Car Price Differentials in the European Union: An Economic Analysis

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An investigation for the Competition Directorate-General of the European Commission

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Hans Degryse and Frank Verboven

K. U. Leuven and C.E.P.R.

CENTRE FOR ECONOMIC POLICY RESEARCH, LONDON

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EXECUTIVE SUMMARY

Previous documentation on EU car price differentials

Since the early 1980's consumer organizations, competition agencies and academic researchers have produced a considerable number of studies on car price differentials in Europe. Most of this research aimed to assess the presence and importance of international price differentials, using different measurement methodologies. At the same time, efforts have been made to explain the causes of the observed price differentials. As new studies were published, the automobile industry also entered into the debate to express their views, both on the adopted methodologies and on the causes of the price differentials.

Chapter 1 of this report reviews the rich literature on car price differentials. The goal of this review is twofold. First, it summarizes the previous findings on EU car price differentials, thereby putting the results of the present study into a broader context. Second, it introduces the methodological issues that need to be taken into account when conducting a comparative car price study.

The review consists of three parts. Section 1.1 reviews the various car price reports as published by consumer organizations and policy makers since the early eighties. BEUC, a consortium of European consumer organizations, was among the first to draw attention on the issue of car price differentials in Europe. It conducted a series of studies during 1981-1993. Roughly speaking, the methodology consisted of taking a sample of popular models with comparable specifications across European countries. For each model, the pre-tax common currency prices in the different countries were computed and expressed relative to the price in a base country. These relative prices were then averaged across all models to obtain a measure for the general car price level in the different countries. Over the period 1981-1993 BEUC found the pre-tax car price level to be the lowest in Denmark, followed by Greece and the Benelux countries. Higher car price levels occurred in France, Germany and Portugal (about 30-40 percent above the level in Denmark). Even higher price levels were found in Italy, Spain and Sweden (in the 30-50 percent range), Ireland (in the 40-60 percent range) and the United Kingdom (in the 50-80 percent range).

The studies by BEUC initiated a lot of public policy attention. In 1992 the European Commission published a first report, the "Intra-EC car price differential report". This report differed from the BEUC studies in terms of methodology and in terms of focus. First, the report conducted a more detailed adjustment for specification differences across cars, and also attempted to account for discounts and financial benefits (its "phase 2"). Second, the report did not aim to provide a measure for the general car price level in the different countries. Instead, the focus was on the magnitude of the price differentials for individual car models. The study found that specification-adjusted maximum car price differentials frequently exceeded the 12 and 18 percent norms referred to in a Commission Notice.[1] According to that Notice, the selective and exclusive distribution system (SED system) is compatible with EC law if, among other conditions, the maximum price differentials are no larger than 12 percent for more than one year, and no larger than 18 percent for a shorter period. In 1993 the European Commission decided to publish its bi-annual reports on specification-adjusted car prices, to better monitor price differentials across Europe.

The Monopolies and Mergers Commission (MMC) in the United Kingdom has also investigated car price differentials in Europe, with a particular focus on the car price level in the United Kingdom. In a first report in 1992, the MMC concluded that the UK market did not show excessive adjusted price differentials with France and Germany, the two markets with the most similar characteristics to the UK. In its recent 1999 report, the MMC made use of the price reports published by the European Commission since 1993. The MMC argued that these data broadly represent actual price differences since a separate study showed no clear evidence that discounts and financial benefits differed in a systematic way between the UK and other countries. The MMC's main focus was on the measurement of the general car price level. Yet it also considered car price differentials for individual models to assess the full extent of arbitrage opportunities. The MMC reported that the general car price level in the UK was higher than in France, Germany and Italy by a margin of between 3.5 and 7.1 percent over the period 1993-2000, and by a margin of 10.1 and 12.6 percent over the second half of that period. Considering the prices of individual models in May 1999,

[1] See the OJ 85/C17/03 of January 1st 1985.

the MMC reported that the majority of the models were at least 20 percent more expensive in the United Kingdom than in other countries with similar tax regimes.

Section 1.2 reviews the academic literature on car price differentials. Several studies appeared on the construction of hedonic price indices. This is an econometric approach to measure the general car price level after correcting for differences in observable specifications. Several of these studies considered a long time horizon to evaluate the persistence of price differentials. Most studies found large differences in the general car price level between countries, broadly consistent with the results from the policy reports. In addition, a persistence of the price differentials over time was found, despite a rather substantial year-to-year volatility for some countries.

A number of academic studies aimed to go one step further and explore the validity of various explanations for the price differentials that had been offered by policy makers and industry insiders. The presence of local market power by domestic producers emerged as one explanation for the international price differentials. In addition, the importance of several regulatory factors was investigated. Exchange rate fluctuations, tax differentials and trade restrictions (tariffs and quotas) create different cost conditions across European markets. If companies pass through these costs incompletely to consumers, international price differentials result. The empirical evidence clearly demonstrated the presence of incomplete pass-through of taxes, tariffs and especially exchange rates.

Based on the studies reviewed in sections 1.1 and 1.2, section 1.3 makes a methodological checklist. The methodological checklist does not aim to provide definite answers, but rather to point out several issues that need to be handled in a comparative car price study. The checklist begins with relevant points on the measurement of car prices. The informational value of list prices is discussed, as well as approaches to the measurement of consumer discounts from list prices, and financial benefits. Next, the checklist discusses the issues that have been raised regarding the comparability of car prices on an international basis. Adjustment approaches for differences in specifications between countries are discussed. In addition, taxes and exchange rates are discussed as factors that may affect the interpretation of international car price differentials. Finally, the checklist discusses issues related to the presentation of price comparisons. This includes the question

whether one should focus on the price differentials for individual models, or rather on the construction of appropriate indices measuring the general car price level in the different countries.

The comparative car price study

Data

The comparative car price study is conducted in chapter 2. Section 2.1 describes the used data set, which has been collected by the European Commission on a bi-annual basis since 1993. During each period the data set covers the pre-tax and post-tax prices for about 75 car models available in most European countries. Prices are adjusted for differences in major specifications, including engine characteristics and major equipment items. The price data set is complemented with information on sales (new car registrations) in the different countries; contemporaneous and period-average exchange rates and inflation; and information on a questionnaire conducted by the European Commission.[2] Section 2.2 discusses the evolution of exchange rates and taxes, which will be useful for later reference.

General framework

Section 2.3 discusses the general framework of analysis. The framework is illustrated in Figure E.1, as shown at the end of the Executive Summary. We propose to document car price differentials from two different angles: international price dispersion and systematic price differentials. First, we consider *international price dispersion* (top right circle on Figure E.1). This analysis focuses on the price differentials for individual car models throughout the European Union. The analysis is based on alternative measures such as the price differential range between the most expensive and the cheapest country, or the coefficient of price variation. Second, we look at *systematic price differentials* (bottom right circle on Figure E.1). This analysis focuses on average price differentials across countries, based on the construction of price indices. The two approaches may generate rather different results. For example, it may turn out that international price dispersion for the individual models is quite

[2] The quantitative information of the questionnaire relates to dealer margins, discounts and import prices. From the results we present one cannot deduce any brand-level or firm-level confidential information.

large, while at the same time the systematic price differentials across countries are limited. This would happen if some models were cheap in some countries and other models were cheap in other countries, while on average prices were similar across countries.

The two different approaches can shed light on two different policy options that may reduce price differences.[3] This is shown on the left part of Figure E.1. The analysis of international price dispersion serves to measure arbitrage opportunities to consumers for individual car models. This helps to obtain an idea on the extent of cross-border trade restrictions (top left of Figure E.1). The results on price dispersion may be confronted with a policy standard to determine whether the degree of European integration is acceptable or whether policy action to promote cross-border trade is called for. For example, the policy maker may use the mentioned 12/18 percent norm on price differentials as the policy standard, but also other – more or less severe – standards may be adopted if this is believed to be more appropriate.

The results on systematic price differentials cannot be used directly for assessing the extent of cross-border trade restrictions, since price dispersion for individual car models may exist even if there are no systematic price differentials. Instead, the results can be used as a guide to understand the role of several structural conditions underlying price differentials, for example taxes, exchange rates and competitive conditions (bottom left of Figure E.1). If certain structural conditions are important and can easily be influenced, then the policy maker may choose to influence these conditions directly in order to reduce price differentials.

After a detailed analysis of international price dispersion and systematic price differentials based on pre-tax, specification-adjusted recommended retail prices, we consider various possible adjustments. These are shown on middle right part on Figure E.1. A first question is which measure for car prices should be used. The specification-adjusted recommended retail price (RRP) is an informative point of departure, and can be easily collected for a large set of models/countries. Yet to gain confidence in the reliability of this measure, it is necessary to seriously consider adjustments to account for the actual transaction price paid by the customer. We

[3] Note that a policy to reduce price differentials does not imply that prices converge to the lowest level. Most economic models would expect that prices would convergence to intermediate levels.

consider two related measures: customer discounts and gross dealer margins. Gross dealer margins have the advantage that information is more widely available from the companies. More importantly, they provide a measure for the potential of both customer discounts and financial benefits offered on behalf of the dealer, which are difficult to quantify directly. Finally, gross dealer margins make it possible to also consider (unexploited) arbitrage opportunities from the perspective of the dealer rather than from the perspective of the final customer.

A second question is whether car prices should be analyzed with or without adjusting for taxes or exchange rates. From the point of view of consumers seeking to engage in cross-border trade and exploit international arbitrage opportunities, it is largely irrelevant to adjust prices for these variables. From a policy point of view, however, a tax or an exchange rate adjustment may be a relevant option. Suppose the policy maker wants to reduce price differentials by directly influencing structural conditions under its control, such as taxes or exchange rates, instead of trying to reduce possible cross-border trade restrictions, such as those made possible by the SED system. We show how a proper adjustment can account for price differentials that arise from the incomplete pass-through behavior of taxes or exchange rates. This adjustment thus enables one to conduct a counterfactual analysis and ask how car prices would approximately be if taxes were harmonized across countries or if exchange rates were stabilized. The tax or exchange rate adjusted analysis can thus indicate whether a direct policy such as a tax harmonization or an exchange rate policy would be sufficient to reduce international price dispersion, or whether indirect alternative measures to promote cross-border trade are also called for.

Methodological details

Sections 2.4 and 2.5 constitute the first part of the car price study. The analysis is based on pre-tax list prices, converted into a common currency using the six-month average exchange rates. At this point, prices are not adjusted for tax differentials or exchange rate fluctuations. The focus is simply on what actually happened during the period of 1993-2000. Section 2.4 performs an analysis of international price dispersion. It considers alternative measures including the price differential range (the price difference between the most expensive and the cheapest country, expressed as a percentage of the average price of a given model) and the coefficient of variation (i.e.

the relative standard deviation, expressed as the standard deviation of the prices in percentage of the average price). The analysis asks which brands, segments or countries have shown the largest price dispersion and thus provided the largest arbitrage opportunities to consumers.

In section 2.5 we investigate to which extent the (unadjusted) price differentials have been systematic. We construct Fisher indices to measure the general price levels in the different countries and years.[4] This approach starts from computing different price indices using the car baskets of different countries as the base, and then averaging over the obtained indices. We classify the countries according to their general car price levels, and ask whether systematic price differentials have been persistent through time.

Section 2.6 considers the role of deviations from the RRP (or list price) in explaining price differentials, based on both customer discounts and dealer gross margins.

Section 2.7 repeats the analysis on price dispersion and systematic price differentials, but after adjusting prices for differences in taxes and exchange rate fluctuations. The adjustment is based on the evidence for the degree of exchange rate pass-through documented in chapter 1, and on new evidence for the degree of tax pass-through. This approach helps to consider the approximate effects of a tax harmonization and exchange rate stabilization.[5]

Section 2.8 extends the analysis of price dispersion further by considering the role of the right hand drive (RHD) surcharge in arbitrage opportunities to consumers from Ireland and the United Kingdom.

Results

The main results on international price dispersion and systematic price differentials are summarized in Table E.1 and Table E.2, as presented at the end of this executive

[4] Fisher indices are an example of cost of living indices. They start from representative consumer baskets in different countries, and weigh prices accordingly.

[5] The adjustment only considers the effects of a tax harmonization or exchange rate stabilization at an approximate level, because the structural parameters of a pricing model are not estimated. Note also that the tax harmonization refers to a zero tax level. Nevertheless, the results would be similar if we adjusted for taxes by assuming a harmonization in the 20-30 percent range. This is because of our focus on relative prices. See the report itself, for further details on the adjustment approach.

summary. These tables will be used when discussing the results below. More detailed tables and figures can be found in the report itself.

Price dispersion

We first consider international price dispersion, based on unadjusted pre-tax common currency prices. A detailed analysis can be found in Section 2.4. The first dispersion measure is the price differential range between the cheapest and the most expensive country. On average, this measure appears to be around 33-39 percent depending on the period.[6] Yet the report shows in more detail that there is a wide variation across models. There is a significant fraction of the models with a price differential range of either less than 10 percent or greater than 80 percent. There is no tendency for the price differential ranges to diminish over time. Alternative measures of price dispersion confirm these conclusions. First, the price differential range excluding the most expensive and the cheapest country reveals that this measure is obviously lower, in the 19-21 percent range on average, as shown in the middle of the first column of Table E.1. Yet again, the report finds that there is substantial variation across models and there seems no tendency for a decrease over time. Second, the coefficient of variation (or the relative standard deviation) is computed. This measure is also lower, around 9-10 percent on average (bottom part of the first column in Table E.1). Once again, substantial variation across models exists and there is no tendency for a reduction over time.

An analysis by segment shows that price dispersion in percentage terms is quite similar across segments, for both the price differential ranges and the coefficient of variation. The only exception is the luxury F segment, where price dispersion is lower in percentage terms (though not in absolute terms). An analysis by brand shows that the Italian brands (Fiat and Alfa Romeo), the Japanese brands (Nissan, Honda, Toyota, Subaru and Mazda) and Ford show price differentials in excess of 50 percent for more than 25 percent of their models. In contrast, Mercedes is the only brand that shows price differentials less than 20 percent for more than 25 percent of its models. Other brands with comparatively low international price differentials are BMW and Lancia, and the French brands Peugeot, Citroën and Renault.

[6] This is shown in the first three cells of the first column in Table E.1.

An analysis of price dispersion by country shows that high tax countries such as Denmark, Finland, Greece and the Netherlands are countries where the price is frequently the lowest or the second lowest for a given model. The United Kingdom and Germany appear to be the countries were the most expensive or the second most expensive car is most often found, followed by France, Austria, Ireland, Finland and Greece. Note that Finland and Greece thus appear to be countries at the opposite side of the spectrum, with either comparatively high or comparatively low prices for individual models.

Systematic price differentials

We next consider systematic price differentials across countries, again based on unadjusted pre-tax common currency prices. The analysis is presented in detail in section 2.5. A general overview, based on the construction of Fisher price indices, highlights several trends for price differentials across countries and their evolution over time. These are summarized in the first part of Table E.2. A main result is that exchange rates play an important role in explaining short-term fluctuations in the systematic price differentials, whereas taxes are an important determinant of long term, persisting price differentials. At the same time, exchange rates and taxes do not explain all of the price differentials and their evolution over time.

One can make the following ranking of countries in terms of pre-tax price differentials. At the low end of the price spectrum lies Denmark with a systematic price discount of more than 20 percent compared to the average for a subset of 9 EU countries (Belgium, France, Germany, the Netherlands, Spain, Italy, Luxembourg, Portugal and Ireland). Other low price countries are Finland and Greece, which are about 10 percent below the EU9 average (over the past three years). The Netherlands, Portugal and Spain have been moderately low price countries with systematic price discounts of about 5 percent from the EU9 average. Countries close around the EU9 average have been Austria, Belgium, France, Ireland, Italy, Luxembourg and Sweden. Germany has been systematically above the EU9 average by around 5 percent. Since Germany has a high market share of the EU9 car sales, the systematic price differential between Germany and the *other* countries is in fact much larger, more around 10 percent. The United Kingdom has been the highest priced above the EU9 average (which excludes the United Kingdom), by around 15-20 percent during the

last three years. While the United Kingdom has been in line with the EU9 average during 1993-96, this was a rather unique period. The evidence from other data sources, as presented in Chapter 1, showed that the United Kingdom was also an expensive country over the long term.

The country rankings usually remain stable when one considers individual segments.[7] One main particularity in the ranking is found in the A/B segment, where Finland and the Netherlands no longer belong to the cheap categories, but are rather in line with the EU9 average. Another change in the ranking is found in the D segment, where Ireland no longer belongs to the average category, but rather to the moderately cheap category together with the Netherlands and Portugal. Similarly, in segment D Spain shifts from the moderately cheap to the cheap category, close to Greece and Finland. A further change in the ranking appeared in the E/F segment where all countries, except for Denmark, and the United Kingdom, fall within a very close band of the EU9 average. And even these two countries are considerably closer to the average than they were in the other segments. As we discussed above, there are also other differences in the relative prices across segment, yet these are usually not of the amount to alter the price ranking across countries.

There are also some changes in the country ranking when one distinguishes between different countries of origin, i.e. French cars, German cars, Italian cars, European based US cars and Japanese cars. These findings are detailed in section 2.5.4 of the report.

Adjustments for discounts and margins

We use both customer discounts and gross dealer margins to adjust the list prices and verify whether the results on car price differentials remain relatively unaffected. The (limited) data on customer discounts suggest that the differences across countries are usually not large on average, at most 3-4%. The data on gross dealer margins suggest a possibly larger variation across countries. We correspondingly redo the analysis on international price dispersion after subtracting the gross dealer margins. The effect of this adjustment on the price dispersion results turns out to be modest, as can be seen in the fourth column of Table E.1. The reduction in price dispersion after adjusting for

dealer margins is around 0.5 percent for most measures/years. The only exception is the price differential range in 1996, which shows a drop by 3.7 percent, yet even this number is low compared to the initial level of around 30 percent.

We also considered how an adjustment for dealer margins affects the results on systematic price differentials. It turns out that the systematic price differentials may increase or decrease by a few percent points for some countries. Yet the changes do not necessarily go in the direction of a lower price level in the expensive countries or a higher price level in the inexpensive countries.

Adjustments for taxes

Section 2.7 repeats the analysis on international price dispersion and systematic price differentials in section 2.4 and 2.5, after adjusting for taxes and exchange rates. As explained above, these adjustments may help to address the question how prices would approximately be under a tax harmonization and/or fixed exchange rates, taking into account the fact that taxes and exchange rates are only incompletely passed through to consumer prices.

The tax-adjusted analysis shows that international price dispersion would be reduced if a harmonization of car purchase taxation took place. This is shown in the second column of Table E.1. The price differential range would on average fall by about 7 percent points to 27-32 percent if all countries are included, and by about 2.5 percent point to 16.5-17.5 percent if the most expensive and the cheapest country are excluded. The coefficient of variation would on average fall by about 1.5 percent point to 8-9 percent. At the same time, there remains a large heterogeneity across models after adjusting for taxes. Considering individual countries, we find that Denmark would no longer appear as the cheapest country for many models if a tax harmonization took place. Instead, Greece, Italy, Spain and Luxembourg would become the cheapest countries in many cases. Furthermore, Denmark and Greece would become the most expensive countries for more models.

Systematic international price differentials between countries would also change after a tax harmonization, as shown in the second part of Table E.2. Most of the low tax

[7] The segments divide car models mainly according to size. The A segment refers to “small” cars. The B, C, and D segments are larger cars. The most luxurious cars are in the E and F segments.

countries would become more in line with EU average: Finland, Greece, the Netherlands, Portugal and especially Denmark (+23 percent points). An exception is Ireland, which would shift from a moderately inexpensive country to a country that is moderately above average. Generally speaking, the systematic car price differentials would become lower if taxes were harmonized (though recall that this does not say anything about price dispersion for individual models). Most countries would have a general car price index no larger than 2 percent below or above the EU9 average during the last four years. Upward exceptions would be Germany, Ireland and especially the United Kingdom. Downward exceptions would be Greece and Spain.

Adjustments for exchange rate fluctuations

An exchange rate adjusted analysis shows what would happen to prices if exchange rates became fixed. We chose to take the average exchange rates over 1993-2000 as the reference levels at which all exchange rates are fixed for the entire period.[8]

The main effect of adjusting for exchange rates is that much of the year-to-year volatility is eliminated. Especially the United Kingdom would show a smoother pricing pattern over time. Conclusions for the longer term would not be drastically different. Table E.1 and Table E.2 show that the differences usually remain limited to 1 percent point if one adjusts for exchange rates. Exceptions occur mainly because of the United Kingdom. We first consider international price dispersion. Most measures are relatively unaffected. The exception is the first measure, the price differential range between the most expensive and the cheapest country. The drop in the average price dispersion by 3-5% during 1997-2000 can be explained by the reduction in the price level in the United Kingdom during these years under the assumption that the British Pound would have been stabilized at the average level during 1993-2000. Despite this, the United Kingdom would still be the most expensive country for the majority of the car models.

We next consider exchange rate adjusted systematic price differentials. The third part of Table E.2 shows that the United Kingdom would become relatively cheaper during the later years (1997-2000), though it would still be the most expensive country in the

[8] An alternative that we also discuss would be to fix the exchange rates for the entire period at their levels on January 1st 1999, the beginning of the EMU.

European Union. At the same time, the United Kingdom would now also become the most expensive country during the earlier years (1993-1996). If one chose the exchange rates of January 1st 1999 as the reference level, then the United Kingdom would also be the most expensive throughout the whole period. There would however be a larger systematic premium than if the 1993-2000 average exchange rate level is chosen as the reference. This is because the period 1993-1996 was a rather unusual period with a quite low value for the pound compared to previous and subsequent years[9].

Adjustments for the RHD surcharge

We finally elaborate on the price differentials of the RHD-surcharge during November 1997-May 2000.[10] One general conclusion is that the price differentials across countries for the RHD-surcharge are low compared to the price differentials for the car models themselves. An analysis by brand reveals important price variability. The impact of taxes seems less important in the pricing of the RHD-surcharge than in the pricing of the cars alone. An adjustment of car prices for the RHD surcharge reveals that the price dispersion drops to a moderate extent (see also the relevant column in Table E.1). The United Kingdom is still the most expensive country for most models if one adds the RHD surcharges to models sold on the continent.[11] Ireland, in contrast, shows a large number of relatively inexpensive models after applying the RHD adjustment.

Residual (or unexplained) price differentials

The above discussion has shown the role of several structural factors in explaining international price dispersion and systematic price differentials: taxes, exchange rates, discounts and dealer margins, and the RHD regulation. We now ask what are the residual (or unexplained) price differentials.

[9] A long run analysis of the British Pound shows that the Pound was especially low during 1993-1996, both in nominal terms and in real terms (i.e. after adjusting for inflation differences).
[10] Commission Notice OJ 85/C17/03 of January 1st 1985 states the condition that the suppliers charges an objectively justifiable supplement on account of any differences in equipment and specification.
[11] The same would be true if one were to subtract the average RHD surcharges on the Continent from the car prices in the UK and Ireland.

The last column of Figure E.1 shows the residual international price dispersion for the period 1999-2000.[12] Put differently, it shows the residual price dispersion, i.e. after adjusting for taxes, exchange rates, dealer margins and the RHD surcharge. One can approximately calculate the residual price dispersion by subtracting the values in the second, third and fourth column from the values in the first column.[13] The residual price differential range resulting from the first measure of price dispersion is 20.7 percent on average, compared to the initial 38.8 percent. Slightly more than half of the price differential range thus remains unexplained by taxes, exchange rates, margins or the RHD. The residual price differential range excluding the most expensive and the cheapest country is 14 percent on average, compared to the initial 19.5 percent. The residual coefficient of price variation is 6.1 percent, compared to the initial 9.7 percent. About two thirds of the second and the third measure of price dispersion can thus not be explained by the considered structural factors.

The residual systematic price differentials may in principle also be computed. However, a formal adjustment for dealer margins and the RHD surcharge is difficult because insufficient information is available to reliably reconstruct the Fisher indices. The above discussion suggests that margins and the RHD surcharge play a modest role in explaining systematic price differentials. We thus consider the residual price differentials by accounting only for taxes and exchange rates. The results are shown in the last part of Table E.2, as obtained from Table 36 in the report. In contrast to the residual international price dispersion, the residual systematic price differentials are relatively small. Most countries show residual systematic price differentials within a 5-6 percent band around the EU9 average. During 1999-2000, two notable upward exceptions are Germany (4.3 percent above average) and the U.K. (8.2 percent above average). The only notable downward exception is Spain (5.6 percent below average).

In sum, the analysis of the residual price differentials shows the following. The systematic price differentials can be fairly well explained by observed structural factors such as taxes and exchange rates. In contrast, the price differentials for

[12] Because of insufficient data on either dealer margins or the RHD, the numbers for the previous years are not computed.

[13] Yet this will not exactly give the numbers in the last column, since we allow for interaction effects between the exchange rate and tax adjustment by accounting for both simultaneously.

individual car models, i.e. international price dispersion, can only be explained to a partial extent by these factors.

Drawing policy implications

To draw policy implications, the results on international price dispersion and systematic price differentials may be applied to the general framework, as we outlined above using Figure E.1. If one is mainly interested in assessing the extent of cross-border trade restrictions, then the results on international price dispersion for individual models can be used. These results may be confronted with a policy standard to determine whether trade-promoting measures are called for. An example of a policy standard is the 12/18 percent norm, set out in the 1985 Commission Notice on the SED system. This norm is based on the lowest price before taxes for a given model. To illustrate here how policy implications may be drawn, we give examples using the 12/18 percent norm. Yet other more or less severe standards may in principle also be applied.

The first measure of price dispersion is the unadjusted price differential range including all countries, averaged across car models.[14] It varies in the 33-39 percent range. This simple measure would thus imply that the 12/18 percent norm is violated for the majority of the models throughout 1993-2000 and call for trade promoting measures, such as a relaxation or modification of the SED system.

