.40	-3.10	-2.84	-2.54	-1.57
2	-3.83	-3.55	-3.31	-3.02	-1.99	-3.89	-3.59	-3.33	-3.03	-2.00
5	-4.85	-4.56	-4.30	-4.01	-2.92	-4.88	-4.58	-4.31	-4.01	-2.92
10	-6.00	-5.69	-5.43	-5.13	-4.03	-6.01	-5.70	-5.43	-5.12	-4.01
15	-6.88	-6.57	-6.30	-6.00	-4.88	-6.88	-6.56	-6.29	-5.98	-4.86
20	-7.62	-7.30	-7.04	-6.73	-5.61	-7.61	-7.29	-7.02	-6.71	-5.58
25	-8.27	-7.95	-7.69	-7.38	-6.26	-8.25	-7.93	-7.66	-7.35	-6.22
50	-10.83	-10.51	-10.24	-9.92	-8.80	-10.78	-10.46	-10.19	-9.87	-8.74
75	-12.79	-12.46	-12.20	-11.88	-10.76	-12.71	-12.40	-12.13	-11.82	-10.68
100	-14.44	-14.12	-13.85	-13.53	-12.41	-14.35	-14.04	-13.77	-13.45	-12.33
150	-17.21	-16.89	-16.62	-16.30	-15.19	-17.10	-16.79	-16.52	-16.21	-15.08
200	-19.55	-19.22	-18.95	-18.64	-17.52	-19.41	-19.11	-18.84	-18.53	-17.41
250	-21.61	-21.28	-21.01	-20.70	-19.58	-21.46	-21.16	-20.88	-20.58	-19.46
300	-23.47	-23.14	-22.86	-22.56	-21.45	-23.31	-23.01	-22.73	-22.43	-21.31

Table A4.LL, Critical Values as reported by Levin & Lin (1992) [NOTE: This table is extracted from the main text]

Appendix 5
Derivation to Goldberg & Verboven Technique of Convergence

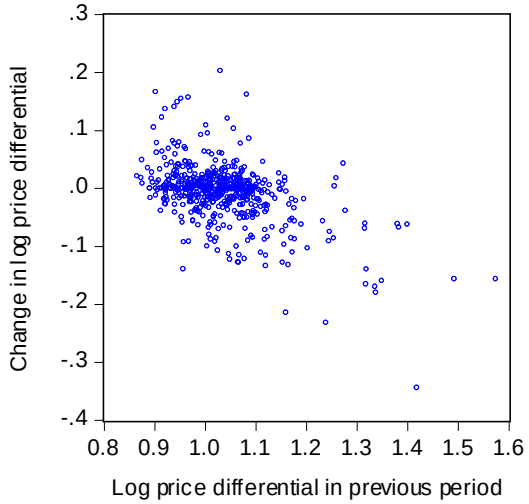
As initially positioned, the dataset did not provide the most appropriate 'set-up' to facilitate a good comparison with the work of Goldberg and Verboven. The principal differences between the collected data, and the data used by Goldberg and Verboven were; bi-annual vs. annual data and log prices vs. absolute log prices.

The implications of comparing bi-annual data to annual data regarding the speed of convergence are relatively large. Whereas annual data will observe a speed of convergence between a given year and the previous year, say -0.5, bi-annual results will only reflect part of that drop of price differential in one half-year, and the remainder in the other half year.

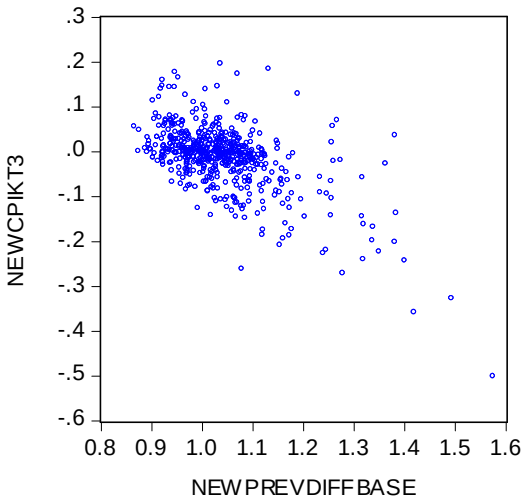
Although it is not entirely robust, doubling the speed of convergence result would seem a reasonable way of adjusting the speed of convergence result to account for the different time lengths, however, if the reduction of price is not consistent over an entire year, i.e. the speed of price convergence is greater in one half of the year and less in the other, the results may become skewed. This is relatively haphazard, and therefore another method could be more accurate.