Yet the Commission Notice refers to some qualifications in applying the 12/18 percent norm, in particular to the fact that consumers may pay taxes or fees of over 100 percent of the net price in some countries.[15] A first way to account for such qualifications is by using the two alternative measures of unadjusted price dispersion: the price differential range excluding the most expensive and the cheapest country and the coefficient of price variation. These alternative measures put less weight on the countries with "extreme" characteristics (such as high taxes) and lead to correspondingly lower price dispersion.[16] It varies between 19 and 21 percent for the

[14] For a detailed analysis of the distribution of price dispersion across models (thus extending beyond the average), we refer to the detailed report itself.

[15] Another qualification refers to the possibility that the violations concern "an insignificant portion of the motor vehicles with the contract programme." This is not the case for our measures, since they are based on the data for the most selling models.

[16] For example, at the low price end, Denmark would frequently be excluded because of the high taxes. At the high price end, the U.K. would often be excluded because of the expensive pound.

modified price differential range, and between 9 and 10 percent for the coefficient of variation. In fact, if the 12/18 percent norm were based on the coefficient of variation, there would longer be violations. However, this measure does not obviously correspond to the spirit of Commission Notice, which explicitly refers to bilateral price differentials between pairs of countries and not to aggregate price differentials across all countries.[17]

Another way to account for the qualifications in the Commission Notice is by adjusting the price dispersion measures for structural characteristics. For example, a tax adjustment is particularly relevant in light of the tax qualification in the Commission Notice, since it treats high tax countries as if they had a tax system in line with the other countries. The results described in section 2.7.2.1, in particular Table 25, Table 26 and Table 27, reveal that the tax-adjusted price dispersion measures are lower than the unadjusted figure. Similarly, one may use the results on exchange rate adjusted price dispersion (see section 2.7.2.2), or a combination of adjustments for exchange rates and taxes (see section 2.7.3.3), to possibly allow for further qualifications.

If one is more interested in assessing structural differences in market conditions, and not so much in evaluating the extent of European integration, then the results on systematic price differentials are more relevant than the results on international price dispersion. The fact that systematic price differentials narrow considerably after adjusting for taxes and exchange rates is of particular importance here. It indicates that most of the systematic price differentials would be eliminated by a tax harmonization and an exchange rate stabilization for all currencies. The United Kingdom seems to form the main exception. It may be considered as the most expensive market for new cars, even after adjusting for taxes and exchange rates (see section 2.7.3).

[17] The first two measures of price dispersion refer explicitly to bilateral price comparisons. This contrasts with the coefficient of variation. This measure is proportional to the standard deviation of price differentials. It thus averages the squares of price differentials across countries and does not refer to price differentials between pairs of countries.

Figure E.1 The General Framework of Analysis

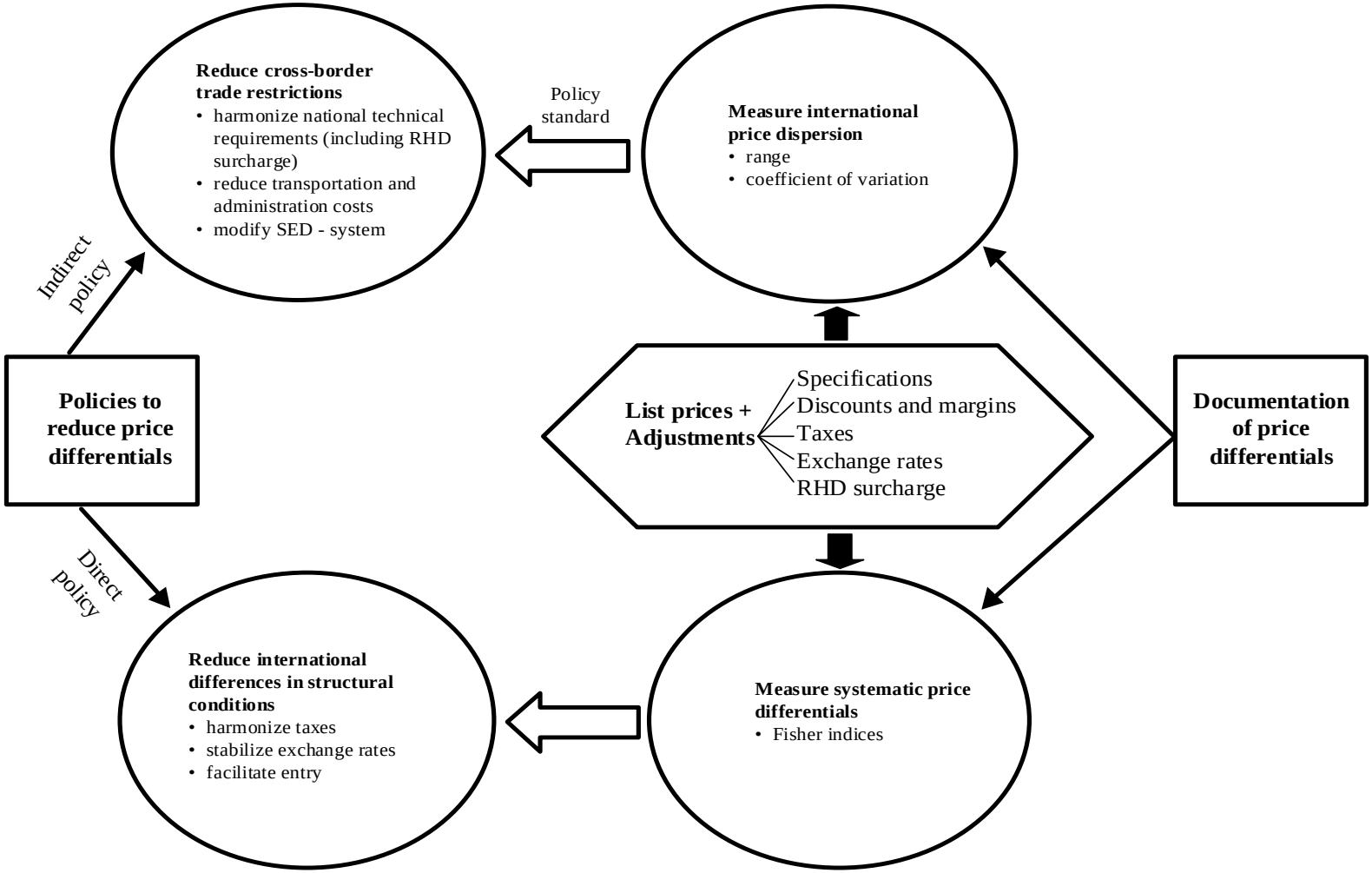

Table E. 1 Average price dispersion measures for the European car market -- general overview

	Period	Average price dispersion*	Change in price dispersion due to adjustment for: Taxes	Exchange rates	Dealer margin**	Right hand drive***	Residual average price dispersion****
Price differential range – including all countries	1995-96	32,9	-6	-0,5	-3,7		
	1997-98	38,9	-6,9	-3,2		-2,6	
	1999-00	38,8	-7,7	-5,7	-0,4	-4,7	20,7
Price differential range – excluding most expensive and cheapest country	1995-96	19,2	-1,7	-0,8	-0,7		
	1997-98	21	-2,7	-1		-0,2	
	1999-00	19,5	-2,8	-1,1	-0,5	-0,7	14
Coefficient of price variation	1995-96	9,2	-1,3	-0,3	-0,9		
	1997-98	10,1	-1,3	-0,7		-0,6	
	1999-00	9,7	-1,5	-1,1	-0,1	-0,8	6,1

* The price dispersion measure of every car model is averaged across all models.
** The differences are computed using the same data set with and without adjustment for dealer margins
*** The differences are computed using the same data set with and without adjustment for right hand drive.
**** Average price dispersion unexplained by taxes, exchange rates, dealer margins and the RHD surcharge. The numbers are based on the joint tax and exchange rate adjustment in Table 31, from which the differences due to dealer margin and RHD surcharge are subtracted. This thus accounts for interaction effects of taxes and exchange rates.

Table E. 2 Systematic price differentials in the European car market -- general overview

	Actual Fisher index*				Change due to adjustment for taxes**				Change due to adjustment for exchange rates***				Tax and exchange rate adjusted Fisher index***			
Period	93-94	95-96	97-98	99-00	93-94	95-96	97-98	99-00	93-94	95-96	97-98	99-00	93-94	95-96	97-98	99-00
Austria		105,1	100,1	101,2		1,2	1,2	1		-1,1	0,4	0,2		105,1	101,6	102,4
Belgium	101,9	100,6	97,2	99	-0,2	-0,3	-0,2	-0,2	1	-1,3	0,3	0,1	102,7	99,0	97,3	98,9
Denmark	80,5	80	78,1	79,6	23	23	22,3	24,1	0,7	-0,6	-0,2	-0,4	104,4	102,2	100,1	103,1
Finland		94,5	92	92,2		9,9	9,4	8,9		-2,0	-1,2	-1,0		102,2	100,0	100,1
France	102,7	99,9	98,3	98,7	-0,4	-0,3	-0,3	-0,4	1,1	-0,4	-0,3	-0,4	103,4	99,2	97,8	97,8
Germany	106,3	106,7	103,9	104,9	-0,8	-0,9	-0,9	-0,8	0,8	-1,2	0,3	0,2	106,3	104,6	103,4	104,3
Greece	96,3	98	91,6	90,5	3,2	3	2,9	3,6	-1,9	-0,7	1,6	3,1	97,6	100,3	96,2	97,3
Ireland	97,3	97,7	100,7	96,9	5,1	4,6	4,8	4,8	1,1	1,1	-2	-0,4	103,6	103,5	103,4	101,3
Italy	92,6	92,7	99,8	98,3	-0,3	-0,3	-0,2	-0,1	-1,3	2,3	-0,9	-0,6	91,0	94,8	98,7	97,6
Luxembourg	101,9	100,2	96,9	99,3	-0,8	-0,9	-0,9	-0,8	1	-1,3	0,3	0,2	102,1	98,1	96,3	98,6
Netherlands	100,3	99,6	93,8	94,5	3,8	3,8	3,6	3,7	0,8	-1,6	0,5	0,5	105,0	101,7	97,9	98,7
Portugal	95,2	96,4	95,5	97,1	4,2	5,1	5,1	5	-0,4	-0,6	0,4	0,8	98,9	101,0	101,0	102,8
Spain	93,2	97,2	95,6	93,8	0,8	0,5	0,3	0,3	-1,8	-0,4	1	1,2	92,2	97,4	96,9	95,4
Sweden		98,1	101,1	101		1,4	0,5	0,3		0,2	-1,4	-1,3		99,7	100,2	99,9
UK	100,8	98,9	115,1	116,9	-0,4	-0,5	-0,6	-0,7	3,4	5,5	-4,8	-8	103,8	103,8	109,7	108,2

* Based on Table 9.
** Based on Table 9 and Table 34.
*** Based on Table 9 and Table 35.
**** Based on Table 9 and Table 36.

1. PREVIOUS DOCUMENTATION ON EU CAR PRICE DIFFERENTIALS

Since the early 1980's there have been a considerable number of studies on car price differentials between European countries. Documentation comes from consumer organizations, competition agencies and academic researchers. While most of this research aimed to develop and implement a sound methodology to assess the presence of price differentials, efforts have also been made to explain the causes of the observed price differentials. As new studies were prepared or published in policy reports, scientific journals or in the press, car manufacturers and other industry insiders also entered into the debate and expressed their views, both on the adopted methodology and on the causes of price differentials.

This chapter reviews the previous documentation on car price differentials. The goal is twofold:

(1) to summarize the previous findings on EU car price differentials, and to review the explanations that have subsequently been offered;

(2) to introduce the methodological aspects that should receive attention when conducting a study on car price differentials.

We begin with a review of the literature by consumer organizations and competition agencies in section 1.1. Next, we discuss the contributions to the debate from the academic world in section 1.2. Sections 1.1 and 1.2 provide a fairly detailed overview of the previous findings. They may be skipped at a first reading if one is mainly interested in the methodological issues that have emerged during the debate. Finally, section 1.3 provides a synthesis through a methodological checklist that should be kept in mind when conducting a comparative car price study.

1.1 Studies by consumer organizations and competition agencies

1.1.1 Studies by BEUC

One of the first studies on car price differentials between European countries was elaborated by BEUC (1981), a consortium of consumer organizations in the Member States of the European Communities. The study compared the prices of 25 popular models on June 22, 1981 in Belgium, Denmark, France, Germany, Luxembourg, Ireland, the Netherlands and the UK. The models were chosen to have the same or similar specifications regarding displacement (cc), horsepower, and number of doors. Retail prices were compared before and after taxes (VAT rates and possible special taxes on the car purchase).

Regarding pre-tax retail prices, BEUC computed percentage price differences for the 25 models. While there is some variation across models, BEUC concluded that Denmark was on average the cheapest country. Benelux countries were some 20 percent more expensive than Denmark, followed by Germany (+ 27 percent), France (+ 30 percent), Ireland (+ 50 percent) and the United Kingdom (+ 80 percent). BEUC acknowledges that the models may not be really identical in all countries (concerning paint, seat-belts, head-rests, tires), yet it states that

> "nothing indicates that it is in the countries were price is highest that the equipment is the most complete. The opposite is equally possible. It will surely be admitted that these differences in equipment do not justify in any case price differences ranging from 50 to 80 percent."

BEUC also provided several potential explanations of its findings:

(1) the differences in taxes, in particular the high taxes on the car purchase in Denmark, which induces manufacturers to set low pre-tax prices;

(2) the differences in the degree of competition (in particular the degree of import penetration by Japanese firms and the ability by domestic firms to charge higher prices in the national market than abroad;

(3) the possible differences in profit margins by importer and dealers;

(4) price controls in Belgium;

(5) exchange rate fluctuations.

In a subsequent study, BEUC (1982) reported the reactions by the manufacturers to its 1981 report. They summarized their views in the following points:

- international price comparisons depend heavily on the timing, since prices are adjusted considerably less frequently than the exchange rates change;
- international price comparisons depend on the specifications of the models, the services included in the price (delivery charges, guarantees) and the conditions of sale (customer discounts by the dealers, trade-ins).

BEUC argued that it had been well aware of these aspects and that the methodology and the results of its previous study had not been seriously challenged. BEUC thus followed the same methodology to compare prices in the following year, on June 22, 1982, for the same 25 models, of which there were 14 models with unchanged specifications.

BEUC again computed pre-tax percentage price difference and confirmed that Denmark was the cheapest country on average. The average price (expressed in the common contemporaneous exchange rate) in Belgium and Luxembourg became almost as advantageous as in Denmark, due to the devaluations of the BEF. The Netherlands joined the group of France and Germany with prices about 25 percent more expensive than in Denmark; the highest prices occurred in Ireland (+ 63 percent) and the UK (+ 70 percent).

In comparing the findings of its 1981 and 1982 studies, BEUC concluded that the local price increases (expressed in local currency) were the greatest in the countries with high inflation rates and depreciating currencies.

In a third study, BEUC (1986) surveyed the prices of 30 models on June 1, 1986, again using a similar methodology. The study now also collected information on customer discount practices followed by the dealers in the various countries. Ignoring discounts, BEUC reported that pre-tax prices were still the lowest on average in Denmark. Benelux countries were similar, and were some 22 percent more expensive, followed by Germany and France (+ 30 percent), Portugal (+36 percent), Italy and Spain (+ 45 percent) and Ireland and the UK (+ 51 percent). Taking into account the maximum available discounts (closely related to the gross dealer margin), prices were

mainly reduced in Belgium, Italy and the UK. BEUC concluded that the average prices net of discounts are still significantly higher in France and Germany than in Belgium; while prices also remained significantly more expensive in the UK, the gap between the other countries had narrowed.

BEUC (1987) again followed a similar methodology, surveying the prices of 22 models, and also taking into account discounting practices in the various countries. It concluded that the pre-tax price differences in 1987 were very similar to those in 1986. BEUC (1989) surveyed the prices for 24 models, and reported the discounting practices in the various countries. It concluded that the pre-tax price gaps had widened compared to the 1987 survey. In January 1990, BEUC filed a complaint to the European Commission alleging that differences in car prices between European countries are excessive and that there exist significant barriers to trade. This complaint (as well as another complaint on the same issue by a member of the European Parliament) triggered the Commission to launch an inquiry on car price differentials, completed in 1992. We come back to that study in section 1.1.2.

BEUC (1992) also prepared a report for the European Commission, surveying the prices of 13 models, and the discounting practices in the various countries. It found that Denmark was again the lowest priced country, followed by the Benelux countries (+ 30 percent), Germany, France and Portugal (+ 35-40 percent), Spain, Italy and Ireland (+24-49 percent) and the UK (+ 59 percent). BEUC offered the following explanations for the observed price differentials, in addition to the ones offered in its 1981 reports:

(6) gradual reduction of import duties in Portugal and Spain;

(7) differences in specifications due to “green” incentives policy (catalytic converters in the Netherlands and Germany);

(8) differences in the extent of fleet purchases, which may lower the prices to fleet customers but increase the prices to other consumers;

(9) transportation costs;

(10) the selective distribution system, limiting arbitrage opportunities.

The results of the periodic price studies by BEUC are summarized in Table 1.

Table 1 Pre-tax car price indices based on BEUC, between 1981-1992, DK=100

	1981	1982	1986	1987	1989	1992
Country						
BE	120	110	121	121	123	130
GE	127	131	129	128	137	140
DK	100	100	100	100	100	100
SP			146	142	149	149
FR	131	125	130	128	132	136
GR					107	111
IT		137	144	129	148	142
IR	149	158	151	130	145	146
LU	118	110	122	122	127	129
NL	120	125	123	122	130	131
PO			136	127	140	135
SW					144	139
UK	182	169	151	143	161	159
Number of models	*25*	*25*	*30*	*22*	*24*	*13*

Source: BEUC and own calculations.

BEUC methodology: (i) Collect pre-tax list prices of several models selected according to their sales, their availability across markets and comparability of specifications. (ii) For each selected model convert the prices into a common currency using the current spot exchange rate. (iii) For each selected model convert the common currency prices into an index relative to a base country. (iv) Take the unweighted arithmetic average of these indices to obtain market indices.

Conclusions. The studies by BEUC focused on examining systematic (average) price differentials between countries, rather on price differentials for individual car models. Generally speaking, BEUC found systematic price differentials of up to 60 percent during the eighties, with Denmark at the low price end and Ireland and the UK at the high price end.

According to the UK Monopolies and Mergers Commission (1992), whose report we review below, the BEUC results were widely criticized on two grounds. First, it was said that account had not been taken of significant differences between countries in respect of the specifications of cars used in the sample. Secondly, it was claimed that

discounts and other financial benefits to consumers (which BEUC surveyed in its later studies) had been understated. According to the UK Commission, it was also recognized on all sides that any price differences were sensitive to fluctuations in exchange rates.

1.1.2 Studies by the European Commission

1.1.2.1 The 1992 Intra-EC Car Price Differential Report

In 1992 the European Commission published the Intra-EC Car Price Differential Report, based on a study by Motor Industry Research Unit (MIRU) and Computer Industry Research Unit (CIRU). The study covered the period 1988-1991 in Belgium, France, Germany, Italy, the Netherlands, Spain and the UK. High tax countries Denmark and Greece and low sales countries Ireland and Luxemburg were excluded. The market was divided into several segments reflecting the dimensions and other characteristics of the models. The study was carried out in two phases. In phase one, the list prices of 68 models net of taxes, import duties and delivery costs were compared in 7 countries during 1988-1991. The 68 models were selected according to sales and availability. In phase two, 21 models were subject to a more detailed investigation, to more fully adjust for differences in specifications, discounts to consumers and other financial benefits. The 21 models were selected to include those which showed the greatest price difference in phase one, and to include at least one model of each manufacturer reviewed in phase one.

To adjust for specification differences in phase 2, a benchmark model with “standard” specifications was defined. The prices of the specifications that are not standard in certain countries were then added to the list price of the model, using option price lists on 91 equipment items. A uniform RHD surcharge was included of 100 ECU. Discounts and other financial benefits were included, when the manufacturers supplied the information.

In sum, the methodology in phase one roughly corresponds to the one adopted in the series of studies by BEUC (except for the fact that BEUC also reported information on customer discounts in its later studies). The methodology in phase two is more sophisticated in that list prices are adjusted for possible differences in optional

specifications. Nevertheless, the adjustment approach, which evaluates differences in optional specifications based on the option price lists, also creates potential problems. For example, certain optional items may be priced rather expensively by the firms and valued little by consumers, which would be reflected in low sales for these optional items.

Phase one calculated average pre-tax list price indices, for all the market segments considered.[18] These average list price indices were summarized by taking the lowest priced and the highest priced country, in order to identify the maximum average list price index differences. For the whole period 1988-1991 it is found that these maximum price differentials were the largest in the segments B and C, but are also significant in the more luxurious segments C/D and D/E. Belgium typically emerged as the lowest priced market for the whole period, whereas the UK consistently showed the highest prices. Germany and Spain were also relatively expensive, whereas France, the Netherlands and Italy were relatively inexpensive over the considered period. According to the report, the Peugeot Group, Rover, GME, the Fiat Group, the VW Group and especially Ford showed the largest price differentials. Mazda and Honda also showed high price differentials. BMW, Renault and Volvo showed the smaller maximum price differences over the covered period. Mercedes-Benz had the smallest differentials.

Phase two considered the list prices for selected models in 1990, adjusted for differences in equipment, discounts and financial benefits. These were referred to as "fully adjusted list prices". It was found that even these fully adjusted list prices showed very large differentials. For 18 of the 21 models studied, the price differentials exceeded 18 percent and for 19 of the 21 models studied, the price differentials exceeded 12 percent for two consecutive dates of investigation. These percentages refer to the thresholds set out in a Commission Notice,[19] stating that the maximum price differentials should be no larger than 12 percent for more than one year, and no larger than 18 percent for a shorter period.

The percentage price differentials were the largest in the B segment. (The A segment was not included). Segment average pre-tax price indices were again computed. Spain

[18] The report does not specify whether it calculated unweighted average price indices or sales-weighted average price indices.

now appeared to be the most expensive country in the year 1990, followed by Italy, France and Germany. Belgium, the Netherlands and the UK now showed the lowest prices. Using the specification adjustments for the other periods of the study, Spain and Germany most frequently showed the highest prices in 1988; the UK in 1989, and Spain in 1990-1991. The volatility of the country rankings, in particular as concerns the UK, was attributed to exchange rate fluctuations.

The report lists the following explanations for the price differentials:

(1) exchange rate fluctuations;

(2) the differences in taxes;

(3) differences in market access, in particular Japanese penetration rates;

(4) fleet purchases, i.e. purchase in bulk by leasing firms or large companies;

(5) the number of dealers in some markets;

(6) transportation costs;

(7) consumer arbitrage costs and the existence of a selective distribution system.

1.1.2.2 The bi-annual reports on Car Prices within the European Union

In his Communication of 15 April 1992, the then Competition Commissioner Sir Leon Brittan (1992) commented on the 1992 Intra-EC car price differential report. He stated that any study can be criticized for not been taking into account certain factors. Yet he concluded that the very large price differentials found in the report were incontestable, and a political as well as an economic fact. To obtain a more complete understanding of the role of the selective distribution system in explaining the price differentials, Brittan proposed a list of actions. One of these actions was to publish, on a bi-annual basis, a comparative price analysis, across different national markets, for standard, low-equipment models in each range, with the aim of monitoring whether adjusted prices are within the ranges provided by Regulation 123/85.

Since May 1993, such reports have indeed been published on a bi-annual basis. The data were supplied by the manufacturers and collected through ACEA. Each report

[19] See the OJ 85/C17/03 of January 1st 1985.

contained information on pre-tax and post-tax list prices adjusted for equipment differences, covering about 70 models sold in the countries of the European Union. Information on Denmark, Finland and Greece was excluded before May 1999 because of their high taxes. Separate price information on the major equipment options was also included, as well as the RHD surcharge in countries other than Ireland and the UK.

In each report the European Commission summarized the information by converting prices into a common currency, using the contemporaneous exchange rate. The summary results on prices were presented for each model in relative terms, taking the cheapest country as the base. Each report was also accompanied by a press release, which interprets the price differences between the various countries.

The data from the bi-annual reports have also been used in the UK 1999 Monopolies and Mergers Commission car price study. They will also be used in the car price study presented in this report.

Conclusions. Following the work of BEUC in the eighties, the European Commission documented both systematic price differentials and price differentials for individual car models in the nineties. The results are broadly in line with the results obtained by BEUC.

1.1.3 Studies by the Monopolies and Mergers Commission

The Monopolies and Mergers Commission (MMC) in the UK has written two detailed reports on the automobile industry in 1992 and in 1999. Both reports include a detailed examination of car prices in Europe. The focus is somewhat different from the studies by the European Commission. Whereas the European Commission focuses on monitoring the maximum price differences between all the EU countries, the MMC in the UK is interested in measuring the maximum price difference with respect to the UK. Nevertheless, it is instructive to review the results obtained by the MMC, including also the methodology that it employed in both studies.

1.1.3.1 The 1992 MMC study on price differentials

In its 1992 report the MMC presented a study on car price differentials in collaboration with Ludvigsen Associates Ltd (LAL). The goal of the MMC/LAL study was to improve upon the methodology by BEUC, by more adequately accounting for specification differences and discounts granted to consumers. The study consisted of three phases, phase A and phase B, mainly conducted by LAL and presented in MMC (1992b), and phase C presented in MMC (1992b). The study covered the period 1988-1990 for Belgium, France, Germany, the Netherlands, Italy and the UK, as well as Ireland for phase A and B.