A superior method might be to take the 'previous period' as the period 2 periods prior, so the difference in price is measured over a year instead of 6 months. This allows the data to be more closely reconciled with that of Goldberg and Verboven, while using the entire dataset. Additional data from early 2000 and late 1999 was added to reduce the number of lagged terms with zero values.

Graphs A5.1 and A5.2 illustrate graphically the difference between 6-month estimates and yearly estimates by showing the dependent variable against an independent variable. The speed of convergence (i.e. the line of best fit in the data) would have a steeper slope, and therefore a faster speed of convergence, which would be expected from examining a longer period.



Graph A5.1, Plotting the Dependent Variable against the independent variable



Graph A5.2, Plotting the Dependent Variable against the independent variable for the Annual

Another effort to reconcile these results would be to examine the absolute values of the price differentials rather than the actual ratio price differential. By doing this, it no longer becomes clear whether the long term price differentials are above or below the Belgian price. The positive is that, when examining differentials, the price differential will reflect 'how far' the price is from Belgium, most useful in observing convergence of prices, rather than their differentials. This is the method used by Goldberg and Verboven (2005), so, again, it should more prominently reconcile with their results.

Appendix 6
Detailed Output Results of 'Speed of Convergence' Framework

The speed of convergence framework examines price differentials and convergence both with and without exchange rates. Equation 4.4 provides the without exchange rates specification, and Equation 4.5 includes lagged exchange rate variability.

$$\Delta p_{i,k,t} = \alpha_k + \beta p_{i,k,t-1} + \sum_{l=1}^{L} \gamma_l \Delta p_{i,k,t-l} + \varepsilon_{i,k,t}$$

Equation 4.4, Convergence Equation without Exchange Rates

$$\Delta p_{i,k,t} = \alpha_k + \beta p_{i,k,t-1} + \sum_{l=1}^{L} \gamma_l \Delta p_{i,k,t-l} + \sum_{m=0}^{M} \delta_m \Delta e_{k,t-m} + \varepsilon_{i,k,t}$$

Equation 4.5, Convergence Equation with Exchange Rates

The critical values reported by Levin and Lin (1992) for t=5 are as follows:
-10.68 at 1% level
-10.35 at 5% level
-10.17 at 10% level

For t=10, the critical values are as follows:
-10.93 at 1%
-10.47 at 5%
-10.23 at 10%

Dependent Variable: Change Log Price
Method: Least Squares

Sample: 1 12 (Entire Sample)
Included observations: 720

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.573264	0.026537	21.60231	0.0000
Speed of Convergence	-0.573264	0.026372	-21.73759	0.0000
Germany	0.035485	0.004550	7.798861	0.0000
France	0.024179	0.004317	5.600964	0.0000
Italy	0.027701	0.004344	6.376207	0.0000
UK	0.050448	0.005731	8.801885	0.0000
Exchange Lag 1	0.239562	0.041852	5.724049	0.0000
Exchange Lag 2	-0.042234	0.041402	-1.020119	0.3080
Lag Dep. Var. 1	0.261604	0.031760	8.236770	0.0000
Lag Dep. Var. 2	-0.081988	0.034474	-2.378245	0.0177
Lag Dep. Var. 3	0.070947	0.033557	2.114222	0.0348

R-squared	0.566756	Mean dependent var	-0.006656
Adjusted R-squared	0.560645	S.D. dependent var	0.053515
S.E. of regression	0.035472	Akaike info criterion	-3.824998
Sum squared resid	0.892098	Schwarz criterion	-3.755037
Log likelihood	1387.999	F-statistic	92.74910
Durbin-Watson stat	1.866220	Prob(F-statistic)	0.000000

Table A6.1, Convergence Equation (Entire Sample)

Reject the null hypothesis of no convergence at 1% level.

All country dummies are significant at the 1% level.

Dependent Variable: Change Log Price
Method: Least Squares

Sample: 1 12 (2000b-2002a)
Included observations: 240

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.668597	0.044986	14.86248	0.0000
Speed of Convergence	-0.668597	0.044666	-14.96868	0.0000
Germany	0.049203	0.008260	5.957092	0.0000
France	0.024562	0.007762	3.164617	0.0018
Italy	0.025659	0.007742	3.314232	0.0011
UK	0.100535	0.012964	7.755036	0.0000
Exchange Lag 1	0.326462	0.084813	3.849217	0.0002
Exchange Lag 2	-0.482086	0.091066	-5.293818	0.0000
Lag Dep. Var. 1	0.203537	0.050003	4.070483	0.0001
Lag Dep. Var. 2	0.165927	0.053905	3.078129	0.0023
Lag Dep. Var. 3	0.236170	0.101608	2.324332	0.0210

R-squared	0.721966	Mean dependent var	-0.014910
Adjusted R-squared	0.709824	S.D. dependent var	0.068799
S.E. of regression	0.037061	Akaike info criterion	-3.707775
Sum squared resid	0.314529	Schwarz criterion	-3.548245
Log likelihood	455.9330	F-statistic	59.46390
Durbin-Watson stat	1.720284	Prob(F-statistic)	0.000000

Table A6.2, Convergence Equation (2000b-2002a)

Reject the null hypothesis of no convergence at 1% level.

All country dummies are significant at the 1% level.

Dependent Variable: Change Log Price
Method: Least Squares

Sample: 1 12 (2002b-2006a)
Included observations: 480

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.608321	0.043748	13.90521	0.0000
Speed of Convergence	-0.608321	0.043631	-13.94238	0.0000
Germany	0.033828	0.005319	6.360357	0.0000
France	0.028185	0.004889	5.765311	0.0000
Italy	0.032925	0.005007	6.576430	0.0000
UK	0.041587	0.005963	6.974159	0.0000
Exchange Lag 1	0.077274	0.048642	1.588627	0.1128
Exchange Lag 2	0.053043	0.045426	1.167666	0.2435
Lag Dep. Var. 1	0.360779	0.041412	8.711917	0.0000
Lag Dep. Var. 2	-0.151695	0.045561	-3.329477	0.0009
Lag Dep. Var. 3	0.066159	0.035075	1.886219	0.0599

R-squared	0.491941	Mean dependent var	-0.002529
Adjusted R-squared	0.481108	S.D. dependent var	0.043427
S.E. of regression	0.031282	Akaike info criterion	-4.068902
Sum squared resid	0.458944	Schwarz criterion	-3.973253
Log likelihood	987.5365	F-statistic	45.41206
Durbin-Watson stat	1.877975	Prob(F-statistic)	0.000000

Table A6.3, Convergence Equation (2002b-2006a)

Reject the null hypothesis of no convergence at 1% level.

All country dummies are significant at the 1% level.

Dependent Variable: Change Log Price
Method: Least Squares

Sample: 1 12 (2000b-2003a)
Included observations: 360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.673673	0.039156	17.20491	0.0000
Speed of Convergence	-0.673673	0.038930	-17.30455	0.0000
Germany	0.048893	0.006615	7.391239	0.0000
France	0.026741	0.006114	4.374088	0.0000
Italy	0.029274	0.006105	4.795322	0.0000
UK	0.093706	0.010194	9.191882	0.0000
Exchange Lag 1	0.406802	0.051364	7.919987	0.0000
Exchange Lag 2	-0.389976	0.077220	-5.050158	0.0000
Lag Dep. Var. 1	0.190807	0.040807	4.675876	0.0000
Lag Dep. Var. 2	0.100015	0.045762	2.185542	0.0295
Lag Dep. Var. 3	0.065787	0.043908	1.498293	0.1350

R-squared	0.685738	Mean dependent var	-0.011923
Adjusted R-squared	0.676733	S.D. dependent var	0.062619
S.E. of regression	0.035603	Akaike info criterion	-3.802695
Sum squared resid	0.442383	Schwarz criterion	-3.683953
Log likelihood	695.4850	F-statistic	76.15378
Durbin-Watson stat	1.628065	Prob(F-statistic)	0.000000

Table A6.4, Convergence Equation (2000b-2003a)

Reject the null hypothesis of no convergence at 1% level.

All country dummies are significant at the 1% level.