In phase A, 20 variants were selected, based on sales and availability in the countries and over the period concerned. In phase B, before and after tax list prices were adjusted for specification differences using the UK specifications as the base. In phase C, the specification-adjusted list prices were adjusted for discounts (based on a telephone survey), other financial benefits, delivery charges and number plates, based on 1990 information. The results were summarized by market segment. The methodology and country/time coverage are thus comparable to the European Commission report, although the details on the adjustment for specification and discounts may differ, as well as the focus in the presentation of the results.

Among other things, MMC (1992a) presented the pre-tax average list price indices before and after adjusting for specification differences and discounts, for each segment.[20] To compute the indices prices are converted in a common currency, using contemporaneous exchange rates. The market averages are presented and summarized in Table 2 below.

Table 2 Pre-tax car prices based on MMC (1992), between 1988-1990, UK=100

	oct/88	feb/89	oct/89	feb/90	oct/90	oct/90
Country						
	List price indices not adjusted for specification differences					
B	75	72	77	79	74	

[20] To compute the average price indices by segment, one can infer from the numbers that an unweighted average is used, although this is not explicitly stated. To obtain the average indices for the whole market, weights according to sales per segment and per country are taken, as is explicitly stated in the report.

D	82	79	86	88	82	
F	80	77	83	84	79	
IRL	89	84	92	94	84	
NL	79	76	83	84	76	
UK	100	100	100	100	100	
	Price indices adjusted for specification differences					
	List prices					Transaction prices
B	81	77	83	86	81	82
D	86	83	91	94	88	91
F	83	81	87	90	83	86
IRL	91	86	94	97	87	
NL	83	79	85	87	80	84
UK	100	100	100	100	100	100

Source: MMC and own calculations.

MMC method: Unadjusted list price indices follow a comparable method to BEUC. Adjusted list prices correct for differences in specifications by appropriately adding or subtracting option list prices where these are different from the (UK) base model.

Considering pre-tax list prices, MMC concluded that price differences were the greatest in February 1989, and the smallest in February 1990, although it noted that there are variations across models, segments and time. The MMC also emphasized the role of exchange rates and domestic inflation rates in explaining prices expressed in the local currency.

Considering pre-tax, specification-adjusted list prices, the MMC concluded that the same ranking of periods emerged for the adjusted prices as for the unadjusted prices, the difference in prices being the greatest in February 1989 and the smallest in February 1990. Incorporating discounts to obtain average transaction prices for October 1990, the price differentials were slightly smaller.

In part based on the reactions by the suppliers, the MMC considered several robustness checks of its results. First, it looked at the role of the choice of the exchange rate used when converting prices in a common currency. MMC recomputed price differences for October 1990, when the British Pound was at a high level, using the exchange rate of April 1990, when the pound was around the lowest point for the year. Using the April exchange rates reduced the price differences relative to the UK by on average 7 to 8 percent points.

Second, the MMC considered the sensitivity of the results with respect to the measurement of discounts. The average discounts used in the LAL survey were based on a telephone survey, composed of around 50 calls for each selected model for each country. The MMC also used estimates from the suppliers' studies, based on management reports and dealer surveys. Using such alternative measures of discounts the price differences relative to the UK reduced by up to 4 percent points at the market level, and between 3 and 8 percent points for the individual segments.

Third, the MMC considered the role of financial benefits. General Motors Europe (GME) argued that in the UK "financing support" (e.g. reduced interest rates on loans granted by the manufacturers for the purchase of a car, or insurance rates) was more common than in other countries; in other countries most of GME's financial benefits were in the form of additional specification on special model editions. Ford reported its financial benefits in 1990 to be 5.7 percent of the pre-tax list price in the UK, compared to small in other countries. A study by the Boston Consulting Group for Rover reported financing packages to be worth about 4 percent of the pre-tax list price in the UK, compared to 2 percent in Germany and the Netherlands and insignificant in France and Belgium. Using the information from the suppliers, the price differences relative to the UK decrease by about 2 to 3 percent points.

In its overall summary of the EC price comparisons the MMC concluded that the UK market did not show significant adjusted price differentials with France and Germany, the two markets with the most similar characteristics to the UK. It also pointed out that there are a number of model variants, particularly in the smaller segments, whose adjusted prices are substantially lower in France and Germany than in the UK. Prices in Belgium and the Netherlands were concluded to be significantly below those in the UK, in all segments and particularly noticeable in the small segment. The MMC argued, however, that these two markets are less reliable guides for comparisons with the UK because of differing market characteristics.

1.1.3.2 Studies by the manufacturers presented in the 1992 MMC study

The MMC also presented the results from the price studies carried out by four suppliers (Ford, General Motors, Rover and Renault). A study by Ford, for its own model ranges, showed that the UK had the lowest prices for most models, after

adjusting for specifications, discounts and financial benefits. The study by GME, for its model ranges, also made adjustments for specifications, average actual discounts and other financial benefits, based on the actual transactions prices. GME concluded that prices were not significantly higher in the UK than elsewhere in Europe, with the exception of January 1989 when prices were on average 12 percent higher than in the cheapest EC country. Rover commissioned a study by the Boston Consulting Group (BCG), covering a range of different suppliers. BCG adopted a similar methodology to the other studies, by adjusting for specification differences, discounts and financial benefits. BCG concluded that the adjusted prices for Belgium and the Netherlands appeared lower than in the larger EC countries, but prices in France, Germany and the UK fell within a relatively narrow band.

1.1.3.3 The 1999 MMC study

The study on car price differentials by the MMC in 1999 was based on the European Commission's bi-annual new car price survey, supplied by the manufacturers, covering the period May 1993-May 1999. We refer to the details in section 1.1.2.2 for a data description.

1.1.3.3.1 Adjustments for specifications, discounts and (other) financial benefits

The MMC study began by reviewing the criticisms by the manufacturers to the European Commission's price survey. These criticisms relate to the adjustment for specification differences and to the use of list prices rather than transaction prices.

First, regarding the adjustment for specification differences, the MMC reported that most suppliers accepted that the specification-adjusted list prices were an acceptable starting point for price comparisons, and that no suppliers had complained to the European Commission about their accuracy. One additional adjustment relevant for the UK and Ireland concerns the adjustment for the RHD option, if there is an additional production or distribution cost for cars sold with a RHD option. From the European Commission May 1999 survey, the MMC inferred these to be slightly above £450, depending on the suppliers; Vauxhall told the MMC it had a higher cost for RHD cars of £200-300; Rover reported that it had no differing costs since its production was split more or less evenly between LHD and RHD cars; BMW and VW

stated that there were RHD surcharges because of the uneven distribution of LHD and RHD cars; Ford reported a cost difference between LHD and RHD cars of 1 to 3 percent of the list price. Some suppliers also argued that allowances should be made for extended warranties, which may be more common in the UK. The MMC argued that based on the European Commission's report these elements were not so important.

Second, the suppliers argued that the list prices in the European Commission's study do not coincide with the actual transaction prices. Some suppliers argued that customer discounts and (other) financial benefits granted by the dealers play a larger role in the UK than elsewhere; yet only Ford provided evidence across countries. The MMC considered three types on evidence on transaction prices: the Promocar study; anecdotic evidence by car magazines; and the Ford study.

The Promocar study on consumer discounts is based on mystery shopping, a methodology also applied by the manufacturers for their own purposes. Seven firms were considered in 3 segments (small, lower medium and medium) in four countries (Germany, Italy, Spain and the UK), resulting in about 500 observations over the January – May 1999 period per country. Using the obtained information, average discounts and discount ranges by country and segment were computed. Country-average discounts (weighted by the segment sales) were 2.7 percent, compared to 4.6 percent for Germany, 4.1 percent for Italy and 6.6 percent for Spain.

The Promocar study offered a qualitative overview on the presence of alternative types of financial benefits, including free insurance, 0 percent finance, other financing deals, warranty-based incentives, equipment package at reduced price, after-sales incentives, trade-in or scrapping program and air-conditioning at reduced price. The study argued that is was difficult to quantify the size of financial benefits, but that there was evidence that several of these alternative types of benefits were commonly available in the countries considered.

The MMC described and defended itself against several criticisms by the manufacturers on the Promocar survey on discounts and financial benefits: the segment average discounts were unweighted averages; they applied to a selection of the most popular models which may be in limited supply and thus have lower

discounts; the numbers were obtained through mystery shopping and not on actual transactions; no quantification of the financial benefits was provided.

In addition to the Promocar survey, the MMC also provided anecdotal evidence on discounts from UK and German car magazines, which were argued to be consistent with the Promocar study and show higher discounts in the UK than elsewhere.

The MMC finally provided evidence by Ford on discounts (based on its dealer composites and its own accounts). While the level of discounts was found to be higher than in the Promocar study, the differences across countries were of a similar magnitude, the UK again offering the lowest discounts. The main contribution of the Ford study was its quantification of financial benefits. The numbers were confidential, but the MMC concluded that discounts and financial benefits taken together were more favorable in the UK than in the other countries.

Taking together the results from the Promocar and the Ford study on discounts and financial benefits, the MMC argued that there is no clear evidence on significant differences between the UK and other countries in either direction. The MMC concluded that the price differences shown by the European Commission price surveys broadly represented actual price differences.

1.1.3.3.2 Exchange rates, taxes and residual values

The MMC categorized the role of exchange rates, taxes and residual values as “factors affecting comparisons of average prices over time.

Exchange rates.

The MMC discussed the role of exchange rates in conducting international price surveys, in part based on the views expressed by the suppliers. The MMC began by noting that there appears to be no relation between domestic prices in the UK and exchange rate changes. In particular, car prices did not fall following the appreciation of the pound; the price decreases did not even occur after two years of relatively stable exchange following the peak of the pound obtained in August 1997.

The suppliers’ reactions to the role of exchange rates were that one could not use current (contemporaneous) exchange rates in an international price comparison because exchange rate fluctuations, such as the appreciation of the pound, may be

unanticipated. The suppliers also provided various explanations for why exchange rate fluctuations are not fully passed-through into local consumer prices:

- list prices are adjusted only bi-annually due to adjustment costs;
- domestic firms do not experience the cost changes following exchange rate fluctuations;
- there are local destination costs, according to Harbour Wade Brown, about 30 to 35 percent of the cost of supplying a new car;
- exchange rate fluctuations may be perceived as temporary;
- there may be an option value of delay if there are sunk costs to increasing sales;
- frequent price cuts may damage the brand.

The MMC aimed to cope with the exchange rate issues by considering various alternative measures of the exchange rate: the contemporaneous exchange rate (as is done in most studies); the three month forward exchange rate, which take into account exchange rate expectations; two constant measures of the exchange rate: the six and ten year average value of the exchange rate.

Taxes.

Many manufacturers argued that a key factor of price differentials is given by the tax differentials between the countries. Denmark, Finland and Greece have very high rates of car taxation, whereas the Netherlands and Portugal also have high rates. Vauxhall explained that manufactures would lower their margins a little to cushion some of the effect of the tax rather than lose greater volumes.

To incorporate these aspects, the MMC provided comparisons of UK prices with the lowest priced of any EU country; with the weighted average of all EU countries; and with the weighted average of France, Germany and Italy.

Residual values.

Some suppliers argued that the residual values were higher in the UK than elsewhere. The MMC used Eurotax data to show that residual values in the UK were in line with those in other countries, substantiating its claim with data on 2-year-old cars. Some

suppliers argued that trade-ins were more prevalent in the UK. The proportion of sales involving trade-ins is similar in Germany and the UK (about 75 percent), whereas they are also quite prevalent in other countries (between 54 and 61 percent in France, Italy and Spain).

1.1.3.3.3 Methods for computing price indices

The MMC distinguished between a number of approaches that can be used when comparing prices between different countries over time. The main approach it considered is what it called the country approach. The country approach first indexes the price of each model against the lowest priced country from the group of comparison (with the lowest priced country set equal to 100). For each segment (small, lower medium, upper medium, executive/luxury and other) an unweighted arithmetic average is computed. The MMC justified this by the fact that the models are broadly representative for each segment. To compare relative prices across countries, the MMC then computes a weighted arithmetic average of the segment averages, basing its weights on the segment sales in each country. Because the segment weights differ by country, the MMC interpreted this approach as addressing the question how much more (or less) expensive it is for the average UK consumer to buy a representative car in the UK than it is for consumers in other EU countries to buy representative cars in their own countries.

Ford criticized the country approach, arguing it violated the basic axioms in the literature on index number construction. Ford suggested to compare prices using approaches which use the same basket of cars across countries, which might be baskets purchased in the UK (Paasche index), in the other EU countries (Laspeyres index) or some combination of the two (Fisher index or Tornqvist index). Ford also criticized two other aspects in the country approach adopted by the MMC. First, prices were expressed as relative prices and then arithmetic averages were taken, whereas geometric averages should be taken. Ford provided an example to show that the arithmetic averages overstate price differences. Intuitively, applying arithmetic averages on relative prices would systematically overestimate situations were the UK was more expensive and underestimate situations were the UK was least expensive. Second, averages within each segment were unweighted averages; only averages across segments applied weights based on sales.

The MMC aimed to incorporate these criticisms and presented results using the Fisher index rather than the country approach. It also considered the robustness of the results when geometric averages rather than arithmetic averages were taken, and averages were weighted by model sales. The MMC reported that the results were robust to these alternatives.

1.1.3.3.4 Results

Using the data from the European Commission, as supplied by the companies, the MMC presented four sets of tables with price indices, each using a different measure for the exchange rate. Each table contained comparison between the UK and the cheapest country, and between the UK and the average of France, Germany and Italy; by segment using the country approach; and averaged over the market using the country approach and the Fisher index; and averaging over subperiods and the whole period.

The MMC' s overall conclusion was that, on the longer-term basis (covering 1993-1999), UK prices were higher than those of France, Germany and Italy by a margin of between 3.5 and 7.1 percent. Following the appreciation of the pound, the gap had widened in the second half of the period to between 10.1 and 12.6 percent. According to the MMC, the full extent of arbitrage opportunities to consumers is assessed by comparing UK prices with the prices in all European countries. Taking the May 1999 survey, 58 of the 71 analyzed models were found to be at least 20 percent more expensive in the UK than elsewhere excluding the high tax countries Denmark, Finland and Greece; when these countries were included, 49 of the 71 models were found to be at least 40 percent more expensive in the UK.

1.1.3.3.5 Criticisms to the report

Various criticisms have been formulated against the analysis by the MMC. The MMC spends considerable detail on the views expressed by the manufacturers. For example, the MMC summarizes the criticisms by Ford on the methodology for computing price indices.

Consulting firm NERA (2000) also expressed doubts on the analysis by the MMC. First, NERA argues that it is inherently difficult to measure true transaction prices for cars. Although the MMC attempted to account for variations in discounts and

financial benefits, NERA argues that the issues are so complex that many findings on pricing remain open to challenge.

Second, NERA argues that the desire by the MMC for uniform pricing across Europe should not neglect the fact that companies need to cover their fixed costs to remain profitable. Imposing a uniform price across Europe would not imply that prices in the expensive countries would simply converge to the level of the lowest priced countries. It would also entail a rise in the prices in countries that are currently inexpensive.

Third, NERA argues the MMC implicitly assumes that prices should be fully cost based. NERA argues that cost-based pricing is not economically efficient, since differences in demand conditions across countries are also important. In addition, if the cost based pricing principle is followed, it should be consistently applied, and thus include an account for the 5 percent extra RHD costs.

Fourth, NERA argues that the proposed remedy, the abolition of the selective and exclusive distribution system (SED system), is no solution, since there are other consumer industries with high price differentials and no such system, and since the SED system entails various benefits.

Conclusions. The UK Monopolies and Mergers Commission, now the UK Competition Commission, has conducted two studies, with the particular focus of comparing the UK with the rest of Europe. The 1992 study concluded that there were no substantial systematic car price differentials between the UK and the major countries, France and Germany. The 1999 study concluded that the prices in the UK were significantly higher than in France, Germany or Italy over a long-term basis. The results of the study have been criticized by the industry, based on tax arguments and exchange rate arguments, and the index methods used for deriving systematic price differentials.

1.2 Academic studies

1.2.1 Hedonic price studies

Mertens and Ginsburgh (1985) proposed to estimate hedonic price regressions. This method allows one to estimate specification-adjusted price indices based on price and characteristics data for a set of car models. The hedonic method in principle makes it unnecessary to use outside sources (such as option price lists) to quantify the monetary value of the model specifications that may differ across countries. One only needs to know the price of the models and the specifications corresponding to that price. Using regression analysis, one can then obtain a statistical estimate for the value of the specifications. As a simple example, suppose that one has data on two models in four countries. For the first model, the specifications and the prices are identical across the four countries. For the second model, the specifications are also identical, except that air conditioning is included in only two countries; the prices are 1000 Euro higher on the models that include air conditioning. From this simple example, one may estimate the price for air conditioning at 1000 Euro, even without a direct measure for the monetary value (option price) of air conditioning.[21] The estimates for the value of these specifications are "hedonic estimates" and allow one to compute specification-adjusted price indices. More rigorously, a simple hedonic regression may look as follows:

$$p_j^m = x_j^m \gamma + \theta^m + \varepsilon_j^m \qquad (1)$$

where p_j^m is (the logarithm of) the price of a model *j* in market (or country) *m* as expressed in a common currency, x_j^m is a vector of specifications for model *j* in

[21] This is a simplified example, and we emphasize that the method only allows to obtain a statistical estimate. The reliability of this estimate will depend on the variation of specifications across models and countries. For example, suppose again that there are two models in four countries. Prices and specifications are the same for both models in the first three countries. In the fourth country, the models are the same, except that they include air conditioning in contrast to the other three countries. Prices in the fourth country are 1500 Euro higher. From these data only, it is impossible to infer whether prices in the fourth country are higher because of the inclusion of air conditioning or because of other reasons not relating to specification differences.

market m, θ^m are market-specific "fixed effects", and ε_j^m is a statistical disturbance term. The vector γ contains parameters measuring the effect of the various specifications on the price of model j in market m. The parameters are estimated using regression analysis and serve to adjust for price differences across markets and/or models due to differences in specifications. The market-specific fixed effects θ_m may be estimated using dummy variables; they form the basis for the construction of the specification-adjusted, or hedonic price index.

Mertens and Ginsburgh collected a data set for about 100 car models sold in five European countries (Belgium, France, Germany, Italy and the UK) in 1983. The data included pre-tax list prices and technical characteristics available from consumer car magazines. The technical specifications were length, width, engine (gasoline or diesel), horsepower, weight, number of doors, engine capacity, and maximum speed. These data were used to estimate a hedonic regression, similar to the form above. Mertens and Ginsburgh also included country-of-origin fixed effects, to estimate whether French, German, Italian or UK cars showed significant price differences after adjusting for differences in specification. Finally, Mertens and Ginsburgh included a domestic firm effect, to see whether domestically produced cars (e.g. German cars sold in Germany) sold at different specification adjusted prices than foreign cars.

Mertens and Ginsburgh obtained estimates for the effects of all these elements. For example, a car with a diesel engine was estimated to be about 15 percent more expensive than an identical car with a gasoline engine. Cars of a German origin were found to price about 11 percent higher than cars of a Japanese origin. Domestically produced cars sold at a 4 percent premium. Most relevant for our purposes are the estimates of the market-specific "fixed effects", which reflect the specification-adjusted or hedonic price indices. Taking Belgium as the reference country, it was found that specification-adjusted cars were some 16 percent more expensive in France and Germany, about 30 percent more expensive in Italy and 43 percent more expensive in the UK.

Ginsburgh and Vanhamme (1989) extended the hedonic analysis to consider a longer time period. They collected price and specifications data on about 120 models in the same five countries for the period 1984-1987, yielding a total number of about 2400 observations. They found that specification-adjusted price differences (taking Belgium

as the reference country) had seriously decreased in 1986-1987 compared with 1983-1984. They cannot however conclude whether this is due to movements in exchange rates going in the "right" direction[22] or due to compliance with voluntary export restraints negotiated with the EC for certain Member States. They also found that prices increased in all countries by a larger amount than the consumer price index, especially in France and the UK. Finally, they found that prices of imported and domestically produced cars seem to move in a parallel direction.

Mertens (1990) was the first to study a very long time period, the period of 1970-1985. He considers a bit more than 100 models per market/year over this period in Belgium, France, Germany and the UK. The total amount of observations on prices and technical specifications is about 7000. Using hedonic regressions, Mertens computed the specification-adjusted price differences over the entire period. The long time horizon allowed Mertens to shed more light on the role of exchange rate fluctuations. In one extension, Mertens decomposed the evolution of price differences into an exchange rate effect and a residual effect, asking what would have happened if exchange rates had remained at their 1970 level. Mertens concluded that one may divide the studied period into two subperiods. During the period 1970-1979 there were relatively narrow price differences. During 1980-1985 price differences became large, partly because exchange rate movements seemed to move in the "wrong" direction.

Goldberg and Verboven (1998) computed hedonic price indices for Belgium, France, Germany, Italy and the UK, covering about 100 models over the period 1980-1993. They found that, over this period, Belgium was persistently the cheapest country, followed by France and Germany, the most expensive countries being Italy and the UK.

We do not discuss the findings by Goldberg and Verboven on the evolution of the hedonic price indices here in further detail. Instead, we use Goldberg and Verboven' s recently updated their data set covering the entire period 1980-1999. In Figure 1 we present the hedonic price indices for the five countries for the period 1980-1999, combined with the hedonic price indices for the period 1970-1979, as obtained by

[22] The depreciations of the lire and the pound during that period may cause prices to move closer together under incomplete exchange rate pass-through.

Mertens for four of the five countries (not Italy).[23] To delineate the hedonic price indices estimated based on the Goldberg-Verboven data from those obtained by Mertens, a vertical line is added at the year 1980.

See Figure 1 in chapter 4.

Several interesting findings emerge from Figure 1. Over the whole period 1970-1999, Belgium appeared to be the cheapest country. France, and especially Germany showed a persistent and fairly stable positive price differential. Italy and the United Kingdom also showed positive and frequently even larger price differentials with respect to Belgium, yet there appeared to be considerably more volatility. The United Kingdom showed positive price differentials with Belgium in the 7-35 percent range, except during a few years, namely 1973-1976 and 1993-1996 when price were in line or even below the price level in Belgium. Italy showed similar positive price differentials with Belgium, except during 1993-1996 (before 1980 we have no price data).

See Figure 2 in chapter 4.

The volatility of the price differentials can be related to exchange rate fluctuations, an issue to which we return in more detail in section 1.2.2. Figure 2 shows the evolution of the real exchange rates (adjusted for inflation) relative to Belgium during 1960-1999. This picture shows relative weaknesses of the British Pound (not explained by inflation) during 1972-1978 and during 1993-1994, exactly when the car price indices were relatively low. The British Pound rose sharply or was particularly high during 1980-1983 and 1997-2000. These were the years when the hedonic price index for the United Kingdom was close to or more than 30 percent above the price index for Belgium. The Italian Lira showed weakness relative to the BEF during 1973-1979 (for

[23] The indices by Mertens (1990) and Goldberg and Verboven contain the overlapping period 1980-1985. It appears that the levels of price differences may differ by 1 or 2 percent points, yet the direction of changes is virtually identical. To make a smooth index we adjust the index numbers obtained by Mertens by appropriately multiplying so that the 1980 numbers coincide with the ones from Goldberg and Verboven.

which we have no price data) and during 1992-1995, when prices were in line with Belgium; the Lira showed strength during 1981-1991, when prices were high in Italy.

Bouckaert and Verboven (2000) computed hedonic price indices for the period 1993-1999, covering a considerably larger set of countries, i.e. all EU countries except Denmark, Finland and Greece. Their indices were based on the data supplied by the European Commission; yet they are limited to a selection of 11 models. They distinguish between three groups of countries and compare those to Belgium: countries with volatile exchange rates (Italy, Ireland, Sweden and the UK); countries with a stable exchange rate regime (Austria, France, Germany, Luxemburg and the Netherlands); and other countries (Portugal and Spain). They find that systematic (i.e. country-level) price differences across countries may occur, though the price differences are moderate for many countries. The systematic price differences may be very volatile over time. This is most notable for Italy and the UK and is related to the large exchange rate fluctuations in these countries. Finally, they find no evidence on price convergence over the studied period, whether or not one controls for exchange rate fluctuations.

Conclusions. Academic studies have constructed quality-adjusted price indices for measuring systematic price differentials, based on the hedonic method. The results are broadly consistent with the other studies.

1.2.2 Explanations for the observed price differences

Broadly speaking, one may classify the explanations by academic researchers for the observed international price differences in three categories:

- International differences in brand preferences and in the intensity of competition, as reflected in differences in market shares and concentration levels.
- Differences in local costs.
- Incomplete pass-through of taxes, tariffs and exchange rates. Incomplete pass-through occurs if firms do not fully pass-through a change in a cost variable to consumer prices. If pass-through is incomplete, then differences in pre-tax

common currency prices will arise when there are exchange rate fluctuations or tax or tariff differences.

The early price studies limited explanations of price differences to informal conjectures that required further research. For example, Mertens and Ginsburgh (1985), documenting the international price differences in 1983, conjectured that the degree of market concentration could explain the observed price differences. Concentration was the lowest in Belgium, because of the absence of a strong domestic producer and a high Japanese import penetration, and correspondingly prices were the lowest. In contrast, concentration and prices were high in Italy and the UK.

As the international price differences became better documented, several studies appeared that attempted to find more systematic explanations. Gual (1993) used data on list prices and transactions prices collected by BEUC, and augmented with information from some retail catalogues. The data covered 28 models sold in 1986 in 8 European countries, Belgium, Denmark, France, Germany, Luxemburg, Italy, the Netherlands and the UK. Gual focused on the role of several potential determinants in explaining price differences: taxes (VAT), import restraints (quotas and voluntary export restraints), transportation costs and domestic market power. Gual found that taxes are an important determinant of price differences. In countries with high taxes, firms tend to charge lower pre-tax prices.[24] Companies thus tend to pass-through taxes incompletely to consumers. In addition, the presence of import restrictions against Japanese cars is a significant explanatory variable. Furthermore, domestically produced cars are sold at a significant premium in Italy and the UK. In contrast, transportation costs do not seem to be a significant explanatory variable for price differences across countries.

Flam and Nordström (1995) considered the role of taxes, tariffs and import quota constraints, using the data collected by MIRU for the Intra-Car Price Differential Report by the Commission (1992). Their data set covered the prices of 43 models for 11 European countries sold during 1989-1992, with a total number of 1788 observations. The standard deviation of the pre-tax car prices across countries was on average 14 percent of the price, whereas the maximum price difference is on average 50 percent of the price. They found that taxes significantly reduce the pre-tax price of

cars. For example, an increase in the tax rate in Sweden by 1 percent point (from 25 percent to 26 percent) would lead to an increase in the consumer price by only 0.7 percent point, and thus lower the pre-tax price by 0.3 percent point. Furthermore, they found that the effects of tariffs on pre-tax prices were highly significant. An increase in the tariff by 1 percent point lowers the price of the average car by 1 percent. There is thus both incomplete pass-through of taxes and tariffs. Flam and Nordström also found that the presence of import quota constraints raises the pre-tax price of the average Japanese car by 12 percent, whereas it also increases the price of the competing European car by 7 percent. Finally, Flam and Nordström found significant effects on prices when the car is domestically produced: for small and small-medium cars the effect is significantly positive (4 percent); for large cars the effect is significantly negative (- 4 percent).

Verboven (1996) considered price differences between Belgium, France, Germany, Italy and the UK. He used a data set on list prices, technical characteristics and sales (based on new car registrations) for all models sold in 1990. In contrast to the previous reduced form studies, Verboven estimated a structural model of price-setting behavior. This approach allowed Verboven to explicitly distinguish between two types of explanations for the observed cross-country price differentials: differences in profit markups or differences in local costs. Verboven found that, for the year 1990, markups differ across countries, interpreted as evidence of international price discrimination. Markups tend to be higher on domestically produced cars in France, Germany, the UK, and especially in Italy. Furthermore, markups tend to be higher on Japanese cars with import quota constraints in France and Italy, in contrast to UK where the voluntary export restraints did not have significant effects. Verboven also found, however, that differences in markups (or international price discrimination) do not explain all of the observed price differentials. For Germany and the UK the price differential relative to Belgium that is unexplained by markup differences is the highest. While unexplained price differentials may be the result of a misspecification of the model of price-setting behavior,[25] cross-country differences in local costs can

[24] Kirman and Schueller (1990) also find an important role for tax differences.

[25] Verboven explains that a more general demand structure could have been estimated. In addition Verboven tests the possibility that car manufacturers behaved collusively rather than non-cooperatively. The results show that the presence of collusive behavior could not be rejected for Germany and the UK, yet non-cooperative behavior is also plausible according to the price and sales data.

also be responsible. First, the past exchange rate appreciations of the DM may lie at the basis of higher local distribution costs in Germany; yet the reverse would hold for the UK, given the exchange rate depreciations preceding 1990. Second, the inclusion of the catalytic converter in Germany and the UK, and extended warranties and roadside assistance in the UK, may form important elements of higher local costs. Finally, discounts from the recommended retail price may be higher in the UK than elsewhere according to some sources, e.g. the 1992 UK Monopolies and Mergers report.

Conclusions. Several academic studies have sought to explain price differentials based on a short-term data set (a single year or a few years). It is found that price differentials can partly be explained by differences in taxes and tariffs, due to incomplete pass-through behaviour by the companies. The pass-through rate measures the extent to which a cost change is passed onto the consumer prices. Furthermore, cross-country differences in import quota constraints, domestic market power and local costs incurred in the country of sale play an important role.

Several other studies have considered longer time horizons. These studies attempted to also relate the price differentials to exchange rate fluctuations. If exchange rates, just like taxes and tariffs, are passed through incompletely in local consumer prices, then international price differences may be very volatile and large at certain points in time. We discuss these studies separately in the next subsection.

1.2.3 Studies on exchange rate pass-through

The early hedonic price studies by Ginsburgh and Vanhamme (1989) and by Mertens (1990) already made conjectures and some preliminary econometric work on the role of exchange rates in understanding the international price differences and the fluctuations of international price differences over time. Cowling and Sugden (1989) also studied the role of exchange rate adjustment in explaining the prices in Germany and the UK. They found that the appreciation of the pound in 1979-1980 failed to give rise to a decline in the relative prices for imported cars in the UK, and did not lead to

an increase in the relative price of exported UK cars. Cowling and Sugden interpreted this as a quite natural consequence of the oligopolistic structure of the market, through which firms adjust their markups rather than their prices in response to exchange rates.

Bourdet considered exchange rate pass-through behavior in Sweden, during two different exchange rate regimes: the period 1981-1984 and 1992-1994. Constructing hedonic price indices Bourdet found that exchange rate pass-through was less complete under the floating exchange rate regime (1992-1994) than under the fixed exchange rate regime (1981-1984). Bourdet interpreted this as being the result of the larger uncertainty involved with exchange rate fluctuations under the floating regime.

One of the first attempts to quantify the degree of exchange rate pass-through was by Le Cacheux and Reichlin (1992). They used a data set on car prices from 1982-1987 for Belgium, France, Germany, Italy and the UK. They had monthly data, in contrast to the previous academic studies which all used annual data. Interestingly, their figures reveal that firms tend to adjust price about two to three times a year, although the frequency does not follow a regular pattern. Le Cacheux and Reichlin observed that the law of one price fails to hold in the European car market. Their econometric analysis indicated that the cross-country price differences fluctuate almost proportional to the exchange rate fluctuations. This may be interpreted to mean that firms do hardly pass through exchange rates movements into consumer prices. Le Cacheux and Reichlin interpret these findings to be compatible with imperfect competition and extremely variable markups in the short run. Concerning the longer run, they cannot draw clear conclusions, but they do not see a clear tendency for prices to diverge.

Gross and Schmitt (1996) considered exchange rate pass-through by German, Japanese, French and Belgium-based automobile producers in the Swiss market, using quarterly data on import unit values for the period 1977-1991. They quantified the rate of exchange rate pass-through, and distinguish between short run and long run effects. They estimate long-run pass-through rates that are typically less than 50 percent, and frequently in the 20-30 percent range. This implies that even in the long run firms tend to keep prices stable in the local currency. Small and medium cars show the lowest pass-through rates, and correspondingly the strongest tendency for “pricing to market

behavior" or "local currency price stability". They interpret this as stemming from the stronger degree of competition in the small segment.

Herguera (1995) separately considered the Spanish market (1981-1991) and the Italian market (1986-1991). He found evidence of incomplete exchange rate pass-through, with pass-through rates averaging to about 27 percent. German firms tend to pass-through the most (30 percent) followed by Italian firms (24 percent) and Japanese firms (16 percent). Herguera also consider pass-through of import tariffs, and finds that these are passed through more extensively, by about 75 percent.

Methodological contributions by Knetter (1989, 1993) and others offered new possibilities to quantify the extent of exchange rate pass-through (or pricing to market behavior). The methodology consists of relating prices to exchange rates for exporters selling to a panel of destination countries (rather than a single destination country). This panel approach allows one to control for cost shocks to the exporting firm that are common across destinations by including time dummy variables. Gagnon and Knetter (1995) applied this approach to German, Japanese and US firms selling into several destination countries using data on import unit values for 1973-1987. In the short run they find price rigidities leading to price differentials across destination markets under fluctuating exchange rates. In the long run they only find low exchange rate pass-through by Japanese exporters, compared to a larger pass-through rate by German firms and a complete pass-through by US firms. Exchange rate pass-through appears to be the most complete in the largest segments of the market. Gagnon and Knetter interpret the presence of incomplete exchange rate pass-through, when it occurs, as evidence of markup adjustment.

Pareja (1999) selected 30 models from the data set on pre-tax prices collected by the European Commission over the period 1993-1998 to apply the panel approach. Pareja found strong evidence of incomplete exchange rate pass-through. In other words, there is strong pricing to market behavior or local currency price stability. Generally, speaking exchange rate price-through appears to be less than 25 percent, except for the cars from the largest segments where the pass-through rate is around 50 percent. Pareja also found that the rate of incomplete exchange rate pass-through is independent of the invoicing currency used by the manufacturer, and that there

appears to be no differences in the rate of pass-through after exchange rate appreciations or depreciations.

Bouckaert and Verboven (2000) extended to panel approach by Pareja in two ways (limiting attention to only 11 models). First, they distinguished between short run and long run incomplete exchange rate pass-through. Second, they also considered the pass-through of taxes in addition to exchange rates. They found that exchange rate pass-through is greater in the long run than in the short run, yet the long-run pass-through rate is still less than 50 percent in 7 out of the 11 considered models. This incomplete exchange rate pass-through results in large international price differences, which may fluctuate considerably from period to period, yet also persist over a more extended period. The evidence on pass-through of taxes is less reliable, largely because taxes did not fluctuate sufficiently to measure their effects very precisely. Broadly speaking, it appears that the pass-through rate of taxes in the long run varies uniformly between zero and one. For most of the 11 models the tax pass-through rate is larger than the exchange rate pass-through rate and for four out of the 11 models the tax pass-through rate is in fact significantly larger (at a 5 percent confidence level). Since taxes affect the full marginal cost of a car, whereas exchange rates only apply to the exporting cost and not to the local destination costs (distribution and marketing), Bouckaert and Verboven interpret their findings as suggesting that not only markup adjustment but also the presence of local costs may explain incomplete exchange rate pass-through and fluctuations in international price differences.

The above described data set on car prices and specifications collected by Goldberg and Verboven (1998) involves five destination countries. They can thus also apply the panel approach to measure the extent of incomplete exchange rate pass-through. The degree of exchange rate pass-through differs widely across exporting countries. Exchange rate pass-through over the period 1980-1993 is high by firms exporting from Germany (75 percent), Japan (80 percent) and Korea (80 percent). Pass-through is lower by firms exporting from France (55 percent) and Italy (45 percent). It is the lowest by firms from Sweden (30 percent), Spain (25 percent) and the UK (20 percent). Goldberg and Verboven do not interpret the presence of incomplete exchange rate pass-through as stemming necessarily exclusively from markup adjustment. They explain that their reduced form findings on incomplete exchange

rate pass-through may stem from either markup adjustment or from the presence of significant local costs, i.e. costs incurred in the country of destination.[26]

To more fully understand their reduced form findings on exchange rate pass-through Goldberg and Verboven also estimated a structural model of price-setting behavior. This approach can assess the relative importance of local costs and markups as explanations for the international price differences, and the year-to-year changes because of exchange rate movements. Goldberg and Verboven found that the high prices in Italy over the period 1980-1993 can be explained primarily by domestic market power, whereas the higher prices in the UK are mainly attributed to local cost factors, e.g. better-equipped cars. Import quota constraints have a significant impact on prices in France, Italy and the UK. The year-to-year changes in international price differences are the result of incomplete exchange rate pass-through (or local currency price stability) through two channels. First, local (distribution) costs are important, making up about 30-40 percent of the car cost according to some sources. Under these conditions, exchange rates movements are naturally passed through incompletely since they do not affect local costs. Second, there is some markup adjustment following exchange rate fluctuations. Intuitively, exporters prefer to reduce their markups and keep local import prices relatively constant when their currency appreciates, so as not to loose too much market share (and vice versa under a depreciation). Goldberg and Verboven found that a relatively large fraction of the local currency price stability is due to the presence of local costs (about two-thirds). The remaining one third is due to markup adjustment. These findings highlight the importance of taking into account both cost and markup explanations when conducting a comparative price study and possibly drawing conclusions about firm conduct.

Conclusions. Some academic studies have used long-term data sets to explain price differentials. These studies usually find highly incomplete exchange rate pass-through behavior by the companies, or in other words a tendency to keep prices relatively stable in the local currency. As a result, international price differentials may fluctuate

[26] This interpretation differs from Gagnon and Knetter. Yet note that Gagnon and Knetter do not need to consider the possibility of local costs, since their price data are import unit values, i.e. a measure of

largely from year to year. The estimates for the pass-through rate roughly vary between 30 percent and 70 percent, depending on the car model and the time horizon being adopted. Comparing the rich literature on exchange rate pass-through with the few studies on tax or tariff pass-through, it appears that exchange rate pass-through is less complete than tax and tariff pass-through.

1.3 A methodological checklist

From the review of the previous findings on car price differentials in sections 1.1 and 1.2 various common methodological themes emerge. We now provide a synthesis through a methodological checklist, containing the most important points that need to be taken into account when conducting a comparative international car price study.

1.3.1 Measuring car prices

(1) *List prices*

Several types of data have been used in the comparative studies on car prices in the European Union. Some studies used data on import unit values. Unit values refer to the value of one unit of an imported product (or category) when it is imported in a country. These data have been popular to use in the literature on incomplete exchange rate pass-through (see e.g. the study by Gagnon and Knetter (1995). An advantage of these data is that they measure the value of the product when it is imported and thus do not contain local costs in the country of import. Evidence of incomplete exchange rate pass-through from unit value data can thus be interpreted as evidence on markup adjustment.[27] An important disadvantage of the data on unit values is that they cannot be used to measure international price differences in a reliable way. This is because the data are usually relatively aggregated over a whole set of products (cars). When the composition of a product category differs between two countries, one cannot draw any conclusions on international price differences from differences in unit values. A

price before local costs are incurred.

[27] It is thus not surprising that the studies that used unit values, such as Gagnon and Knetter (1995), found higher rates of exchange rate pass-through than other studies. In the other studies incomplete exchange rate pass-through may also stem from local costs.

country with a high average price may simply be a country with high imports of high-quality products.[28]

Most studies made use of data on the recommended retail prices, or list prices. The list prices are published in the suppliers' new car brochures, and are also available in the price lists published by car magazines. According to the MMC (1992), "the pricing system for the car industry is founded upon the supplier's list price, which in the main functions as a point of reference and a basis upon which calculations can be made rather than as a firm price at which transactions actually occur". In particular, the price paid by the dealer is set as a fixed percentage below the current list price excluding taxes. This percentage is referred to as the dealer margin. Consumers use the list prices to compare the prices of different cars in the initial stages of the new car buying process.[29] Yet consumers usually do not pay the full list price. They may obtain discounts that come out of the dealer margin, or receive some other forms of financial benefits.

The recommended retail prices, or list prices, thus form an incontestable building block of the suppliers' pricing strategies in various respects. A consensus has emerged that list prices form an informative point of departure in conducting a comparative car price survey. At the same time, however, the debate on car price surveys has resulted in a general awareness on several potential problems associated with the use of list prices. We synthesize these in the next points.

(2) Discounts and other financial benefits

A common theme throughout the discussions on car price studies has been the common practice by the dealers of offering discounts or (other) financial benefits to consumers. Discounts and financial benefits imply that the transaction prices are lower than the list prices. Ignoring these practices may lead to an overstatement of price differences between two countries, yet note that the reverse is also possible. The relevant question for a cross-country price comparison is not so much whether

[28] For measuring incomplete exchange rate pass-through, this may not be a serious problem if one can assume that the composition of a product category does not change too much over time.

consumer discounts and financial benefits are important, but rather whether they differ significantly across countries.

Discounts from the list price (or recommended retail price) may vary from consumer to consumer. There is thus no single measure for the consumer discount. Most studies report the average consumer discounts, and also provide the minimum and average discounts to have a measure of the range. Two methods for computing discounts are broadly used. The first method is through mystery shopping. A set of dealers is contacted (either physically or by telephone) to request a price at which one can purchase. The average discount and the discount range can then be computed for each model/country surveyed. As noted by the MMC (1999), the firms themselves often use this method to infer the practices of their dealers. An objection to the mystery shopping method is that it does not reflect a real transaction. There is usually no haggling so that the average discounts may be understated.

A second method is to collect data on actual transaction prices (from dealer information or management reports). This information is of course more precise, yet it may be harder to obtain. Ford criticized the mystery shopping approach and presented its own estimates based on actual data. As noted in section 1.1.3.3.1, the estimates of discounts obtained by Ford were higher, yet the differences across countries were similar whichever method was used. This may be explained as follows. If the main weakness of the mystery method is the fact that it does not involve haggling, then the discount estimates should be lower. Yet this would not imply differences in estimates across countries provided that haggling practices are similar across countries. Through either method one could then obtain a reasonable proxy of consumer discounts.

In addition to discounts, other financial benefits are often granted to consumers. Generally speaking, financial benefits are considerably harder to quantify, and verify by policy makers. Some studies have undertaken attempts to directly measure some of these benefits. Other studies, such as the study by the MMC (1999), limited the analysis to a qualitative description on the common practice of various financial benefits across various countries.

[29] The MMC (199) reports this view by the suppliers.

There is in fact a third, indirect method that may be used to obtain an idea for the potential of granting both consumer discounts and other financial benefits. One may collect information on the dealer margin. As mentioned above, the gross dealer margin is computed as a percentage of the list price, and allows one to measure the price paid by the dealer to the supplier. Assuming that dealers do not (or cannot) sell at a loss, the dealer margin is a measure of the maximum potential for discounts to consumers. The dealer margin would obviously overstate the level of average discounts obtained by consumers. Yet differences in dealer margins across countries may be a reasonable proxy for measuring differences in consumer discounts across countries. This would be the case if dealers demand the same margins net of discounts across countries, which would be plausible if they face similar cost and competitive conditions.

Conclusions. A general consensus has emerged that the recommended retail price, or list price, is an informative point of departure in conducting a comparative price study, provided that one seriously considers whether and how the results are affected if transaction prices are used. The transaction price may differ from the list price due to customer discounts and other financial benefits. Several adjustment methods are available. The use of gross dealer margins has the advantage of providing a measure for the potential of both customer discounts and financial benefits.

1.3.2 Comparing car prices

(3) Adjustments for specifications and options

A major theme throughout the discussions on car price studies has been the adjustment for specification differences. The first studies by BEUC approached the issue by considering models with the same name and "comparable" specifications across countries. However, most studies now accept that models are frequently not identical across countries and correspondingly need to be adjusted for differences in specifications. Such differences may occur for several reasons.

First, the engine characteristics of a given model may differ between countries in terms of engine capacity, horsepower, speed, acceleration and fuel efficiency. The base engine model (with the lowest engine specifications) may differ across countries.

Even if there is a model with the same engine specifications across all countries, it is not clear that this model is comparable, since the pricing strategies may differ, for example if this model is the base engine model in one country, but not in the others.

Second, models may differ in terms of the options that are included in the price of a given version, e.g. air conditioning, ABS, delivery charges and extended warranties. A common point of discussion relates to which options are included as standard equipment, and whether such practices differ systematically across countries. For example, the reports by the Monopolies and Mergers Commission in the UK have presented views by the suppliers on equipment commonly offered in the UK.

Third, certain countries may still impose different technical requirements. A European Directive as part of the 1992 program made sure that most of these technical requirements are now harmonized. In practice, an obvious remaining exception is the RHD regulation in the UK and Ireland.

To adjust for specification differences, previous studies have typically followed two possible methods. The first method may be called the direct method. This method starts by defining a "benchmark car model", i.e. a model with the standard specifications to be used for the price comparisons. When the benchmark model is not available in a certain country, one may start with the price of a model with close specifications. To this price one can add the value of any specifications that are missing from the benchmark model, using the prices from option price lists. Or conversely, one can subtract the value of any specifications that are extra, compared to the benchmark model. The resulting total price is the specification-adjusted list price (relative to the benchmark model). For example, the LAL report used by the MMC (1992) chose a standard model in the UK as the benchmark model; since the variants in other countries usually contained less standard equipment, the option prices of the missing specifications were subtracted to obtain a specification-adjusted list price. The MIRU study by the European Commission also used the direct method to correct for specification differences. The bi-annual report by the European Commission also used the direct method, adjusting for air conditioning, power steering, air bag, ABS and automatic transmission.

One potential problem with the direct method is that optional specifications, used to compute the specification-adjusted price, may be priced differently from their implicit

value embedded in the standard specifications of the benchmark model. For example, suppliers in some countries may exclude some specifications from the standard equipment. This allows them to sell certain options separately to obtain higher margins as a market segmentation strategy; in this case the estimates of the specification-adjusted prices for models with less standard equipment than the benchmark model may be biased upward.

An alternative approach to the direct method is the hedonic method. This approach, followed by several academic studies as reviewed above, estimates implicit prices for specification differences rather than directly computing their value from option price lists. As discussed above, this may be accomplished by relating the prices of the available models to the standard specifications they include. Most hedonic studies on the European car market have only included specifications such as horsepower and size. Yet in principle one may also include available standard equipment, such as air conditioning, to compute an implicit price for this equipment.

The hedonic approach may be a useful alternative to the direct method when the prices of optional equipment are not very representative, or when the options are not available in certain countries. A disadvantage of the hedonic approach is that the specification-adjusted price estimates may not be always be precise. This will occur when there is little variation in the data. As an extreme example, suppose that air conditioning is available as standard equipment on all models sold in Spain, and on no models sold elsewhere. In this case, a (hypothetically) high price of the car in Spain could either be due to the availability of air conditioning or due to some other factors specific to the Spanish situation. There is no way the hedonic method can identify this. An additional disadvantage of the hedonic method may be its intuitive credibility. The estimated implicit price for specifications is a theoretical concept. It is never actually charged as a separate item, so it may be less appealing from an intuitive point of view.

(4) Taxes

Another theme in the discussions has been whether one should use car prices before or after taxes. Taxes come in various forms. The most common tax is the value added tax (VAT). Because of tax harmonization efforts, the VAT has slowly converged across

countries. The main source of tax differences is currently a special car tax, which comes in various forms, i.e. sales/registration taxes or registration charges. It may be levied as a fixed percentage in addition to the VAT; it may be dependent on engine capacity (liter) or (fiscal) horsepower; or it may be related to the fuel efficiency of the car as part of a policy for green incentives.

The first comparative studies usually presented prices both before and after taxes. Since taxes are paid in the country of intended use and not in the country of purchase, it is now commonly accepted to express prices before taxes. Industry insiders evaluating comparative price studies have often argued that extremely high tax countries such as Denmark, Finland or Greece (with tax rates up to or exceeding 100 percent of the value) should be excluded from the comparative price surveys. The argument was based on the view that the pricing policies are distorted in such high tax countries. This follows from incomplete tax pass-through behavior, i.e. the practice of raising consumer prices by less than the full amount of a tax increase (and thus lowering markups). As a result, several price studies indeed did not include the high tax countries; see for example the early bi-annual reports by the European Commission. Other studies made separate price comparisons for the whole set of countries and for a subset of countries with comparable tax regimes, e.g. the report by the MMC (1999).

From the consumers' point of view there is little reason to exclude high tax countries from a comparison. Such countries have generally the lowest pre-tax prices and offer the greatest arbitrage opportunities. In fact, the arguments advanced by industry insiders did usually not go much deeper than a brief mentioning of "distorted prices" in high tax countries. One exception is the explanation by Vauxhall, reported by the MMC (1999), that manufactures would lower their margins to cushion some of the effect of the tax rather than lose greater volumes. In the economics literature, this explanation is well studied; it refers to the practice of incomplete pass-through of taxes because of markup adjustment.[30]

[30] Taxes are analogous to exchange rates in that they both affect the costs of the firms and thus may be passed through incompletely. There are however some differences. First, tax increases apply to the full cost of a car, whereas exchange rates fluctuations only affect the fraction of the cost incurred in the exporting country. Second, tax rates are less volatile over time, in contrast to exchange rates. The adjustment to tax changes may thus occur faster than the adjustment to exchange rates.

From the previous debate no convincing economic arguments have emerged for why to simply exclude countries with high taxes from a comparative study. Yet there may be economic arguments that one should adjust prices for taxes using a sound methodology that takes into account incomplete pass-through of taxes. This could allow one to obtain an idea of how prices would be if taxes were harmonized across the European Union.

(5) Exchange rates

The issue of exchange rates has probably been the most controversial throughout the discussions on car price studies. A central question has been which exchange rate measure should be used to convert local prices into a common currency.

Most of the early studies used the current, or contemporaneous, spot market exchange rate to convert prices into a common currency. For example, BEUC followed this practice for its series of studies during the eighties. BEUC justified its approach by saying that it was mainly interested in the potential for exploiting international arbitrage opportunities, to measure the degree of European integration. The LAL study for the MMC (1992) also used contemporaneous exchange rates, yet it conducted a sensitivity analysis by looking at different dates. The bi-annual car price reports by the European Commission also used contemporaneous exchange rates, prevailing at a certain date. A first version of the MMC (1999) price comparison study was also based on contemporaneous exchange rates.

Manufacturers have criticized the use of contemporaneous exchange rates since they reflect only a very specific moment in time. In a response to the first version of the MMC (1999) price comparison, the industry provided a number of explanations as to why prices do not respond quickly and instead pass through exchange rates incompletely into consumer prices. This results in sometimes large international price fluctuations. The explanations by the industry, which were listed in section 1.1.3.3.2, may be synthesized into two main types of arguments: a price adjustment cost argument and a local cost argument. First, exchange rates are not fully passed through because there are adjustment costs of various kinds, including the uncertainty associated with fluctuations, the option value for delay, and the risk of brand damage.

Second, exchange rates are not fully passed through because products may incur local costs in the country of destination. This is obviously the case for domestically produced products. Yet also products imported from other countries may contain a potentially important local component, including distribution and marketing costs.