Dependent Variable: Change Log Price
Method: Least Squares

Sample: 1 12 (2003b-2006a)
Included observations: 360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.551150	0.061755	8.924812	0.0000
Speed of Convergence	-0.551150	0.061643	-8.941050	0.0000
Germany	0.028115	0.006529	4.306492	0.0000
France	0.025111	0.005927	4.236523	0.0000
Italy	0.028965	0.006163	4.699939	0.0000
UK	0.037176	0.006777	5.485889	0.0000
Exchange Lag 1	0.038770	0.078319	0.495030	0.6209
Exchange Lag 2	0.072184	0.049991	1.443945	0.1497
Lag Dep. Var. 1	0.355999	0.046461	7.662280	0.0000
Lag Dep. Var. 2	-0.184700	0.057497	-3.212326	0.0014
Lag Dep. Var. 3	0.047044	0.049011	0.959866	0.3378

R-squared	0.449263	Mean dependent var	-0.001390
Adjusted R-squared	0.433482	S.D. dependent var	0.041940
S.E. of regression	0.031567	Akaike info criterion	-4.043341
Sum squared resid	0.347766	Schwarz criterion	-3.924599
Log likelihood	738.8014	F-statistic	28.46961
Durbin-Watson stat	1.782940	Prob(F-statistic)	0.000000

Table A6.5, Convergence Equation (2003b-2006a)

Cannot reject the null hypothesis of no convergence at 1% level.

All country dummies are significant at the 1% level.

pikt*post2002

Dependent Variable: CPIKT3A
Method: Least Squares
Date: 03/15/07 Time: 16:30
Sample: 1 12
Included observations: 720

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.581049	0.027146	21.40422	0.0000
PDB2A	-0.578520	0.026645	-21.71201	0.0000
PDB2A*POST2002	-0.003794	0.002822	-1.344832	0.1791
GERMANY	0.036009	0.004564	7.889574	0.0000
FRANCE	0.024509	0.004322	5.671384	0.0000
ITALY	0.028056	0.004350	6.449699	0.0000
UK	0.051212	0.005756	8.896683	0.0000
LAG1A	0.264732	0.031828	8.317717	0.0000
LAG2A	-0.077464	0.034618	-2.237656	0.0256
LAG3A	0.067958	0.033611	2.021881	0.0436
ERCH2A	0.232339	0.042171	5.509396	0.0000
ERCH2B	-0.048157	0.041612	-1.157297	0.2475

R-squared	0.567860	Mean dependent var	-0.006656
Adjusted R-squared	0.561146	S.D. dependent var	0.053515
S.E. of regression	0.035452	Akaike info criterion	-3.824772
Sum squared resid	0.889825	Schwarz criterion	-3.748451
Log likelihood	1388.918	F-statistic	84.57794
Durbin-Watson stat	1.863496	Prob(F-statistic)	0.000000

pikt*post2002 + Countries

Dependent Variable: CPIKT3A
Method: Least Squares
Date: 03/15/07 Time: 16:31
Sample: 1 12
Included observations: 720

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.664148	0.030462	21.80272	0.0000
PDB2A	-0.664445	0.030386	-21.86665	0.0000
PDB2A*POST2002	0.000445	0.006098	0.073047	0.9418
GERMANY	0.050337	0.007529	6.685655	0.0000

GERMANY*POST2002	-0.013059	0.008961	-1.457257	0.1455
FRANCE	0.023241	0.007211	3.222855	0.0013
FRANCE*POST2002	0.007072	0.008829	0.801015	0.4234
ITALY	0.024310	0.007197	3.377702	0.0008
ITALY*POST2002	0.011149	0.008851	1.259596	0.2082
UK	0.092961	0.010542	8.818069	0.0000
UK*POST2002	-0.048812	0.011192	-4.361149	0.0000
LAG1A	0.284520	0.031473	9.040107	0.0000
LAG2A	-0.038014	0.034682	-1.096058	0.2734
LAG3A	0.030348	0.033510	0.905629	0.3654
ERCH2A	0.166952	0.043219	3.862939	0.0001
ERCH2B	-0.093938	0.041733	-2.250913	0.0247