Both arguments may be valid explanations for fluctuations in international price differences, especially for the short run. The price adjustment cost argument is consistent with the empirical evidence on the frequency of price changes. The studies reviewed above suggest that firms adjust car prices by about 2 to 3 times a year, depending on the economic conditions. Price adjustments occur more frequently upwards than downwards. Since exchange rates may change continuously (until EMU at least) and sometimes show large annual fluctuations, international price differences depend on the specific time at which the current exchange rate is measured. The longer the time frame of the price studies, the less important the adjustment argument may be, since firms have plenty of time to adapt their prices.

The local cost argument also has empirical support. Several countries have strong domestic producers and distribution and marketing costs are estimated to amount to up to 30-35 percent of the costs. In the longer term the local cost argument may be less obvious. While nominal exchange rates may vary dramatically in the long run, this is less clear about real exchange rates, i.e. exchange rates adjusted for inflation differences. The theory of purchasing power parity (PPP) suggests that real exchange rates are stationary in the long run. The empirical evidence on PPP is not unambiguous, yet evidence exists that it holds in the very long run.[31] Whatever the evidence on PPP, it is reasonable to expect that strong appreciations of a currency are at least partly compensated by lower domestic inflation in the long run. If local costs follow domestic inflation, the local cost argument should be modified to refer to real rather than to nominal exchange rates.

In sum, the objections against the use of contemporaneous exchange rates based on adjustment cost and local cost arguments have their economic relevance. This is especially so for studies covering a short time frame. For the longer term, there may be more ambiguity. A counterargument is that the causes for international price fluctuations do not matter if one is merely interested in measuring consumer arbitrage

possibilities at certain points in time. Furthermore, there is a third argument for incomplete pass-through of exchange rates: intentional markup adjustment (as opposed to unintentional markup adjustment stemming from price adjustment costs). This argument is based on similar economic grounds as the explanation why firms do not pass through taxes completely. Firms may find it optimal to temporarily lower markups after their currency appreciates, so as not to loose too much business; conversely, firms may find it advantageous to increase markups after their currency depreciates. In their empirical analysis, Goldberg and Verboven (1998) compared the local cost argument with the markup adjustment argument. They found that both arguments have empirical support, with the local cost argument accounting for approximately twice as much of the year-by-year fluctuations in international price differences.

Several alternative exchange rate measures have been used to incorporate the objections against the use of contemporaneous exchange rates. One alternative has been to use the average exchange rate over the period of the frequency at which the price data had been collected. For example, Goldberg and Verboven (1998) used data of annual frequency and took the one-year average exchange rate to compare prices. This would (roughly) account for the adjustment cost argument, allowing one to focus on the local cost and markup adjustment arguments. Even if this approach makes price comparisons less sensitive to the precise timing of the study, conversion problems remain. For example, when computing one-year average exchange rates in a price study with data at annual frequency, should one use the average over the year preceding the date of the price comparison? Or should one use the average over the year surrounding, or after, the date of the price comparison?

Another alternative has been to use the average exchange rate over a very long-time period. For example, the MMC (1999) used the six-year and ten-year average exchange rates as alternatives to the contemporaneous exchange rate. The MMC argued that this would provide a long-term view by removing fluctuations of exchange rates that occur over time. Yet problems also remain with this approach. For example, what should be the length of the period over which to take the average? The industry argued to the MMC that the six-year and ten-year periods were arbitrary and that one

[31] See Rogoff (1996).

should rather take the average over the period for which the employed price data were collected. In addition, the average nominal exchange rate over a long time horizon does not account for inflation. If PPP holds, average nominal exchange rates may distort price comparisons. It may thus be preferable to use the average real exchange rate (adjusted for inflation) rather than the average nominal exchange rate. No car price studies have as yet adopted this approach.

Forward exchange rates have also been used as a basis for price comparisons. For example, the MMC (1999) used the three-month forward exchange rate. The MMC argued that companies might use forward exchange rates when determining list prices. The forward exchange rate equals the spot exchange rate adjusted for differences in nominal interest rates and thus incorporates market expectations about the future exchange rate. Yet there is little empirical support that forward exchange rates are better predictors than spot market exchange rates. The MMC also reported that very few suppliers confirmed to use forward exchange rates in determining prices. Forward exchange rates may thus serve as an additional robustness test when comparing prices, yet there seems to be little theoretical or empirical foundation for preferring them to spot market rates.

Conclusions. There have been several concerns regarding car price comparisons. First, it is generally accepted that models should be comparable in terms of engine specifications and options. A commonly used method is to adjust prices for equipment differences based on their value in option price lists. Another approach is the hedonic regression method. Second, there has been debate whether the large differences in taxes distort price comparisons. There are in fact little economic arguments to exclude high tax countries from a price comparison, if one is simply interest in measuring cross-border arbitrage opportunities. Yet it may be defendable to conduct an appropriate tax adjustment that takes into account incomplete tax pass-through behavior. This allows one to ask how prices would become if taxes were harmonized. Third, there has been a debate which measure of exchange rate should be used. The annual average exchange rate seems preferable to the contemporaneous exchange rate, since this helps to account for incomplete exchange rate pass-through behavior. There are related arguments to adjust the exchange rate further by considering exchange rate

measures for an even longer term, and by considering real rather than nominal exchange rate measures.

1.3.3 Presenting price comparisons

(6) Car prices versus car price indices

Car price studies have reported price comparisons for individual models and/or presented summary statistics on price differences by market segment or for the whole market. The bi-annual car price report by the European Commission only presents price comparisons by individual model. Most other studies have reported summary statistics that may come in several forms. One approach is to count the number of models for which the price differences exceed a certain percentage amount. For example, the MIRU report for the European Commission (1992) counts the number of car models for which price difference between the cheapest and the most expensive country exceeds 18 percent at a specific point in time, and 12 percent for more than one year.

Another approach is to compute average price differentials, usually expressed in percentage terms. While this seems to be a straightforward procedure, it turns out that there have been various variations. Not all approaches are in fact justifiable, and several approaches may lead to highly misleading results. A first procedure has been to first compute the relative prices for each model, relative to the price in a common base country. An unweighted arithmetic average of the relative prices is then taken to obtain a price index, by market or by segment. This approach has been followed in several studies, in particular in the BEUC studies, the MIRU study for the European Commission and the LAL study for the MMC. A more sophisticated variation of this approach is the hedonic price study, as done by Mertens and Ginsburgh (1985) and by others, in that a correction for specification differences is made. Another variation is to use the country with the cheapest model as the base country, rather than a common base country, as in the MMC (1999) study.

Several points have been made regarding the procedure of taking unweighted averages. Several criticisms have been reviewed in the MMC (1999) report. First, one should take a common base country, rather than a base country that varies from model

to model when the cheapest country is used. Second, it is preferable to compute geometric averages rather than arithmetic averages when prices are expressed relative to a base country. If these criticisms are not taken into account, then there is a tendency to overstate price differences.

Third, it has been argued that one should use weighted averages, based on sales, when constructing price indices. Only the MMC (1992) and the MMC (1999) have attempted to follow this approach.[32] The MMC (1999) first followed the "country approach", where the weights were based on the country-specific sales. The objection to this approach is that it violates certain rules on index number construction. In fact, one country might have a higher car price index simply because it has a larger proportion of sales in the high segment. For this reason, it is necessary to make comparisons using a basket of products that is the same across countries. For example, if one composes a basket of products assuming they all have the same sales, then an unweighted average can be taken. The unweighted average can only be justifiable if the products indeed have indeed a similar importance in the consumers' purchase basket. More generally, one can weigh the products in the basket based on the consumers' purchasing behavior, using the sales in a base country. The Paasche index asks how much cheaper it is to buy the basket of cars from another country in that country than it is to buy the same basket in the own country. The Laspeyres index asks how much cheaper it is to buy the basket of cars from the own country in another country than it is to buy that same basket in the own country. The Fisher index is an average of the Paasche and the Laspeyres index. The Tornqvist index is the weighted geometric average of the relative prices, where the weights are the expenditure shares on the model in the countries compared.

(7) Reference country and countries included

There has been some discussion on the choice of the reference country against which prices are compared. An often-used approach has been to take a low priced country as the common base country for comparison, for example Denmark or Belgium. Some have argued that the percentage price differences appear lower if one uses the opposite

[32] As we noted above, however, the weights only served to average across segments. Within segments, unweighted averages are taken, based on the assumption that the chosen models are representative.

approach and takes a high priced country, such as the UK, as the common base. In fact, one could find a violation of the EU 12 percent and 18 percent norms using the former case, whereas it would be satisfied if one were to adopt the latter case. While this is not a fundamental point, it may be useful to bear in mind when interpreting the results and confronting them with other studies.

Somewhat more substantially, there has been discussion on whether all countries should in fact be included in a comparative price study. In particular, in response to the MMC (1999) report some companies argued that high tax countries should be excluded from a comparative analysis. Some companies further argued that only countries with similar characteristics in other dimensions should be included. The MMC (1999) correspondingly reported price comparisons for three sets of countries: the whole set, the set of countries excluding high tax countries Denmark, Finland and Greece, and a restricted set of four countries (UK, France, Germany and Italy). The arguments for excluding certain countries usually referred only vaguely to "price distortions". In fact, from the point of view of international arbitrage opportunities, there may be little reason for excluding certain countries from an international price comparison, provided that a proper methodology for measuring and comparing prices has been followed.

Conclusions. Car price comparisons have been made from two perspectives. A first perspective has been to look at price differentials for individual car models. This usually involved comparing the cheapest with the most expensive country. A second perspective has been to measure systematic price differentials across countries, based on the construction of price indices. There are several economic issues that should be taken into account for the proper construction of price indices. There has been some discussion on which country should be used as the reference for comparison, and whether some countries should be excluded from the analysis.

2. THE COMPARATIVE CAR PRICE STUDY

In this chapter we use the database published in the series of Reports on Car Prices from the European Commission to conduct a detailed study on car price differentials over the period 1993-2000. We first describe the data in section 2.1, and provide some background evidence for later reference on the evolution of exchange rates and taxes in section 2.2.

Section 2.3 discusses the general framework of analysis. We propose to analyze car price differentials from two different angles. First, we look at *international price dispersion* for individual car models, based on alternative measures such as the price differential range between the most expensive and the cheapest country. Second, we look at *systematic price differentials*, based on the construction of price indices. These approaches may shed light on two policy options: a policy to reduce cross-border trade restrictions or a policy to directly influence price differentials (e.g. through taxes or exchange rates).

Section 2.3 also discusses how the specification-adjusted recommended retail price (RRP) may be adjusted to better measure the actual transaction price paid by the customer. We consider two measures: customer discounts and gross dealer margins. We also discuss how an adjustment for taxes and exchange rates can approximately account for price differentials due to incomplete pass-through behavior. These adjustments may show whether direct policy measures as a tax harmonization or a fixed exchange rate policy would be sufficient to reduce international price dispersion, or whether indirect policy measures to promote cross-border trade are called for.

In section 2.4 we start with an analysis on the presence of international price dispersion, using unadjusted prices. We describe potential arbitrage opportunities available to consumers during 1993-2000. In particular we analyze which brands, segments or countries have provided the largest arbitrage opportunities to consumers. In section 2.5 we investigate to which extent the (unadjusted) price differentials have been systematic. We classify the countries according to their general car price levels, and ask whether systematic price differentials have been persistent through time.

Section 2.6 extends the analysis by considering deviations between the RRP and the actual transaction prices. We consider both customer discounts and gross dealer margins. Gross dealer margins have the advantage to be more widely available, and to provide a measure for the potential of both customer discounts and financial benefits. Gross dealer margins also make it possible to consider (unexploited) arbitrage opportunities from the perspective of the dealer rather than the final customer.

Section 2.7 repeats the analysis on price dispersion and systematic price differentials after adjusting prices for differences in taxes and exchange rate fluctuations. The adjustment is based on the evidence for the degree of exchange rate pass-through documented in chapter 1, and on new evidence for the degree of tax pass-through. This analysis helps to do a counterfactual analysis and address the question whether direct policy to influence price differentials is sufficient (tax harmonization or exchange rate stabilization), or whether additional measures to reduce cross-border trade restrictions are also called for.

Finally, section 2.8 considers how the analysis of price dispersion is affected by considering the role of the right hand drive (RHD) surcharge in arbitrage opportunities to consumers from Ireland and the United Kingdom.

2.1 The data set

2.1.1 Price data

The data set on pre-tax and after tax list prices used in this study consists primarily of the bi-annual European Commission Survey conducted over the period from May 1993 to May 2000. These surveys contain specification-adjusted information on around 75 most-sold models in the European Union. The first of these surveys was published in May 1993 and covered 10 European countries, i.e. Belgium, Germany, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal and the UK. Austria and Sweden are covered since May 1995. During the first surveys Denmark, Finland and Greece were excluded due to their high taxation of car purchase. However, these three countries are included in the survey since May 1999. The specification-adjusted list prices should correct for quality differences across countries

and therefore are an acceptable reference point to compare price differences.[33] The after-tax list prices are directly taken from the survey. In other words, we did not refer to other publications on the tax rates. This list-price data set has been complemented with other data provided by the European commission in electronic format. These data cover pre-tax list prices and include Denmark and Greece since November 1994 and Finland since May 1995.

Table 3 summarizes the panel structure of our list-price data set.

[33] The adjusted prices were included in case the survey reports more than one list-price.

Table 3 Panel structure of the data set

Country	Pre-tax list price		Post-tax list price	
	Start	End	Start	End
AU	May 1995	May 2000	May 1995	May 2000
BE	May 1993	May 2000	May 1993	May 2000
DK	Nov 1994	May 2000	May 1999	May 2000
FI	May 1995	May 2000	May 1999	May 2000
FR	May 1993	May 2000	May 1993	May 2000
GE	May 1993	May 2000	May 1993	May 2000
GR	Nov 1994	May 2000	May 1999	May 2000
IR	May 1993	May 2000	May 1993	May 2000
IT	May 1993	May 2000	May 1993	May 2000
LU	May 1993	May 2000	May 1993	May 2000
NL	May 1993	May 2000	May 1993	May 2000
PO	May 1993	May 2000	May 1993	May 2000
SP	May 1993	May 2000	May 1993	May 2000
SW	May 1995	May 2000	May 1995	May 2000
UK	May 1993	May 2000	May 1993	May 2000

Note: Country abbreviations are as follows: AU=Austria; BE=Belgium; DK=Denmark; FI=Finland; FR=France; GE=Germany; GR=Greece; IR=Ireland; IT=Italy; LU=Luxemburg; NL=Netherlands; PO=Portugal; SP=Spain; SW=Sweden; UK=United Kingdom.

Other price data concern the surcharge for RHD imposed on cars sold in a LHD country. The European Commission surveys show the supplements charged for the supply of RHD cars in LHD countries. These data are available in electronic format for the period November 1997 - May 2000 and include pre-tax list prices. These pre-tax list prices have been complemented with the after-tax list prices taken from these surveys.

2.1.2 Other data

Other data used in our study include an indication of segment, model-sales volume, customer discounts, gross dealer margins, exchange rates and inflation data.

The European Commission's surveys attach every model to a segment. The report makes a distinction between 7 segments. Segment A includes all mini-cars whereas segment B represents small cars. Medium cars and large cars are included in segment C and D, respectively. Segment E contains executive cars and luxury cars are gathered in segment F. Finally, multi purpose and sports utility vehicles are captured by segment G.

Our data on sales volumes are gathered from l'Argus de l'Automobile et des Locomotions. The data consist of two parts. Firstly, we gathered the country level sales (new car registrations) for the 15 countries included in our study for the years 1994 and 1997. Secondly, for 1994 and 1997 we collected the data on each individual country's 50 best-selling models. This allows us to gain insight into the consumed basket in each individual country.

The data on customer discounts, dealer margins and local distribution costs are taken from an EU Commission questionnaire of August/September 2000. Most of the suppliers replied to that questionnaire.

The data on exchange rates are taken from two different sources. Firstly, the contemporaneous exchange rates are directly taken from the bi-annual survey. Secondly, monthly average exchange rates are provided by International Financial Statistics.[34] This allows us to compute different proxies for the exchange rates. One suggested measure to express prices in a common currency is a 6-month average of the period in between the previous and the current bi-annual survey (for example, for the May reports we took the average of the December to May period).

Data on inflation rates of the 15 countries in our study are obtained from International Financial Statistics.[35]

2.2 Evolution of exchange rates and taxes

Before beginning our analysis of price dispersion and systematic price differences we describe the evolution of exchange rates and taxes. As discussed in Chapter 1, knowing exchange rates and taxes is of potential importance in understanding the sources of international pre-tax and after-tax price differentials and changes of price differentials over time. Exchange rates and taxes are an important source of international price differentials, if they are passed through incompletely by the companies.

For exchange rates, we present the six-month average nominal exchanges rates (relative to the ECU/Euro) over the more extended period 1989-2000, using May 1994 as the base. Figure 3 shows the evolution of exchange rates.

[34] The data were completed using DataStream in case the data in the IFS were missing or incomplete.
[35] The data were completed using DataStream in case the data in the IFS were missing or incomplete.

See Figure 3 in chapter 4.

We grouped the 15 countries in four different categories. Group A consists of Austria, Germany and the Netherlands, which had successfully pegged their exchange rate to the DM during the period. Group B consists of Belgium/Luxembourg, Denmark and France, which followed a policy of keeping exchange rates very close to the DM. Group C and D contain countries with more fluctuating exchange rates relative to the DM. Group C contains the Northern countries Finland, Ireland, Sweden and the UK, whereas group D contains the Southern countries Greece, Italy, Portugal and Spain. We will maintain this grouping of countries also in later figures where all countries are considered together.

The two top pictures in Figure 3 show that the exchange rates of the countries in group A and B have indeed remained within very close bands during the entire period 1989-2000. The exchange rates of other countries were more volatile during this period and showed little correlation with the exchange rates of other countries.

The volatility of the exchange rates has become lower since May 1993, the beginning of our price study (indicated by the vertical line). Nevertheless, also after May 1993 the correlation of the exchange rates between countries from group C and D has been rather low. The country that showed the largest exchange rate fluctuations during the period 1993-2000 has been the UK. The pound appreciated by more than 30 percent since May 1995, returning to the levels of the eighties.

In Figure 29 we also present the evolution of the real exchange rates, after adjusting for inflation differences. The pattern of real exchange rates is rather similar for most countries, because inflation has been low and similar between most countries. An exception is Greece, where inflation has been relatively high so that the real exchange rate in fact showed an appreciation rather than depreciation. The UK also experienced a higher inflation than other European countries, so that the appreciation of the British Pound since 1995 becomes even more striking in real terms.

For taxes, we calculated average tax rates per country and per year over the period 1993-2000, based on the pre-tax and post-tax price data in the price reports of the

European Commission. As mentioned in chapter 1, taxes consist of VAT, and several special taxes including registration/sales taxes and registration charges. These special car taxes may be a fixed amount, or they may depend on car characteristics, such as the horsepower, the fuel efficiency, etc. The special taxes are typically the main cause for the tax differences across countries, after the efforts by the European Commission to harmonize the VAT rates. Figure 4 shows the average tax rates per country during 1993-2000.

See Figure 4 in chapter 4.

For Denmark, Finland and Greece, average tax rates were only computed since May 1999, since no post-tax price data were provided for the previous years. For Austria and Sweden average tax rates were only computed since May 1995.

Countries with "regular" average tax rates, in the 15-30 percent range, are: Austria, Belgium, France, Germany, Italy, Luxembourg, Spain, Sweden (since 1996) and the UK. Average tax rates well above 40 percent occur in Greece, Ireland, the Netherlands, and Portugal. The highest average tax rates are found in Finland (over 80 percent) and Denmark (170 percent).

2.3 The general framework of analysis

2.3.1 International price dispersion and systematic price differentials

See

Figure 5 in chapter 4.

Figure 5 illustrates the framework of analysis. As shown in the right part of Figure 5, we propose to document car price differentials from two different angles: international price dispersion and systematic price differentials. First, we consider *international price dispersion* (top right circle on Figure 5). This analysis focuses on the price differentials for individual car models throughout the European Union. The analysis is based on alternative measures such as the price differential range between the most expensive and the cheapest country, or the coefficient of price variation. The purpose of this analysis is to obtain an idea of the potential arbitrage opportunities to consumers. Second, we look at *systematic price differentials* (bottom right circle on Figure 5). This analysis focuses on average price differentials across countries, based on the construction of price indices. The two approaches may generate rather different results. It may turn out that international price dispersion for the individual models is quite large, while at the same time the systematic price differentials across countries are limited. This would happen if some models were cheap in some countries, whereas other models are cheap in other countries without a systematic bias.

The two different approaches can shed light on two different policy options to reduce price differences.[36] This is shown on the left part of Figure 5. The analysis of international price dispersion serves to measure arbitrage opportunities to consumers for individual car models. This helps to obtain an idea on the extent of cross-border trade restrictions (top left of Figure 5). The results on price dispersion may be confronted with a policy standard to determine whether the degree of European integration is acceptable or whether policy action to promote cross-border trade is called for. For example, a European Commission Notice states that the selective and exclusive distribution system (SED system) is compatible with European integration if, among other conditions, the maximum price differentials are no larger than 12 percent for more than one year and no larger than 18 percent for a shorter period.[37] If this rule is taken as the policy standard for an acceptable degree of integration, our

[36] Note that a policy to reduce price differentials does not necessarily cause car prices to converge to the lowest level in Europe. Economic models would reasonably predict that prices converge to intermediate levels.

[37] See the OJ 85/C17/03 of January 1st 1985, expanding on art. 10 (3) - art. 13 of Regulation 123/85).

results on international price dispersion may be used to investigate how frequently these standards have not been respected. Of course, the policy maker may also use other – more or less severe – standards than the 12/18 percent rule if this is believed to be more appropriate. In general, our results on international price dispersion can then be used to assess whether they meet the policy standard for an acceptable degree of European integration, or whether action to promote European integration is desirable.

The results on systematic price differentials cannot be used directly for assessing the extent of cross-border trade restrictions, since price dispersion for individual car models may exist even if there are no systematic price differentials. Instead, the results can be used as a guide to understand the role of several structural conditions underlying price differentials, for example taxes, exchange rates and competitive conditions (bottom left of Figure 5). If certain structural conditions are important and can easily be influenced, then the policy maker may choose to influence these conditions directly in order to reduce price differentials.

After a detailed analysis of international price dispersion and systematic price differentials based on pre-tax, specification-adjusted list prices, we considered various possible adjustments. These are shown on the middle right part on Figure 5 and discussed in the next two subsections.

2.3.2 Adjusting for discounts and dealer margins

The analysis on international price dispersion and systematic price differentials in sections 2.4 and 2.5 is based on the recommended retail price (RRP), usually referred to as the list price. In practice, the transaction price at which customers can actually purchase their car is almost never equal to the RRP. Nevertheless, as we discussed in Chapter 1, the RRP is a central cornerstone of the companies' pricing strategies. It forms the most informative point of departure in a comparative car price study, and can be easily collected for a large set of models/countries. Yet to gain confidence in the reliability of this measure, it is necessary to seriously consider possible deviations of the RRP from the transaction price paid by the customer. In section 2.6 we consider two approaches.

First, we aim to measure transaction prices directly, by using information on customer discounts granted by the dealers. We make use of the average discounts in four

countries calculated in the Promocar study, as published by the MMC (1999). We also made our own calculations of average customer discounts, based on a recent questionnaire by the European Commission. There are several problems with the use of customer discounts to measure transaction prices directly.

(1) Obtaining systematic information: Several suppliers reported that they do not monitor the dealer's pricing strategies and thus do not know the discounting practices.

(2) No single measure: Different customers typically obtain different discounts from the RRP, depending on several factors, such as the type of customer, the time of the year and the location of the dealer. To aggregate the information, the average discount per model may be a good first indicator. Yet one may also argue in favor of alternative measures, such as the variance or the maximal discount per model.

(3) Other financial benefits: In addition to customer discounts, other financial benefits are a source of deviation of the RRP from the actual transaction prices. Examples are free insurance, trade-ins, etc… These are difficult to quantify as the experience by the MMC (1999) discussed in chapter 1 has shown.

To account for these difficulties we have also aimed to measure transaction prices indirectly, based on the gross dealer margins. The gross dealer margin is typically set as a percentage of the RRP. Adjusting the RRP for the dealer margin resolves many of the problems associated with the direct use of customer discounts. In particular, one may view the dealer margin as the maximum potential to the dealer for offering discounts without making losses. Furthermore, this potential includes any financial benefits that may be offered on behalf of the dealer. Finally, the companies have reliable information on the gross dealer margins at their disposal.

Adjusting the RRP for the dealer margin may also be viewed as a way to measure (unexploited) arbitrage opportunities from the perspective of the dealer, rather than from the perspective of the customer.

2.3.3 Why (not) adjusting for taxes and exchange rates?

An important methodological question is whether car prices should be analyzed with or without adjusting prices for the structural conditions such as taxes or exchange rates. Industry insiders have usually advocated the view that one can simply not make price comparisons between countries with high tax differentials or with volatile currencies.

From the point of view of consumers seeking to engage in cross-border trade and engage in international arbitrage opportunities during the past years, it is in fact largely irrelevant what are the structural conditions underlying systematic price differentials. What matters to consumers (or dealers) are the pre-tax common currency prices at which they can buy a car, either domestically or abroad. Put differently, the pre-tax common currency prices, unadjusted for taxes or exchange rates, are the relevant focus for analyzing international arbitrage opportunities to consumers. This justifies our analysis of price dispersion and systematic price differentials in sections 2.4 and 2.5.

From a policy point of view, however, a tax or an exchange rate adjustment may be a relevant exercise. Suppose the policy maker wants to reduce price differentials by directly influencing structural conditions under its control, such as taxes or exchange rates, instead of trying to reduce possible cross-border trade restrictions, such as the SED system. We will show how an adjustment can account for systematic price differentials that arise from the incomplete pass-through of taxes or exchange rates. This adjustment enables the policy maker to conduct a counterfactual analysis and ask how car prices would approximately be if taxes were harmonized across countries or if exchange rates were stabilized. The tax or exchange rate adjusted analysis can thus show whether a tax harmonization or an exchange rate policy would be sufficient to reduce international price dispersion, or whether alternative measures to promote cross-border trade are also called for.

Any counterfactual analysis is based on assumptions. In the present context, the assumptions relate to the precise degree of tax and exchange rate pass-through by the companies. In chapter 1 we already reviewed in detail the literature on incomplete pass-through behavior, referring to the practice of incompletely passing through cost

changes into consumer prices. In sections 2.7 we make use of the rich available evidence on exchange rate pass-through and on new evidence on tax pass-through to adjust prices and address the counterfactual analysis.

Conclusions. Our framework of analysis documents car price differentials from two different angles. First, we consider international price dispersion, based on measures such as the price differential range and the coefficient of variation. Second, we consider systematic price differentials, based on aggregate price indices. The two different approaches shed light on two different policy options to reduce price differentials: a policy to reduce possible cross-border trade restrictions, and a policy to directly reduce price differentials by influencing structural conditions such as taxes and exchange rates. The framework suggests a possible consideration of several adjustments for prices: discounts and dealer margins, taxes and exchange rates.

2.4 International price dispersion

2.4.1 General overview

We begin our analysis with a general overview of international price dispersion. We use three alternative dispersion measures: the price differential range between the cheapest and the most expensive country, the price differential range between the second cheapest and the second most expensive country, and the coefficient of price variation (relative standard deviation). The focus is here on describing international price dispersion for individual models. We can thus analyze whether and to which extent there have existed potential arbitrage opportunities for European consumers. In the next subsection we take up the different question whether price differentials have varied systematically across countries.

We base our analysis on quality-adjusted pre-tax prices, converted into Euro using the six-month average exchange rate. The data come from the price reports of the European Commission and cover the period May 1995 – May 2000 on a bi-annual basis. The data for 1993-94 are excluded from the analysis because information is not available for all countries during these years. We have calculated our measures of

price dispersion based on all 826 models in the May 1995 – May 2000 price reports, amounting to about 75 models for every half-year period. For some models price information is not available for all countries. For these models the measures of price dispersion may be conservative, i.e. biased downward, if the models were in fact actually available for sale in these countries. In any event, the bias should be small since most countries reported price information for over 90 percent of the models. Exceptions are Denmark, Greece and Sweden, where price information for about 75 percent of the models was available, and Finland, where price information for 67 percent of the models was available. The conclusions on price dispersion we report below are robust when the analysis was conducted based on the limited set of models for which information was available for all countries.

Figure 6 to Figure 11 provide a general overview of international price dispersion in the European car market. Figure 6 and Figure 7 compute the relative price differential range for each car model. The relative price differential range is defined as the maximum percentage price differential, i.e. the price differential between the most expensive and the cheapest country, expressed as a percentage of the average model price across countries. Figure 6 plots this price differential range against the average model price across countries for three different subperiods: May 1995 – November 1996, May 1997 – November 1998, and May 1999 – May 2000. The first two subperiods thus contain information on four half-years, whereas the third subperiod contains information on only three half-years. Since there are about 75 models for every half-year period, the plots contain about 300 data points in the first two subperiods, and about 225 data points in the third subperiod.

See Figure 6 in chapter 4.

The top left part of Figure 6 shows that the relative price differential ranges varied between roughly 10 and 50 percent of the average model price during 1995-1996. There appears to be a weak tendency for the price differential ranges to decrease as the average model price increases. In other words, models from the luxury segments E and F show somewhat lower price differential ranges than models from the smaller

segments A or B. Nevertheless the decreasing relationship seems rather weak, so that absolute price differentials (in monetary units) tend to increase as one moves up to higher and more expensive segments.

The top right part of Figure 6 shows that the relative price differential ranges increased during the period 1997-1998. Many models show price differential ranges over 50 percent of the average price. This is especially so for models with average prices in the 5000-20000 Euro range, so that the decreasing relationship between the price differential range and the average price appears to become more pronounced than in the 1995-1996 period.

The bottom part of Figure 6 shows the price differential ranges for the 1999-2000 period. Price differential ranges still frequently exceed 50 percent, though the tendency seems not as pronounced as during the 1997-1998 period. If 50 percent price differential ranges occur, this is especially for the models with average prices between 5000 and 20000 Euro.

See Figure 7 in chapter 4.

Figure 7 uses the same information to depict the distribution of the price differential ranges more accurately in histograms.[38] This confirms the above discussion. The top right part of Figure 7 shows a relatively concentrated distribution of the price differential ranges. During 1995-1996 about half of the models showed price differential ranges in the 25-40 percent range. Only 5 percent of the models showed price differential ranges in excess of 50 percent. There were no models with price differential ranges less than 10 percent. During the later years there was a tendency for the distribution to shift to the right and to become flatter. This means that the price differential ranges became somewhat higher on average and showed more variation across models. The top right part shows that during 1997-1998 about half of the models showed price differential ranges in the 30-50 percent range. Almost no models showed price differential ranges less than 10 percent and about 25 percent of the

models showed price differential ranges over 50 percent. The bottom part of Figure 7 shows the price differential ranges during 1999-2000. Slightly less than half of the models had price differentials in the 35-50 percent range, and around 15 percent of the models showed maximum price differentials in excess of 50 percent. Thus relatively low and high price differential ranges seem somewhat less frequently present in the last subperiod compared to the 1997-1998-period.

The findings on price dispersion in Figure 6 and Figure 7 may be the result of the price pattern in only a few countries. For example, as we will see later, the UK experienced an increase in Euro prices relative to the other countries over the period 1993-2000. For this reason, we also computed other measures of international price dispersion.

See Figure 8 in chapter 4.

See Figure 9 in chapter 4.

Figure 8 and Figure 9 show plots and histograms for the relative price differential ranges excluding the most expensive and the cheapest country. This is defined as the price differential between the second most expensive and the second cheapest country, expressed as a percentage of the average model price across all countries.[39] These price differential ranges are less sensitive to the incidence of extremes; they are necessarily lower than when all countries are included, unless there are ties at both the most expensive and the cheapest end of the range.

As expected, the price differential ranges are reduced when the cheapest and the most expensive countries are excluded. While the price differential range was around 35 percent on average when all countries were included, the price differential range drops to around 20 percent on average. Nevertheless, as in Figure 6 and Figure 7, there still

[38] The histograms Figure 7 are based on exactly the same information as the plots in Figure 6. The difference is that the histograms no longer explicitly show the average price of the models, yet they allow to more accurately view the distribution of price differentials.

[39] Alternatively, one could have taken this price differential as a percentage of the average model price across all countries excluding the cheapest and the most expensive. This gives very similar results.

appears to be no tendency for the price differential ranges to decrease. If anything, a small increase in the price differential ranges appears to have occurred after 1996. During 1995-1996 almost 60 percent of the models had price differentials between the second highest and second lowest country in the 15-24 percent range. During 1997-1998 around 65 percent of the models had price differentials between the second highest and the second lowest country in the 18-30 percent range; during 1999-2000 around 65 percent of the models had price differentials in the 15-27 percent range.

See Figure 10 in chapter 4.

See Figure 11 in chapter 4.

Figure 10 and Figure 11 show plots and histograms for the coefficient of (price) variation, sometimes called the relative standard deviation (of prices). The coefficient of (price) variation is defined as the standard deviation of prices across countries, expressed as a percentage of the average model price across countries. A similar measure of price dispersion was used in the DKBR (1999) study on price dispersion in various European sectors. The coefficient of price variation takes into account the information on the prices in all countries, rather than only the prices in the two (or four) extreme countries, as done when considering maximum price differentials. As expected, the coefficient of price variation drops further compared to the previous figures, averaging to around 10 percent. At the same time there appears to be no tendency for the coefficient of variation to decrease over time. During 1995-1996 about 70 percent of the models showed a coefficient of variation in the 7-12 percent range. During 1997-1998 about 70 percent of the models showed a coefficient of variation in the 8-13 percent range. During 1999-2000 about 75 percent of the models showed a coefficient of variation in the 7-13 percent range.

Conclusions. The plots and histograms with the alternative measures of price dispersion are summarized in Table 4. These statistics summarize the previous discussion based on the plots and histograms. The three different measures of price variation differ substantially in magnitude, as is expected from their definition. Yet all

measures point in the same direction, indicating that price dispersion has not diminished in recent years.

Table 4 Summary statistics for alternative measures of price dispersion

	Period	Average	Standard deviation	Minimum	Maximum
Price differential range – including all countries	1995-96	32,9	11,0	11,0	89,5
	1997-98	38,9	14,1	7,8	75,7
	1999-00	38,8	13,2	5,5	80,5
Price differential range – excluding most expensive and cheapest country	1995-96	19,2	6,3	4,0	46,5
	1997-98	21,0	8,1	4,6	47,3
	1999-00	19,5	6,8	4,2	41,9
Coefficient of price variation	1995-96	9,2	2,5	3,2	20,8
	1997-98	10,1	3,1	2,8	21,8
	1999-00	9,7	2,8	2,2	17,5

Note: Total number of models during 1995-2000 is 826. All measures are expressed in percentage of the average model price.

Several additional tables aim to explore in further detail which models and which countries lay at the basis of the price differentials. Since there appear to be no strong changes in overall price dispersion over time we have summarized the data for the full period 1995-2000. We turn to an analysis by segment/brand and by country in the next subsections.

2.4.2 Analysis by segment and brand

Table 5 provides an analysis of price dispersion by segment. For each segment the fraction of the models is given that belong to alternative international price differential ranges. The numbers in this table are related to the plots and histograms of Figure 6 and Figure 7, except that now a distinction between segments is made.

Table 5 Analysis of price differential ranges by segment

Segment	Number of models	Fraction of models in the price differential range of:

		0-10%	10-20%	20-30%	30-40%	40-50%	>50%
A	35	0	11	37	**43**	6	3
B	168	0	4	26	**36**	23	12
C	188	0	4	13	**29**	**29**	24
D	233	0	8	17	26	**30**	19
E	94	3	5	**34**	30	16	12
F	37	3	**49**	19	22	3	5
G	71	0	27	**34**	23	10	7

Note: Total number of models during 1995-2000 is 826. Bold numbers indicate the price differential range with the highest frequency.

International price differentials in the 0-10 percent range are rare and occur only in the E and F luxury segments (in 3 percent of the cases). Segments A and B show international price differentials that are mainly in the 30-40% range. For segments C and D the international price differentials are mainly in the 40-50 percent range. For the more expensive segments the price differentials mainly occur in the 20-30% range (E and G) and in the 10-20% range (F).

Table 6 provides a further analysis by brand. For each brand, the fraction of models is given that belongs to alternative international price differential ranges.

Table 6 Analysis of price differential ranges by brand

Country	Number of models	Fraction of models in the price differential range of:					
		0-10%	10-20%	20-30%	30-40%	40-50%	>50%
BMW	33	0	12	**67**	12	3	6
Fiat	45	0	2	16	**31**	20	31
Alfa Romeo	29	0	0	21	24	**28**	**28**
Lancia	33	0	9	**61**	9	21	0
Ford	39	0	0	3	31	**33**	**33**
GME	44	0	0	16	**50**	32	2
Mercedes	33	15	**58**	21	3	0	3
Peugeot	50	0	20	**46**	14	20	0
Citroën	44	0	14	41	**32**	11	2
Renault	62	0	11	**39**	21	21	8

Rover	67	0	13	25	**28**	18	15
Volvo	29	0	3	14	**38**	21	24
Volkswagen	42	0	0	5	36	**38**	21
Audi	36	0	19	14	**58**	8	0
Seat	44	0	7	14	**43**	20	16
Nissan	33	0	0	9	27	**36**	27
Mitsubishi	26	0	12	4	23	**38**	23
Daihatsu	16	0	25	19	**31**	13	13
Honda	22	0	0	5	**36**	32	27
Toyota	33	0	0	3	**39**	30	27
Subaru	12	0	0	8	25	**42**	25
Suzuki	21	0	0	10	**62**	29	0
Mazda	33	0	3	3	12	33	**48**

Note: Total number of models during 1995-2000 is 826. Bold numbers indicate the price differential range with the highest frequency.

Table 6 shows that the following brands have international price differentials in excess of 50% for more than 25% of their models: Fiat, Alfa Romeo, Ford, Nissan, Honda, Toyota, Subaru and Mazda. Thus mainly Japanese and Italian brands show high percentage price differentials. Note that most of the listed brands are primarily active in the smaller segments, where we found higher price differential ranges.

Conversely, Mercedes is the only brand has international price differentials of less than 20% for more than 25% of its models. Other brands with comparatively low international price differentials are BMW, Lancia and Peugeot, Citroën and Renault: these brands have international price differentials less than 30% for at least half of their models. Thus mainly the luxury brands and the French brands show comparatively low international percentage price differentials.

Conclusions. Most segments are comparable in terms of price dispersion. Only the most expensive segments (E and F) show a comparatively lower level of price dispersion in percentage terms. Brands differ somewhat more in terms of price dispersion. Japanese and Italian brands show a comparatively higher level of price dispersion.

2.4.3 Analysis by country

We now turn to a first analysis to identify the countries where the cheapest and most expensive (or the second cheapest and second most expensive) models can be found. Before proceeding, recall that the analysis in this section is based on all models included in the Commission's price reports, so also models that did not have price data for all countries. During the period 1995-2000, most countries had price information on more than 90 percent of the models, except for Finland (about 67 percent of the models), and Denmark, Greece and Sweden (75 percent of the models). In Table 7 and Table 8 the Scandinavian countries and Greece may thus be slightly underrepresented, to the extent that the models for which there was no price information were actually available for sale in these countries (at very low or very high prices).

Table 7 counts the number of models for which a country was the cheapest and the second cheapest. It also presents the fraction of the counted models falling in various price differential ranges.

Table 7 The cheapest and the second cheapest countries – Number of counted models and price differential ranges

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
DK	Cheapest	**510**	0	2	13	**32**	31	22
	Second	**52**	0	2	25	**37**	19	17
FI	Cheapest	**33**	0	0	15	**52**	21	12
	Second	**162**	1	1	13	**35**	26	25
GR	Cheapest	**39**	0	8	**31**	23	28	10
	Second	**148**	0	3	18	29	**30**	21
NL	Cheapest	**58**	0	24	41	**21**	10	3
	Second	**89**	0	8	26	21	**28**	17
IT	Cheapest	**36**	0	14	**56**	22	3	6
	Second	**70**	0	14	**34**	**34**	16	1
PO	Cheapest	**41**	0	12	**61**	20	7	0
	Second	**53**	0	13	23	**36**	13	15

ES	Cheapest	**30**	0	27	**33**	**33**	7	0
	Second	**62**	0	11	18	**29**	26	16
IR	Cheapest	**17**	0	**65**	24	12	0	0
	Second	**40**	3	20	30	**33**	13	3
UK	Cheapest	**17**	0	**35**	**35**	24	6	0
	Second	**30**	0	20	**37**	27	3	13
BE	Cheapest	**7**	0	**43**	14	29	14	0
	Second	**35**	6	26	**31**	14	20	3
SW	Cheapest	**9**	11	11	**33**	11	0	33
	Second	**31**	0	3	26	**39**	19	13
LU	Cheapest	**6**	0	**100**	0	0	0	0
	Second	**22**	0	**36**	27	5	18	14
AU	Cheapest	**7**	0	**43**	29	14	0	14
	Second	**14**	0	29	14	7	**43**	7
FR	Cheapest	**8**	0	0	25	**50**	13	13
	Second	**11**	0	0	9	**45**	36	9
GE	Cheapest	**8**	**38**	**38**	13	0	0	13
	Second	**7**	14	**57**	14	0	14	0

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are cheapest or second cheapest. Bold numbers indicate the price differential range with the highest frequency.

Table 7 shows that Denmark has been the cheapest country for most of the models during 1995-2000 (i.e. for 510 out of 826 models). For the cases where Denmark was the cheapest country the international price differential were most frequently in the 30-40% range (32 percent of the cases), in the 40-50 percent range (31 percent of the cases), or above 50 percent (22 percent of the cases). This observation follows from the fact that Denmark has very high taxes compared to the other countries, as illustrated before in Figure 4. This induces firms to charge lower pre-tax prices, thereby taking part of the burden of taxation by lowering their margins. Nevertheless, Table 7 shows that the very high taxes do not cause Denmark to be the cheapest country for all models. All of the other countries have been the cheapest for some models, especially the Netherlands (for 58 models), Portugal (41 models), Greece (39 models) and Italy (36 models).

Given the overwhelming role of Denmark as a low pre-tax price country it is instructive to also consider the number of cases in which countries have been the

second cheapest. One can see that the second lowest price was encountered more evenly across countries, in particular in Finland (162 models), Greece (148 models), the Netherlands (89 models), Italy (70 models), Spain (62 models), Portugal (53 models) and Denmark (52 models). Most of these countries had relatively high taxes, above 40 percent, yet this is not the case for Spain and Italy where taxes are in line with EU average. Conversely, Ireland also had a tax rate in excess of 40 percent, yet it does not appear to be the cheapest or second cheapest country on a very frequent basis.

Looking at the bottom rows of Table 7, one can see that Austria, France and Germany were almost never found to be the cheapest country. For the models where Germany appeared to be the cheapest country, the international price differential typically was in a small range.

Table 8 counts the number of models for which a country was the most expensive and second most expensive. As in Table 7, it also presents the fraction of the counted models falling in various price differential ranges.

Table 8 The most expensive and the second most expensive countries – Number of counted models and corresponding price differential ranges

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
UK	Most exp.	**387**	1	4	14	25	**32**	24
	Second	**73**	0	8	16	**34**	23	18
GE	Most exp.	**106**	0	8	28	**48**	15	0
	Second	**207**	0	4	19	24	**33**	19
FR	Most exp.	**77**	0	22	**39**	30	6	3
	Second	**75**	0	8	**39**	32	13	8
AU	Most exp.	**52**	2	12	**37**	31	19	0
	Second	**93**	0	5	28	**31**	23	13
IR	Most exp.	**13**	0	0	**54**	46	0	0
	Second	**84**	0	11	8	**29**	**29**	24
FI	Most exp.	**60**	2	7	17	22	17	**37**
	Second	**23**	13	13	13	17	**22**	**22**
GR	Most exp.	**40**	0	18	23	25	8	**28**

	Second	**38**	0	**26**	**26**	**26**	21	0
PO	Most exp.	**24**	4	21	**33**	13	29	0
	Second	**44**	2	7	25	**34**	16	16
SW	Most exp.	**23**	0	13	26	**39**	17	4
	Second	**44**	0	14	9	**30**	27	20
IT	Most exp.	**18**	0	33	0	22	**44**	0
	Second	**35**	0	17	20	**29**	6	**29**
BE	Most exp.	**13**	0	8	**54**	**38**	0	0
	Second	**38**	3	18	26	**42**	5	5
LU	Most exp.	**3**	0	0	0	33	**67**	0
	Second	**23**	0	9	**39**	22	22	9
ES	Most exp.	**3**	0	**33**	**33**	**33**	0	0
	Second	**23**	0	9	17	**48**	17	9
NL	Most exp.	**5**	0	**60**	20	20	0	0
	Second	**17**	0	12	**53**	24	6	6
DK	Most exp.	**2**	0	0	0	**100**	0	0
	Second	**9**	0	22	22	**33**	22	0

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are the most expensive and the second most expensive. Bold numbers indicate the price differential range with the highest frequency.

Table 8 shows that the United Kingdom has been the most expensive country for most of the models during 1995-2000 (387 out of 826 models). For the models where the United Kingdom was the most expensive country, the international price differential was most often in the 40-50% range. Other countries that were frequently the most expensive were Germany (106 models), France (77 models), Austria (52 models), and most surprisingly the high tax countries Finland (60 models) and Greece (40 models). This indicates that high taxes are no guarantee for low pre-tax prices.

Countries that were often either the most or the second most expensive were the large countries the UK (460 in total), Germany (313 models) and France (152 models), followed by Austria (145 models), and surprisingly the high tax countries Ireland (97 models), Finland (83 models) and Greece (78 models).

The bottom rows of Table 8 show which countries were almost never the most or the second most expensive ones. This is the case for Luxemburg and Spain (26 models), the Netherlands (22 models) and Denmark (11 models).

Conclusions. Denmark shows a high frequency of models for which it is the least expensive. Yet also Finland, Greece, the Netherlands, Italy, Spain and Portugal are countries where the lowest or second lowest price for a given model is frequently encountered. The United Kingdom shows the highest frequency of models for which it is the most or second most expensive, followed by Germany, France, Austria, and surprisingly some high tax countries, such as Finland and Greece.

2.5 Systematic price differentials

As discussed in section 2.3.1, systematic price differences refer to aggregate price differences across a whole set of models. They may be used to identify cross-country difference in structural conditions, such as taxes, exchange rates or competition. Systematic price differences may be measured based on price indices.

2.5.1 Constructing price indices

As discussed in Chapter 1 several price index methods have been adopted to study systematic price differences between countries. We distinguish between the unweighted price index approach, the hedonic price index approach and the cost-of-living index approach.

The earliest approach, followed by BEUC, was to calculate an unweighted price index, defined as the unweighted average for a set of model prices in each country, relative to the prices in a base country. For example, consider two models A and B, sold in two countries, 1 and 2. In country 1, the prices for A and B are 10000 and 20000 Euro, respectively. In country 2, the prices for A and B are 15000 and 24000 Euro. Using country 1 as the base, the relative prices for model A and B are then 1.5 and 1.2; or, if multiplied by 100, the relative prices for A and B are 150 and 120. The average of these relative prices is 135, which is used as the unweighted price index. Using this index one would conclude that country 2 is on average 35 percent more expensive than country 1.[40]

[40] This example takes the same country as the base country for each model. We have seen in the review in chapter 0 that some approaches use a different base country for every model, e.g. the cheapest country.

Two criticisms have been formulated against this approach. A first criticism has been that the models may not always be directly comparable, because they may differ in technical specifications across countries. A solution to this approach has been the construction of a hedonic, or quality-adjusted, price index. As discussed in Chapter 1, this approach corrects for differences in technical specifications by regressing the prices on the technical specifications. If the technical specifications contribute significantly to the model price, then a price correction should be made for the amount of the price contribution of the differences in technical specifications. Other than the correction for the technical characteristics, the construction of a hedonic price index is similar to the construction of an unweighted price index.

A second criticism has been that no account is taken of the popularity of the various models, when an unweighted average over relative prices is taken. In the above example, it may be that model A has a negligible market share, in which case an appropriate price index should be based primarily on the relative prices for model B. In this case the price index would be closer to 120, rather than 135 as in the unweighted case. Economic approaches have constructed price indices using the sales of the products as weights. The central difficulty in constructing economic price indices for international price comparisons is that different countries typically have different consumption bundles. Which consumption basket should one then use to make an international price comparison?

The “country approach”, followed as one of the approaches in the MMC (1999) study, uses the sales in each country as weights. In the above example, suppose that country 1 has 10 percent of its sales for product A and 90 percent for product B, whereas country 2 has 90 percent of its sales for product A and only 10 percent for product B. In this case, the average price in country A would be 19000 Euro, compared to 15900 Euro in country B. Country 2 would then appear cheaper than country 1, even if none of the two models is sold at a lower price. The reason is that country 1 has a larger market share than country 2 for the product of the more expensive segment, product B. (One could think of Germany, with a high market share of Mercedes and BMW, as an example.)

There is a consensus among economists that one should use the same basket across countries to make proper price comparisons.[41] This avoids biased estimates if one country has a larger market share for products in the more expensive segments. A commonly used approach is the construction of cost-of-living indices. A cost-of-living index computes the cost of consuming a common basket of products in different countries, where the basket is the basket of some base country. The question then is which country should be taken as the base for constructing the basket. In principle, one can take either country as the base country, if one is careful to present and interpret the results in terms of the basket of the base country. For example, one could use Germany as the base country, and then interpret the cost-of-living indices from the perspective of German consumers who would purchase their consumption basket abroad. Yet one could equally well use a small country such as Belgium as the base, and appropriately re-interpret the computed indices in terms of that base country. One can also summarize the indices using different baskets through the Fisher index. To construct the Fisher index, one first computes 15 different price indices using the baskets of all 15 countries as the base; one then takes the geometric average across countries to obtain the Fisher index.

A potential problem with the use of cost-of-living indices occurs when the products do not have the same specifications across countries. In this case, one could in principle measure the cost-of-living indices in combination with some hedonic regression techniques. In our analysis, this is not required, since we use price data from the European Commission, which are already specification-adjusted for the most important characteristics.

A criticism to cost-of-living indices is that one is computing the costs of a fixed basket in different countries, whereas the baskets across countries may differ because the relative prices of the products differ. An alternative approach is therefore to use ideal standard of living price indices. Such indices look at the standard of living in terms of consumer utility rather than the cost-of-living. To compute such indices, it is necessary to estimate demand systems for the products considered. Several economic models nevertheless indicate that cost-of-living indices are good approximations of the ideal standard of living indices.

[41] See for example Deaton and Muellbauer (1981) for a discussion on price indices.