R-squared	0.588567	Mean dependent var	-0.006656
Adjusted R-squared	0.579800	S.D. dependent var	0.053515
S.E. of regression	0.034690	Akaike info criterion	-3.862763
Sum squared resid	0.847187	Schwarz criterion	-3.761002
Log likelihood	1406.595	F-statistic	67.13938
Durbin-Watson stat	1.853654	Prob(F-statistic)	0.000000

pikt*post2003

Dependent Variable: CPIKT3A
Method: Least Squares
Date: 03/15/07 Time: 16:30
Sample: 1 12
Included observations: 720

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.588754	0.027225	21.62559	0.0000
PDB2A	-0.585606	0.026782	-21.86529	0.0000
PDB2A*POST2003	-0.006296	0.002624	-2.399650	0.0167
GERMANY	0.036549	0.004556	8.021390	0.0000
FRANCE	0.024824	0.004311	5.758281	0.0000
ITALY	0.028395	0.004340	6.543346	0.0000
UK	0.052557	0.005780	9.093583	0.0000
LAG1A	0.261620	0.031654	8.264878	0.0000
LAG2A	-0.071994	0.034610	-2.080115	0.0379
LAG3A	0.074276	0.033474	2.218951	0.0268
ERCH2A	0.245945	0.041797	5.884290	0.0000
ERCH2B	-0.053580	0.041533	-1.290047	0.1975

R-squared	0.570251	Mean dependent var	-0.006656

Adjusted R-squared	0.563574	S.D. dependent var	0.053515
S.E. of regression	0.035353	Akaike info criterion	-3.830321
Sum squared resid	0.884901	Schwarz criterion	-3.754000
Log likelihood	1390.915	F-statistic	85.40673
Durbin-Watson stat	1.852944	Prob(F-statistic)	0.000000

pikt*post2003 + Countries

Dependent Variable: CPIKT3A
Method: Least Squares
Date: 03/15/07 Time: 16:31
Sample: 1 12
Included observations: 720

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.675668	0.031043	21.76527	0.0000
PDB2A	-0.675685	0.030905	-21.86308	0.0000
PDB2A*POST2003	3.45E-05	0.005754	0.005990	0.9952
GERMANY	0.049014	0.006269	7.818762	0.0000
GERMANY*POST2003	-0.012755	0.008432	-1.512744	0.1308
FRANCE	0.026646	0.005913	4.506036	0.0000
FRANCE*POST2003	0.003419	0.008337	0.410059	0.6819
ITALY	0.029246	0.005907	4.951463	0.0000
ITALY*POST2003	0.005772	0.008371	0.689475	0.4908
UK	0.087896	0.009039	9.724174	0.0000
UK*POST2003	-0.044348	0.009856	-4.499521	0.0000
LAG1A	0.264798	0.031090	8.517038	0.0000
LAG2A	-0.018447	0.035363	-0.521635	0.6021
LAG3A	0.083881	0.032932	2.547116	0.0111
ERCH2A	0.286996	0.041661	6.888934	0.0000
ERCH2B	-0.105951	0.042064	-2.518817	0.0120

R-squared	0.589186	Mean dependent var	-0.006656
Adjusted R-squared	0.580433	S.D. dependent var	0.053515
S.E. of regression	0.034664	Akaike info criterion	-3.864270
Sum squared resid	0.845911	Schwarz criterion	-3.762509
Log likelihood	1407.137	F-statistic	67.31146
Durbin-Watson stat	1.810991	Prob(F-statistic)	0.000000

Appendix 7
A Brief Overview of Late 2006 Data (Released March 2007)

Using data not available at the time of data/empirical analysis, this section aims to give a brief overview of these results, and their relation to the results found in this paper.

The European Commission report for late 2006 indicates a high level of price stability. Interestingly, the dispersion of prices over the entire EU 25 states decreased from 6.5% in previous reports to 6.4%, while the Euro-zone dispersion increased from 4.4% to 4.6%. This is slightly contradictory to the results found in this analysis, which suggests overall price convergence, however, the report shows that price dispersion levels were at an all time low.

The report also suggests that new member states on average exhibit lower prices, with prices on average 2% lower. Of the countries examined in this paper, German prices increased 1.3%, France and Italy saw prices rise 1.2%, while the UK saw prices increase just 0.2%. These results fit with the overall findings of consistent reductions in car price differentials, and the report highlights the continuing reductions, which this paper has in some way attributed to the new regulation.

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