We now explain the construction of the cost-of-living indices we compute more precisely. Denote the price of a specific car model *j* sold in a country (market) *m* by p_j^m. There are *J* products, $j = 1 \cdots J$. Similarly, the quantity of model *j* sold in country *m* is given by q_j^m. The cost-of-living price index I_l^m for country *m*, using the basket of country *l* as the base, is then given by:

$$I_l^m = \frac{\sum_{j=1}^{J} p_j^m q_j^l}{\sum_{j=1}^{J} p_j^l q_j^l}.$$

This is the ratio of the cost of consuming the basket of country *l* in country *m* over the cost of consuming the basket of country *l* in country *l*. The Fisher index for country *m* is a (weighted) geometric average of the cost-of-living indices using alternative countries as the base country:

$$I^m = \exp \sum_l \left(w_l \ln I_l^m \right),$$

where w_l is the weight assigned to country *l*, e.g. based on the population in country *l*. To express the Fisher index relative to an average across a set of reference countries, one computes:

$$I^m \Big/ \exp \sum_n \left(v_n \ln I^n \right),$$

where v_n is the weight of country *n* (e.g. based on population) in the set of included countries. In the construction of our indices we computed the Fisher indices relative to an "EU9 average" of 9 reference countries. Austria, Denmark, Finland, Greece and Sweden were excluded because data were not available for all years. The UK was excluded from the set of countries because the large fluctuations of the pound and the significant weight of that country.

Conclusion. To measure systematic price differentials between countries, we make use of the Fisher index. This is a cost-of-living index, making use of representative baskets of car purchases in several countries.

2.5.2 Systematic price differentials: general overview

To construct the price indices we only included the models for which price information was available for all countries. This makes sure that the baskets are identical when computing the cost-of-living indices (even though they may not fully reflect the actual consumption basket in the base country). Nevertheless, we have done a sensitivity analysis in various respects. First, we recalculated the price indices using the unweighted approach. Second, we calculated the price indices by also including all the models for which price information was not available for all countries (so that the baskets are no longer identical as they should be when computing cost-of-living indices), or by including the models that were available for, say, at least 12 of the 15 countries, etc… The indices that were computed using these alternative approaches were very similar to the Fisher indices that we present in our analysis below. To illustrate this, we report Figure 30 at the end of the document. That figure is analogous to the ones discussed in the analysis below, but it also includes the models for which price information was not available for all countries. The intuition for the robustness of the results is that the relative prices within a country do typically not differ extremely across countries, or, if they do, this would stem from models that do not have a substantial market share in the overall car consumption basket.

We begin our analysis with a general overview of the systematic price differentials. We present Fisher price indices based on the price information for all segments and all countries of origin. In the next subsection, we go into more detail and consider also Fisher price indices by segment of the market, and by country of origin (French, German, Italian, Japanese and European based “US” cars).

Figure 12 shows the evolution of systematic price differentials based on the construction of Fisher indices, relative to an EU9 average (which excludes Austria, Denmark, Finland, Greece, Sweden and the UK as explained above). The calculated Fisher indices summarized for four subperiods are also displayed in Table 9. Several points can be made relating to Figure 12 and Table 9.

See Figure 12 in chapter 4.

Table 9 Fisher indices by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		105,1	100,1	**101,2**
BE	101,9	100,6	97,2	**99,0**
DK	80,5	80,0	78,1	**79,6**
FI		94,5	92,0	**92,2**
FR	102,7	99,9	98,3	**98,7**
GE	106,3	106,7	103,9	**104,9**
GR	96,3	98,0	91,6	**90,5**
IR	97,3	97,7	100,7	**96,9**
IT	92,6	92,7	99,8	**98,3**
LU	101,9	100,2	96,9	**99,3**
NL	100,3	99,6	93,8	**94,5**
PO	95,2	96,4	95,5	**97,1**
SP	93,2	97,2	95,6	**93,8**
SW		98,1	101,1	**101,0**
UK	100,8	98,9	115,1	**116,9**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1

First, consider the countries from group A and B in the top right part of Figure 12. One can see that Belgium, France and Luxemburg have shown both a strikingly similar level and a similar evolution of the price indices during the entire period 1993-2000. Prices have remained very close to each other on average and remained more or less stable around the EU9 average.[42] The close similarity of these three countries is related to the fact that the countries had similar tax regimes (see Figure 4) and also had very close or identical exchange rates (see Figure 3).

Two other countries in the two top parts of Figure 12, Denmark and Germany, have also shown a similar evolution of the price indices, remaining stable relative to each other. This also follows from the fact that exchange rates have remained within very close bands for these countries. The particular property for these countries is however that they showed persistently different price levels during the entire period. The most striking country is Denmark, which had a persistently lower price level by about 20

[42] When the indices were computed based on all models, also including the ones for which price information was not available for all countries, then a similar picture emerges. The only difference is

percent relative to the EU9 average. At the other end lies Germany, which shows a persistently higher price level by about 5 percent relative to the EU average. An explanation for the differences in price levels for these countries can be found in the differences in taxation. Denmark has a very high tax rate of around 170 percent on average, whereas Germany had a rather low tax rate of around 15 percent (see Figure 4).

The remaining countries in the two top parts of Figure 12 showed a somewhat more volatile evolution of the price indices relative to the EU9 average, despite the fact that exchange rates were pegged to the DM. The persistently lower price level for the Netherlands can be partly explained by the relatively high tax rate in that country. The price level for Austria has been somewhat below, though relatively close to the German price level. This is a bit surprising given the difference in tax rate by on average 15 percent between these countries.

Turning to the countries in group C and D, in the bottom parts of Figure 12, one can see that there is substantially more volatility in the price indices relative to the EU9 average. With the exception of Ireland, all countries showed variation in the price indices relative to the EU average by at least 10 percent over the period 1993-2000. The highest price variation is given by the UK, which moved from one of the cheapest countries in 1996 to the most expensive country since 1998, with a price index exceeding the EU9 average by about 20 percent. Other countries with volatile price indices have been mainly Finland, Greece and Italy. The volatility of the price indices follows largely from exchange rate fluctuations as will be analysed in further detail below. As the exchange rates have stabilized during the past few years, the volatility of the price indices has also diminished. Nevertheless, differences in price indices across countries have remained during the past few years.

Focusing on the more stable exchange rate period 1999-2000 for the countries in the bottom part of Figure 12, one can see that the Finland and Greece have had price indices below the EU9 average by about 10 percent. The other countries had price indices above or below the EU9 average within the 5 percent range. The low price levels in Finland and Greece may be explained by the high average tax rates in these

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that France appeared to become some 3-5 percent more expensive during 1996-97. This explains also why a larger number of expensive models was counted for France in Table 8.

countries. Taxes do not explain everything, however, as can be seen from the significantly higher price level for Portugal than for Greece despite the fact that average tax rates are higher in Portugal than in Greece.

Conclusions. This general overview highlights several general trends in the systematic price differentials across countries and in the evolution over time. Exchange rates play an important role in explaining short-term fluctuation in the systematic price differentials, whereas taxes are an important determinant of long term, persisting price differentials. At the same time, exchange rates and taxes do not explain all of the price differentials and their evolution over time. At this point, one could make the following ranking of countries in terms of pre-tax systematic price differentials. At the low end of the price spectrum lays Denmark with a systematic price discount from the EU9 average of more than 20 percent. Other low price countries are Finland and Greece, which are about 10 percent below the EU9 average (over the past three years). The Netherlands, Portugal and Spain have been moderately low price countries with systematic price discounts of about 5 percent from the EU9 average. Countries close around the EU9 average have been Austria, Belgium, France, Ireland, Italy, Luxembourg and Sweden. Germany has been systematically above the EU9 average by around 5 percent. Since Germany has a high share of the EU9 car market, the systematic price differential between Germany and the *other* countries is in fact much larger, more around 10 percent. The United Kingdom has been the highest price above the EU9 average (which already excludes the United Kingdom), by around 15-20 percent during the last three years. While the United Kingdom has been in line with the EU9 average during 1993-96, this was a rather unique period. The evidence from other data sources, presented in Chapter 1 showed that the United Kingdom was also a high price country for cars during the eighties and the early nineties.

2.5.3 Systematic price differentials by segment

Figure 13 to Figure 16 show the evolution of systematic price differences for the different segments. Figure 13 to Figure 16 are also summarized in table form in Table 10 to Table 13.

See Figure 13 in chapter 4.

Table 10 Fisher indices, segments A and B by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		105,2	101,9	**103,7**
BE	101,4	97,3	94,7	**97,5**
DK	81,1	82,4	81,3	**82,6**
FI		95,1	99,7	**96,5**
FR	102,8	98,4	96,2	**97,1**
GE	109,5	109,0	106,2	**106,9**
GR	92,0	94,9	85,5	**88,7**
IR	100,8	100,2	106,4	**101,0**
IT	89,9	91,4	97,2	**95,1**
LU	101,4	97,0	94,6	**97,6**
NL	104,4	104,5	98,4	**100,2**
PO	89,5	89,9	90,3	**94,3**
SP	89,3	96,0	96,7	**95,9**
SW		99,7	104,4	**106,5**
UK	104,3	103,4	118,2	**118,1**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 14 in chapter 4.

Table 11 Fisher indices, segment C by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		101,5	96,8	**100,2**
BE	101,8	100,2	95,9	**98,1**
DK	77,4	78,4	76,0	**78,6**
FI		89,0	87,4	**89,7**
FR	102,4	97,9	98,7	**99,8**
GE	106,6	106,7	103,5	**105,5**
GR	94,6	96,5	86,3	**87,5**

IR	94,5	97,3	100,4	**95,8**
IT	93,2	94,2	100,3	**97,6**
LU	101,0	99,5	96,3	**98,6**
NL	99,4	97,7	92,9	**93,0**
PO	93,4	95,6	95,4	**96,8**
SP	92,7	98,1	95,9	**93,1**
SW		97,4	102,6	**103,1**
UK	103,3	104,4	119,2	**121,8**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 15 in chapter 4.

Table 12 Fisher indices, segment D by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		107,3	101,2	**101,2**
BE	102,7	102,2	98,7	**100,3**
DK	76,9	76,4	75,0	**75,3**
FI		93,7	91,0	**90,2**
FR	102,3	101,4	98,4	**98,3**
GE	105,7	106,5	104,1	**105,0**
GR	99,0	98,5	92,0	**91,5**
IR	95,3	96,4	98,4	**95,3**
IT	93,8	92,5	100,2	**99,6**
LU	103,0	102,0	98,1	**100,9**
NL	97,6	97,7	92,2	**92,3**
PO	95,9	98,3	96,1	**97,3**
SP	93,8	96,0	93,8	**92,1**
SW		98,1	100,5	**98,8**
UK	97,5	95,3	112,1	**114,3**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 16 in chapter 4.

Table 13 Fisher indices, segments E and F by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		104,9	101,6	**100,9**
BE	101,6	102,8	99,8	**100,2**
DK	92,2	85,8	87,4	**89,7**
FI		102,2	93,3	**96,9**
FR	103,3	102,1	100,2	**99,7**
GE	101,1	103,2	100,2	**100,5**
GR	102,0	104,5	110,2	**98,9**
IR	99,3	98,9	100,3	**98,5**
IT	95,0	93,2	101,4	**100,9**
LU	102,1	101,9	98,4	**99,4**
NL	99,1	99,1	93,0	**96,6**
PO	110,4	104,9	102,6	**102,3**
SP	101,0	101,3	98,4	**97,9**
SW		95,8	93,3	**94,9**
UK	96,4	92,8	109,6	**109,3**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

Consider first the countries with relatively stable exchange rates, belonging to group A and group B. Most of the price differentials by segment are comparable to the market-level price differentials given in Table 9 and Figure 12. There are however also some striking observations when one considers the price differentials by segment. We list these observations below, by comparing the Figures and Tables by segment with the Figure 12 and Table 9 for cars in general.

Country groups A and B; segment A/B. Table 10 and Figure 13 show that Germany and Austria have been comparatively even more expensive in the A/B segment than elsewhere. The Netherlands is also comparatively more expensive for cars in the A/B segments. The prices in the Netherlands in the A/B segment are in line with the EU9 average, in contrast to cars in general, which were shown above to be typically around 5 percent below the EU9 average.

Country groups A and B; segment C. Austria had a relatively low price index for its segment C cars relative to its general price index during 1996-1997. Otherwise there

seem to be no notable differences in Table 11 and Figure 14 compared to the market-level Fisher indices in Table 9 and Figure 12.

Country groups A and B; segment D. Table 12 and Figure 15 show that the Netherlands is comparatively even cheaper for cars from segment D than for cars in general. The additional price discount below the EU9 average for segment D cars in the Netherlands is around 3-5 percent (compare with Table 9 and Figure 12). The additional discount for segment D cars is even larger for Denmark (usually more than 5 percent during the entire period).

Country groups A and B; segment E/F. Table 13 and Figure 16 show that Germany has low relative prices in the E/F segment. It is more or less in line with EU9 average, whereas the general car price index has typically been around 5 percent higher. In contrast, Denmark becomes comparatively more expensive for cars in the E/F segments. It has only been some 10 percent less expensive than EU9 average for cars from these segments, compared to a 20 percent discount at the market level.

Now consider the countries with more fluctuating exchange rates, coming from group C and D. Comparisons across countries are more difficult since prices differences expressed in Ecu/Euro are more volatile over the period. Nevertheless, some observations for the different segments can be made.

Country groups C and D; segment A/B. Table 10 and Figure 13 show that Finland and Sweden appear to be relatively more expensive for cars in the A/B segment than for other cars. Finland fluctuates around the EU9 average for A/B cars, whereas it is persistently below the EU9 average for the general price index. Sweden is typically above EU9 average for cars in the A/B segment, in contrast to its general price index. In contrast, Portugal is comparatively cheaper for cars in the A/B segment. While its general price index has been about 3-5 percent less expensive than the EU9 average, its price index for the A/B segment is around 5-10 percent less expensive. The striking finding for A/B cars in Greece is the huge drop in Euro prices in November 1997.

Country groups C and D; segment C. Table 11 and Figure 14 show that Finland, though volatile, had a comparatively lower price index for cars from the C segment compared to its already low general car price index. For Greece, the very low price level during May 1997 is again striking. The United Kingdom showed higher relative

price for cars in the C segment, compared to the general car price index in the United Kingdom.

Country groups C and D; segment D. Table 12 and Figure 15 show that prices in the D segment are in line with the general car price index for most countries. There is a slightly lower relative price for segment D cars in the United Kingdom and in Spain over the period.

Country groups C and D; segment E/F. Relative price for cars in segment E/F differ quite substantially. Price for cars in the E/F segment in the United Kingdom are comparatively low. For example, since 1997 they exceeded the EU9 average by about 10 percent, whereas the general car price index for the United Kingdom was around 20 percent higher. Another striking finding are the prices for cars in the E/F segment in Greece, Portugal and Spain. While Greece has shown a general car price index persistently below the EU9 average (by around 10 percent during the past 4 years), its car price index for cars in the E/F segment has been around the EU9 average and even exceed the EU9 average by 10 percent or more during 1996-97. Portugal and Spain have had price in the E/F segments around the EU9 average, whereas their general car price index was persistently lower than the EU9 average, by around 5 percent.

Table 14 Ranking of countries according to systematic price differentials, by segment (1997-2000)

All segments	Segment A/B	Segment C	Segment D	Segment E/F
UK	UK	UK	UK	UK
GE	GE	GE	GE	GR
SW	SW	SW	AU	PO
AU	IR	FR	IT	AU
IT	AU	IT	SW	IT
IR	NL	AU	BE	GE
FR	FI	IR	LU	BE
BE	FR	LU	FR	FR
LU	SP	BE	IR	IR
PO	IT	PO	PO	LU
SP	BE	SP	SP	SP
NL	LU	NL	NL	FI
FI	PO	FI	GR	NL
GR	GR	GR	FI	SW
DK	DK	DK	DK	DK

Note: ranking from most expensive to least expensive. Based on the average price indices during 1997-2000, given in Table 10 to Table 13.

Table 14.provides a synthesis of this discussion by considering the ranking of the countries in terms of systematic price differentials by segment. The ranking in Table 14 is based on the results for the period May 1997 – May 2000, where the exchange rates have been relatively stable (and in fact fixed for the EMU countries since 1999). Recall that in section 2.5.2, we ranked Denmark as a generally very cheap country, followed by Greece and Finland as cheap countries. Moderately cheap countries were the Netherlands, Portugal and Spain. Austria, Belgium, France, Ireland, Italy, Luxembourg and Sweden were average countries. Germany was significantly above average. At the most expensive end one can find the United Kingdom. These findings appear in the first column of Table 14.

Reconsidering the country ranking by segment, one can see that the rankings with respect to price differentials frequently remain stable across segments. One main change in the ranking is found in the A/B segment, where Finland and the Netherlands no longer belong to the cheap categories, but are rather in line with the EU9 average. Another change in the ranking is found in the D/E segment, where Ireland no longer belongs to the EU9 average category, but rather to the moderately cheap category together with the Netherlands and Portugal. A further change in the ranking appeared in the E/F segment where all countries, except for Denmark and the United Kingdom, fall within a very close band of the EU9 average. And even these two countries are considerably closer to the average than they were in the other segments. As we discussed above, there are also other differences relative prices across segment, yet these are usually not of the amount to alter the price ranking across countries.

Another way to synthesize the evolution of the price indices by market segment is by comparing the magnitude of the systematic price differences. Consider the final two years, during which the exchange rates for most countries have been fixed, with the exception of Denmark, Greece, Sweden, and the United Kingdom. The most striking finding is that systematic price differentials across countries have been low in the luxury E/F segment. The price indices of the cars in the E/F segments have been within a range of 5 percent for almost all countries. The only exceptions are the United Kingdom and Denmark. Yet even the price level for E/F cars in the UK is relatively low in light of its high general car price index. Similarly, the price index for

E/F cars in Denmark is considerably closer to the EU9 average than its general price index. For the other segments, the price differentials have been in wider ranges. Even if one excludes Denmark and the United Kingdom, the price indices have been in the 15 percent range for segments A/B, C, and D.

Conclusions. The ranking of countries in terms of systematic price differentials frequently remain stable across segments. There are some exceptions, for example the Netherlands and Finland are comparatively more expensive in the A/B segments than elsewhere. Comparing the magnitude of the systematic price differentials, it turns out that these are comparatively lower in the E/F segments

2.5.4 Systematic price differentials by country of origin

Figure 17 to Figure 21 show the evolution of systematic price differentials for cars by country of origin: French cars (PSA and Renault); German cars (BMW, Mercedes and Volkswagen); Italian cars (Fiat); Ford and GME; and Japanese cars. Table 15 to Table 19 summarize these figures in table form.

See Figure 17 in chapter 4.

Table 15 Fisher indices, French cars by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		104,8	101,7	**101,4**
BE	101,9	99,5	95,5	**99,1**
DK	77,7	76,0	74,2	**77,0**
FI		75,6	95,6	**92,4**
FR	107,6	105,9	103,6	**102,2**
GE	105,1	99,6	101,1	**104,2**
GR	93,1	101,1	99,8	**88,0**
IR	97,2	97,7	102,6	**98,9**
IT	92,9	99,8	100,1	**98,1**
LU	102,0	99,5	95,5	**99,1**

NL	99,7	94,5	94,1	**92,2**
PO	89,1	87,3	89,0	**93,8**
SP	90,6	98,2	97,3	**92,6**
SW		103,0	104,2	**100,3**
UK	98,6	95,2	115,9	**118,1**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 18 in chapter 4.

Table 16 Fisher indices, German cars by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		104,4	99,9	**101,0**
BE	101,8	103,2	98,8	**99,5**
DK	88,4	86,1	82,4	**83,7**
FI		94,5	92,4	**90,6**
FR	102,3	100,9	99,1	**98,8**
GE	103,8	105,1	102,7	**102,8**
GR	97,3	101,7	96,8	**94,7**
IR	101,7	101,1	101,6	**95,3**
IT	93,5	92,6	99,9	**99,8**
LU	101,8	102,1	97,6	**99,5**
NL	100,1	100,2	92,9	**95,3**
PO	103,9	99,4	97,9	**99,7**
SP	97,5	98,1	96,6	**96,2**
SW		97,3	96,4	**97,7**
UK	99,6	96,9	113,0	**111,0**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 19 in chapter 4.

Table 17 Fisher indices, Italian cars by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000

AU		107,2	99,1	**100,6**
BE	102,6	99,2	97,2	**98,0**
DK	76,6	81,9	74,0	**76,4**
FI		93,6	86,7	**99,4**
FR	104,0	100,4	95,4	**98,0**
GE	106,5	109,7	103,3	**103,5**
GR	91,3	90,7	86,9	**83,5**
IR	96,3	88,5	92,2	**97,2**
IT	92,3	90,8	103,4	**101,2**
LU	102,1	99,2	97,2	**98,0**
NL	102,9	102,9	92,6	**95,0**
PO	89,7	90,5	92,4	**94,2**
SP	91,4	93,7	96,6	**93,9**
SW		99,7	103,2	**99,3**
UK	100,8	95,4	125,3	**128,8**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 20 in chapter 4.

Table 18 Fisher indices, Ford and GME by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		106,3	98,3	**103,1**
BE	101,8	95,8	92,0	**99,1**
DK	73,2	75,1	74,5	**77,6**
FI		105,6	106,7	**96,4**
FR	100,8	97,7	98,4	**98,1**
GE	109,3	109,1	106,6	**107,8**
GR	94,8	98,1	84,5	**88,8**
IR	93,6	92,7	100,9	**99,2**
IT	91,3	93,5	100,1	**97,1**
LU	101,8	95,7	92,0	**100,8**
NL	100,4	96,9	91,6	**94,6**
PO	95,3	91,4	88,1	**93,0**
SP	90,9	96,6	91,3	**89,5**
SW		97,9	102,9	**105,9**

UK	100,9	97,9	116,3	**119,8**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

See Figure 21 in chapter 4.

Table 19 Fisher indices, Japanese cars by market, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		100,5	99,4	**101,0**
BE	100,4	100,7	95,6	**98,9**
DK	69,8	71,9	70,4	**73,4**
FI		90,0	84,8	**86,2**
FR	102,4	101,7	98,4	**99,4**
GE	105,0	106,7	104,5	**105,7**
GR	104,3	94,2	90,7	**90,7**
IR	96,5	98,4	105,0	**102,0**
IT	95,0	91,9	98,2	**96,7**
LU	100,9	100,7	97,1	**99,6**
NL	96,7	95,7	93,4	**92,8**
PO	98,6	100,6	101,4	**99,5**
SP	93,6	97,3	96,0	**94,0**
SW		100,3	100,3	**101,9**
UK	99,6	96,2	120,5	**122,5**

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

Generally speaking, the evolution of price differentials is somewhat more volatile when considered at the level of country of origin. This may be partly the result of the more limited set of models considered at this level of detail. For example, for French cars there was no information for all countries during some periods. For this reason, some care should be taken in the comparisons by country of origin, and one should not focus too much on a particularly high or low price index during one period to generalize for all models coming from one country of origin. Several observations can be made.

French cars. French cars in Portugal, the Netherlands and Denmark appear to be somewhat cheaper relative to the general car price index in these countries. In contrast, France appears to be more expensive for French cars.

German cars. German cars appear to be comparatively cheaper in Germany and the UK. In contrast, they are relatively more expensive in Denmark, Greece and Portugal, in light of the low general car price index in these countries.

Italian cars. Italian cars appear to be comparatively cheaper in Germany, Ireland (though the difference declined) and especially in Denmark, where they are some 25-30 percent cheaper than the EU9 average, compared to the general price index for Denmark, which is 20 percent below the EU9 average. Italian cars appear to have been comparatively more expensive in Italy, at least after the lire recovered from its depreciation and stabilized since 1996.

Ford and GME. The European-based US firms Ford and GME have been comparatively less expensive in the Netherlands, Denmark, Portugal and Spain (during the past two years). They have been relatively more expensive in Germany (around 7-8 percent above the EU9 average versus a 5 percent premium for cars in general) and especially in Finland, where the price are above EU9 average, in contrast to the car price index in general.

Japanese cars. Japanese cars have been comparatively cheaper in the Netherlands, Finland and especially in Denmark, where the price discount is about 30 percent (compared to a general price discount for cars of 20 percent). Japanese cars are more expensive in Ireland and in Portugal, by around 5 percent relative to the general car price index.

As before, one may synthesize the tables and figures on the evolution of systematic price differences by country of origin by considering whether the ranking of the countries in terms of price levels differs across countries of origin. This gives the following picture, shown in Table 20.

Table 20 Ranking of countries according to systematic price differentials, by country of origin (1997-2000)

All origins	French cars	German cars	Italian cars	Ford+GME	Japanese cars
UK	UK	UK	UK	UK	UK
GE	FR	GE	GE	GE	GE
SW	GE	AU	IT	SW	IR
AU	SW	IT	SW	FI	SW
IT	AU	BE	AU	AU	PO
IR	IR	FR	BE	IR	AU
FR	IT	PO	LU	IT	FR
BE	BE	LU	FR	FR	LU
LU	LU	IR	SP	LU	IT
PO	SP	SW	IR	BE	BE
SP	FI	SP	NL	NL	SP
NL	GR	GR	PO	PO	NL
FI	NL	NL	FI	SP	GR
GR	PO	FI	GR	GR	FI
DK	DK	DK	DK	DK	DK

Note: ranking from most expensive to least expensive. Based on the average price indices during 1997-2000, given in Table 10 to Table 13.

As in Table 14, Table 20 focuses on the last 4 years where the exchange rates have been more stable. Denmark may be classified as a very cheap country for cars from all countries of origin, even though the prices for German cars in Denmark become somewhat closer to the prices in other cheap countries. Finland and Greece can be classified in the category of cheap countries for all countries of origin. The Netherlands, Portugal and Spain fall in the category of moderately cheap countries for most countries of origin. One exception is Ford/GME, for which Portugal and Spain can be classified in the category of cheap countries. Another exception is given by Japanese cars, for which Portugal is rather a country in line with EU9 average. Austria, Belgium, France, Ireland, Italy, Luxembourg and Sweden are the countries in line with EU9 average for cars from most countries of origin. Exceptions are the French cars in France, and the Italian cars in Italy, which are modestly above EU9 average. Germany belongs to the category of moderately more expensive cars than the EU9 average, with the exception of German cars, which appear to be in line with EU9 average. Finally, the UK may be classified as the most expensive country for cars from all countries of origin. Nevertheless, it is striking to see that the premium paid in the UK can differ substantially across origin. Especially Italian cars are sold at a high average premium in the UK (+28.8 percent on average); Ford/GME, French cars and

Japanese cars are sold at premium of about 20 percent; German cars are sold at a comparatively low premium in the UK (+11.1 percent).

Conclusions. The ranking of countries in terms of systematic price differentials remains relatively stable across countries of origin, though some changes occur. One example is given by the Japanese cars in Portugal, which are comparatively more expensive than cars from other origins sold in Portugal.

2.6 Adjustments for customer discounts and dealer margins

We follow two approaches to account for deviations between the transaction price and the RRP (or list price). First, we provide information on customer discounts. Second, we make use of gross dealer margins. As discussed in section 2.3.2, dealer margins are a reliable way to indirectly estimate the potential deviation between the RRP and the transaction price paid by the customers. Furthermore, they allow us to investigate (unexploited) arbitrage opportunities from the perspective of the dealer rather than the customer.

2.6.1 Customer discounts

Data on the customer discounts granted by dealers are obtained from two sources. The first source is the Promocar's mystery shopping survey, as reported in MMC (1999). The mystery shoppers visited car dealers in four countries (UK, Germany, Italy and Spain). They repeated this monthly exercise for the first five months of 1999 for seven brands (Citroen, Fiat, Ford, Nissan, Vauxhall/Opel and Volkswagen). The results are shown in Table 21. Generally speaking, there is no substantial variation in the average discounts across countries. The weighted average discounts are generally the lowest in the UK, and the highest in Spain. In the small segments there is some variation in the average discounts with a 9.6% average for Spain compared to a 3.6% average for Germany. The differences for the lower medium segment are lower but go in the same direction. For the medium segment the highest average discount is in Germany and the lowest in the UK.

Table 21 Average customer discounts from PROMOCAR study, Jan. to May 1999

	UK	Germany	Italy	Spain
Small	3.8	3.6	4.3	9.6
Lower medium	2.4	4.7	3.4	5.3
Medium	1.5	5.6	5.1	4.4
Weighted average	2.7	4.6	4.1	6.6

Source: Table 7.14 by the MMC(1999)

A second source of customer discounts is the questionnaire by the EU Commission on dealer remuneration and distribution costs, directed to all manufacturers, as described in section 2.1.2. One question inquired about the (average) customer discounts granted by dealers. The results of this question may be summarized as follows. Several manufacturers reported to have *no information* on this issue. Some manufacturers mentioned that this is because they only have general dealer profitability statistics at their disposal; others stated that they do not monitor the pricing strategies by their dealers. Some manufacturers obtained insight into consumer discounts for a *limited number of countries*. These data were mainly obtained from external sources, or were taken from the manufacturer's local market; some manufacturers gathered information via their importers.

Table 22 Average customer discounts from Commission Questionnaire, 1999

Belgium	France	Germany	Italy	Netherlands	Portugal	Spain	UK
9,3	8,2	9,2	10,4	7,5	7,1	9,3	7,6

Source: own computations based on European Commission's questionnaire

Table 22 summarizes information from the Commission's questionnaire. Unweighted average customer discounts are reported, limited to the countries for which there was information from at least six suppliers. Eight countries fulfilled this criterion. A comparison between Table 21 and Table 22 shows that the average customer discounts estimated in the Promocar study are lower than the discounts for the same four countries in the Commission's questionnaire. The questionnaire still indicates that the United Kingdom has the lowest average discounts. In contrast, Spain no longer appears to have the highest discounts among the four countries in the Promocar study.

Generally speaking, Table 22 is consistent with the results from the Promocar study in that the average discounts do not differ substantially across countries. The average discount differential range between countries is 3.3%, with the lowest number for Portugal (7.1%) and the highest number for Italy (10.4%).

2.6.2 Dealer margins

Dealers purchase new cars from their suppliers at the recommended list price, reduced by a percentage gross dealer margin, which differs by brand, model, and Member State. This margin gives a leeway to the dealer to grant discounts and other financial benefits to customers.

One question in the questionnaire by the European Commission to the manufacturers inquired about the dealer remuneration policies. This can shed light on the dealer's ability to give discounts and other financial benefits. Specifically, for the models in the Commission's car price report the manufacturers were asked to provide information for 1993, 1996 and 1999 on the gross dealer margin, expressed as a percentage of the pre-tax recommended retail price. Most of the manufacturers were able to provide this information. The results are summarized in Table 23 as unweighted averages. For confidentiality reasons we do not report the margins at a greater level of detail.

Table 23 Average gross dealer margins

Country/Year	1993	1996	1999
Austria	18,1	17,8	17,4
Belgium	17,2	15,4	14,9
Denmark	8,1	6,4	8,7
Finland	16,1	15,1	14,6
France	16,8	16,6	14,9
Germany	18,9	18,9	16,7
Greece	7,3	8,3	10,2
Ireland	18,7	16,4	16,1
Italy	17,7	16,6	15,7
Luxembourg	14,7	14,4	14,0
Netherlands	18,0	17,2	16,3

Portugal	15,1	15,1	14,3
Spain	15,8	14,4	13,9
Sweden	14,1	14,3	14,5
UK	17,4	13,5	12,7

Note: unweighted average; information available for most models.

Most countries show gross dealer margins above 10%. In 1993 and 1996, the dealer margins typically varied between 14% and 19% across countries; in 1999 they varied between 13% and 17%. Two notable exceptions are Denmark and Greece, where the average dealer margins are mostly below 10%.

The magnitude of the gross dealer margins in Table 23 indicates the potential for offering discounts and/or financial benefits to customers. Furthermore, this potential appears to differ in a non-negligible way across countries. We therefore redo our analysis of price dispersion by adjusting the RRP for the gross dealer margin. The results are displayed in Table 24. In comparison with the unadjusted analysis in Table 4, there are less data: information is available for most models, but only for fewer periods. The total number of model observations over the studied period is 242, compared to 826 in Table 4. To make a consistent comparison, we also present the unadjusted price dispersion using the reduced data. An alternative solution would have been to increase the number of model observations by assuming that the gross dealer margins in the missing periods are equal to the dealer margins in adjacent period. The results are similar when we followed this approach.

Table 24 Summary statistics for alternative measures of price dispersion – unadjusted and margin-adjusted

		Period	Average	Standard deviation	Minimum	Maximum
Unadjusted	Price diff. Range -- incl. all countries	1996	30,7	12,2	7,3	62,1
		1999	33,4	13,3	8,4	65,4
	Price diff. Range -- excl. most exp. and cheapest country	1996	15,3	6,5	2,2	32,1
		1999	15,5	6,2	2,1	41,9
	Coefficient of variation	1996	8,5	2,8	2,7	14,9
		1999	9,0	3,1	2,3	17,3

Margin-adjusted	Price diff. Range -- incl. all countries	1996	27,0	10,6	7,4	56,0
		1999	33,0	11,7	9,0	68,1
	Price diff. Range -- excl. most exp. and cheapest country	1996	14,6	6,1	3,9	30,3
		1999	15,0	5,6	4,1	38,6
	Coefficient of variation	1996	7,6	2,3	2,7	13,6
		1999	8,9	2,7	2,7	16,1

Note: Total number of models during 1995-2000 is 242. All measures are expressed in percentage of the average model price.

The top part in Table 24 shows that the reduced data set produces somewhat lower unadjusted price dispersion measures than obtained before from the full data set in Table 4. Nevertheless, the results for the full and the reduced data set are of a similar order of magnitude.

The bottom part in Table 24 shows the margin-adjusted price dispersion measures. A comparison between the top and bottom parts of Table 24 shows that the measures of price dispersion remain relatively robust. Most averages for the three price dispersion measures drop by less than 1 percent. The only exception is the first measure of price dispersion, the maximum price differential range, in 1996. This measure drops by 3.7 percent points to 27 percent in 1996 when one adjusts for the gross dealer margin. Yet even this drop is small compared to the unadjusted dispersion level of 30.7 percent.

In principle, one could also redo the analysis on systematic price differentials. In practice, this is difficult since our Fisher indices are based on a common basket, and there are too few models with available data for all countries to construct a representative basket. Nevertheless, the dealer margins in Table 23 show how the results will be affected, since they refer to country averages. Among the relatively expensive countries, Germany becomes closer to the EU average if one adjusts by subtracting the average dealer margin. Yet the opposite would be true for the United Kingdom, which would become even more expensive on average after subtracting the dealer margin. Among the inexpensive countries, one can see that Denmark becomes closer to the EU average after subtracting the dealer margins. In contrast, the Netherlands, which is also inexpensive, becomes even less expensive after subtracting the dealer margins. There thus seem no strong indications that the results based on the

RRP are biased towards too large systematic price differentials if one does not adjust for dealer margins.

2.6.3 Local distribution costs

Local distribution costs are the costs incurred in the country of sale. The Commission questionnaire inquired about the sources and the magnitude of the local distribution costs. The manufacturers mentioned the following sources of local costs:

- pre-delivery inspection;
- transport from the factory to the dealer or from the importer to the dealer;
- marketing and advertising of vehicles parts and accessories;
- personnel and management of the dealer;
- inventory;
- recruitment and training of staff;
- administration of policy and warranty;
- administration of recall and rework campaigns;
- information systems;
- import duty and port handling;
- insurance, warranty, etc…

There is quite a lot of variation in the reported figures for the magnitude of the local distribution costs across companies. This may follow to a large extent from the different categories that are adopted in the definitions by the manufacturers. There is also a lot of variation in the reported local costs across countries, but there do not appear to be systematic differences across countries. Generally speaking, the reported local costs are in the range of 10-25 percent of the recommended retail price. Yet some companies reported figures below 5 percent or above 40 percent for specific countries.

Because the reported local costs in the Commission questionnaire are based on different definitions adopted by the companies, and because there is no immediate

evidence that local costs differ systematically across countries, we have not directly adjusted car prices for cross-country differences in local distribution costs. However, in section 2.7 we account indirectly for differences in local costs by adjusting for fluctuations in exchange rates. Indeed, the presence of local costs justifies an adjustment based on a higher pass-through rate for exchange rates than for taxes, which is also consistent with econometric evidence.

Conclusions. Any car price analysis involves the difficulty of obtaining a reliable measure of actual transaction prices at which purchases are made. We have obtained information on customer discounts and gross dealer margins to study how the results on price dispersion and systematic price differentials may be affected. We find that an adjustment for discounts or dealer margins has only a very small effect. They slightly reduce the average price dispersion, by less than 1 percent point. They also may affect the systematic price differentials, but not necessarily in the direction of lowering the price level in the expensive countries and increasing the price level in the inexpensive countries. The analysis based on the RRP in sections 2.4 and 2.5 thus provides reliable information on international price dispersion and systematic price differentials. In the next sections we thus continue the analysis based on the RRP, since this provides the most complete data set. The caveat is of course that the actual results may slightly differ if discount or margin adjustments would be adopted.

2.7 Adjustments for taxes and exchange rates

2.7.1 Methodology

The analysis in sections 2.4 and 2.5 is based on the pre-tax common currency (ECU/Euro) price p_j^m for each model *j* sold in market *m*. In the present section we adjust the prices for taxes and exchange rates, based on assumptions about the degree of tax and exchange rate pass-through by the companies. As we explained in section 2.3, a price analysis adjusted for taxes and exchange rates provides useful additional information. It allows one to conduct a counterfactual analysis and ask how prices would approximately be if taxes were harmonized or exchange rates fully stabilized.[43]

[43] Note that the adjustments provide only approximate answers to the counterfactual analysis on exchange rate stabilization and tax harmonization. For a more complete analysis, it would be necessary

2.7.1.1 Adjustment for taxes

Consider first the adjustment for taxes. As discussed in subsection 2.7.1, our goal is here to measure prices if taxes had been harmonized across countries, taking into account the companies' tax pass-through rate. Denote the tax pass-through rate for a model *j* in a market *m* by β_j^m. For example, if taxes are passed through completely onto consumer prices, then the pass-through rate $\beta_j^m = 1$. In contrast, if taxes are not passed through at all, i.e. manufacturers keep post-tax prices constant when taxes change, then the pass-through rate $\beta_j^m = 0$. More generally, the pass-through rate may lie between zero and one.[44] We define the tax-adjusted price p_j^{Tm} by the following formula:

$$p_j^{Tm} = p_j^m (1+\tau_j^m)^{1-\beta_j^m}. \qquad (2)$$

To understand the intuition behind this formula, consider two examples. First, if there is full tax pass-through, i.e. $\beta_j^m = 1$, then the companies follow a policy of keeping pre-tax prices fixed, i.e. independent of the level of taxes. Consequently, under full tax pass-through no tax adjustment should be made to predict the pre-tax price if taxes were harmonized across countries. We thus have a tax-adjusted price equal to the tax unadjusted price: $p_j^{Tm} = p_j^m$.

Second, if there is no tax pass-through, i.e. $\beta_j^m = 0$, then the companies follow a policy of keeping post-tax prices fixed, independent of the level of taxes. Consequently, in the absence of tax pass-through a full tax adjustment should made to predict the pre-tax price if taxes were harmonized internationally. We then have a tax-adjusted price equal to the post-tax price: $p_j^{Tm} = p_j^m (1+\tau_j^m)$.[45]

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to estimate a structural model of pricing in response to taxes and exchange rates, e.g. in the spirit of Goldberg and Verboven (2000).

[44] Economic theory does not exclude the possibility that the pass-through rate is greater than one, e.g. if the marginal cost of the companies is declining sufficiently with output. In practice, pass-through rates greater than one are unusual.

[45] The formula implicitly considers the case of a tax harmonization to a zero level. More realistically, we could easily have written a formula for a tax harmonization to a level in the 20-30 percent range. For

More generally, for incomplete pass-through, we use formula (2) for adjusting the price to a level that would prevail if taxes were harmonized. To apply (2) one needs to know the pass-through rate β_j^m. To achieve this, we first estimated the following simple pass-through regression model:

$$\ln(p_j^m) = \alpha - (1-\beta)\ln(1+\tau_j^m) + u_j^m \qquad (3)$$

where u_j^m is the disturbance term. This specification implies that $\beta_j^m = \beta$, i.e. the pass-through rate is constant. We found an estimate of $\beta = 0.825$.[46] The tax pass-through rate is thus 82.5 percent, saying that the companies pass through a tax increase by, say 10 percent, by increasing consumer prices by only 8.25 percent. Tax pass-through is thus incomplete. This is in line with the estimates obtained by Bouckaert and Verboven (2000) for a more limited set of car models. We next considered the following more flexible regression model:

$$\ln(p_j^m) = \alpha - \left(1 - \beta_1 - \frac{\beta_2}{2}\ln(1+\tau_j^m)\right)\ln(1+\tau_j^m) + u_j^m . \qquad (4)$$

This specification implies that $\beta_j^m = \beta_1 + \beta_2 \ln(1+\tau_j^m)$, i.e. the pass-through rate may vary with the tax rate. We found an estimate of $\beta_j^m = 0.936 - 0.218\ln(1+\tau_j^m)$.[47] This means that the tax pass-through rate becomes lower as the tax rate increases. For example, if the tax rate is 22 percent (as is approximately the case in Belgium, France and Italy) then the pass-through rate is 89.3 percent. If the tax rate is 176 percent (as approximately in Denmark), then the pass-through rate is only 71.4 percent. In our analysis below, we use the pass-through rate given by $\beta_j^m = 0.936 - 0.218\ln(1+\tau_j^m)$ to

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our purposes, this makes little difference since we are only interested in relative price differences between countries.

[46] The standard error for the estimated coefficient was 0.020.

[47] The standard errors for the estimated coefficients were, respectively, 0.072 and 0.135.

calculate tax-adjusted prices according to (2). The results are nevertheless robust whether the constant or varying pass-through rate is used.[48]

2.7.1.2 Adjustment for exchange rates

Now consider the adjustment for exchange rates. Our goal is again as discussed in subsection 2.7.1, namely to measure prices if exchange rates had remained stable, taking the fact that the companies may have passed through exchange rate changes incompletely. Analogous to the discussion above, denote the exchange rate pass-through rate for a model *j* in a market *m* by γ_j^m. The pass-through rate lies typically (though not necessarily) between zero and one, with complete exchange rate pass-through if $\gamma_j^m = 1$, and no exchange rate pass-through, or local currency price stability, if $\gamma_j^m = 0$. We define the exchange rate-adjusted price p_j^{Em} by the following formula:

$$p_j^{Em} = p_j^m \left(\frac{\bar{e}^m}{e^m} \right)^{1-\gamma_j^m} \tag{5}$$

where e^m is the contemporaneous exchange rate of market *m*, i.e. units of ECU/Euro per unit of *m* 's currency; and $\bar{e}^m$ is a reference exchange rate measure for market *m*. The term $\bar{e}^m / e^m$ thus measures the extent to which the exchange rate of market *m* is undervalued or overvalued, relative to the reference exchange rate $\bar{e}^m$. An appreciation of *m* 's currency (an increase of e^m) can thus be viewed as analogous to a reduction in taxes: the companies receive a higher ECU/Euro amount for the price charged to consumers in market *m*. Similarly, a depreciation of *m* 's currency (a decrease of e^m) can be viewed as analogous to a increase in taxes.

To understand the intuition behind formula (5), consider the companies' behavior in response to exchange rate fluctuations. If exchange rate pass-through is complete, i.e. $\gamma_j^m = 1$, then the companies follow a policy of keeping prices fixed in ECU/Euro. No

[48] Note that the standard errors of the estimated coefficients imply that a constant tax-through rate cannot be rejected. We chose for the more flexible decreasing pass-through rate specification, because the non-rejection of the constant specification is only marginal; because the decreasing pass-through specification provides a better fit of the data, and because it is more intuitive.

adjustment for exchange rates should then be made to predict the ECU/Euro price if exchange rates would be stabilized, so that $p_j^{Em} = p_j^m$. In contrast, if there is no exchange rate pass-through, $\gamma_j^m = 0$, then the companies follow a policy of keeping prices constant in the local prices (in market *m* 's currency). In this case, one would need to adjust the ECU/Euro price fully for the extent to which the exchange rate is undervalued or overvalued relative to the reference exchange rate $\bar{e}^m$. We then have an exchange rate-adjusted price $p_j^{Em} = p_j^m(\bar{e}^m / e^m)$. More generally, if exchange rate pass-through is incomplete, with γ_j^m somewhere between zero and one, then formula (5) is used to adjust prices to the level that would obtain if the exchange rates were stabilized to the reference level $\bar{e}^m$.

To apply equation (5), one needs to know the exchange rate pass-through rate γ_j^m and the reference exchange rate level $\bar{e}^m$. In chapter 1 we discussed the large literature on exchange rate pass-through. We concluded that exchange rate pass-through in the car market is typically incomplete. In fact, most estimates in the literature indicate that the pass-through of exchange rates is considerably lower than the pass-through of taxes.[49] The estimates vary between 30 percent and 70 percent, depending on the car model and the time horizon being adopted. For simplicity, we conduct our analysis here based on the assumption that the pass-through of exchange rates is 50 percent, i.e. $\gamma_j^m = 0.5$. This assumption means that an exporter whose currency appreciates by 10 percent would only raise the local consumer price (in the country of destination) by 5 percent (and vice versa for a depreciation). The results for other assumptions on the pass-through coefficient (available on request) do not provide main additional insights.[50]

[49] As we discussed above, this is because incomplete exchange rate pass-through may also follow from the presence of local costs, amounting to about 30 percent.

[50] To keep the adjustment methodology as transparent as possible, we chose to adopt a simple approach, applying nominal exchange rates relative to the ECU/Euro. Note that several extensions could be made. First, one may use the real exchange rate, i.e. the exchange rate corrected for inflation differences, instead of the nominal exchange rate. We have worked with both measures and obtained virtually identical results, with only for Greece some differences (since the inflation in that country was not in line with the EU average). Second, there are good economic reasons to replace our measure of the exchange rate of market *m* relative to the ECU/Euro by the exchange rate of market *m* relative to the country where the car is produced. Nevertheless, if cars make use of parts coming from several countries throughout the European Union, the exchange rate of market *m* relative to the ECU/Euro may be a reasonable measure for adjustment.

Regarding the reference exchange rate to be used, $\bar{e}^m$, several choices can be made. One approach is to take the exchange rate at January 1st, 1999, when the exchange rates for the members of the EMU became fixed. One then interprets the adjusted prices as the prices that would have obtained if the exchange rates for all countries (including the non-EMU countries) had been fixed at the January 1st, 1999 levels for the whole period. An alternative approach is to take as a reference the average exchange rate over the period of our study, 1993-2000. One then interprets the adjusted prices as the prices that would have obtained if the exchange rates had been stable throughout the period 1993-2000 at their average level. We will report the results for the second approach, yet we will also refer in the text to the results from the first approach whenever they differ.[51]

Conclusions. An adjustment for taxes and exchange rates enables one to ask how price dispersion and systematic price differentials would approximately be if taxes would be harmonized or if exchange rates would be stabilized for all countries. The methodology requires making assumptions about the companies' tax and exchange rate pass-through rate, which measures the extent to which a cost change is passed onto the consumer prices. Consistent with theoretical considerations and empirical evidence, we assume a larger pass-through rate for taxes (around 80 percent) than for exchange rates (50 percent).

2.7.2 International price dispersion

We begin with an analysis of international price dispersion after correcting for taxes and exchange rates. This subsection is thus parallel to the analysis on international price dispersion in section 2.4, where we did not adjust for taxes and exchange rates.

2.7.2.1 Adjustment for taxes

For space reasons, we do not present the plots and histograms on price dispersion and the distribution of price dispersion, as we did for the unadjusted prices in Figure 6 to

[51] Note that the MMC (1999) study also made use of the period average exchange rate in part of its price comparisons. Using our adjustment formula (5), one can explicitly evaluate the approach by the

Figure 11. We limit attention to summary statistics for these results in Table 25. This table has an analogous interpretation as Table 4, which did not adjust prices for taxes.

Table 25 Summary statistics for alternative measures of price dispersion. Adjusted for taxes

	Period	Average	Standard deviation	Minimum	Maximum
Price differential range – including all countries	1995-96	26,9	11,0	11,3	79,7
	1997-98	32,0	11,9	10,8	87,8
	1999-00	31,1	10,1	11,4	60,3
Price differential range – excluding most expensive and cheapest country	1995-96	17,5	5,9	4,4	50,7
	1997-98	18,3	6,5	5,4	42,5
	1999-00	16,7	5,4	6,1	37,5
Coefficient of variation	1995-96	7,9	2,8	3,1	23,7
	1997-98	8,8	3,0	3,6	24,5
	1999-00	8,2	2,5	3,3	18,0

Note: all measures are expressed in percentage of the average model price.

First consider the tax-adjusted price differential ranges across all countries, as found in the first three rows of Table 25. These price differential ranges have on average been 26.9 percent in 1995-96, 32.0 percent in 1997-98 and 31.1 percent 1999-00. This is lower than the averages found in Table 4, which were 32.9 percent, 38.9 percent and 38.8 percent, respectively. At the same time, one can see that the standard deviations for the price differential ranges are between about 10 and 11 percent. Furthermore, the price differential ranges have been at least around 11 percent. They have been at most 79.7 percent in 1993-94, 87.8 percent in 1995-96 and 60.3 percent in 1999-00. From these findings one can draw two conclusions regarding the approximate effects of a possible tax harmonization:[52]

MMC. More specifically, in our framework one can verify that the MMC can be justified only if the pass-through rate would be zero.

[52] Recall that the effects are approximate, since no full structural model of tax pass-through is estimated. Recall also that the tax harmonization refers to a zero tax level, yet the results from an experiment to other levels (e.g. in the 20-30 percent range) would be very similar since we look only at relative prices. See footnotes 43 and 45.

(1) Under the assumed tax pass-through rate discussed in section 2.7.1.1, the price differential ranges would decline on average by around 6-8 percent points if a tax harmonization took place.

(2) There would still be a comparable variation in the price differential ranges across car models, with both cases of very low price differential ranges and rather high ranges.

Now consider the price differential ranges across countries, excluding the cheapest and the most expensive countries. One can see that the price differential ranges also decline on average, compared to Table 4, where no tax adjustments were made. Yet the decline is less pronounced as for our first measure of price dispersion. This follows from the fact that our second measure excludes the country with the lowest pre-tax price, which is typically a high tax country, and the country with the highest pre-tax price, which is typically a low tax country. At the same time, the standard deviations, the minima and the maxima indicate that there is still a lot of variation across models after adjusting for taxes. Similar observations can be made regarding the third measure of price dispersion, the coefficient of variation.

Table 26 The cheapest and the second cheapest countries – Number of counted models and price differential ranges. Adjusted for taxes

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
GR	Cheapest	**155**	0	11	**37**	35	10	6
	Second	**86**	0	27	**33**	28	10	2
IT	Cheapest	**130**	0	18	**58**	18	2	5
	Second	**93**	0	12	**53**	19	14	2
SP	Cheapest	**104**	0	13	**45**	29	11	2
	Second	**104**	0	16	**45**	26	7	6
LU	Cheapest	**64**	0	22	28	**30**	6	14
	Second	**102**	0	21	**33**	28	13	5
DK	Cheapest	**69**	0	22	32	**33**	12	1
	Second	**56**	0	7	**48**	23	11	11
NL	Cheapest	**45**	0	20	**47**	22	7	4

	Second	**70**	0	24	**41**	17	11	6
FI	Cheapest	**69**	0	9	**52**	23	13	3
	Second	**37**	0	24	27	**43**	5	0
SW	Cheapest	**44**	0	18	**39**	30	5	9
	Second	**56**	0	13	**48**	29	4	7
UK	Cheapest	**44**	0	16	**39**	20	16	9
	Second	**44**	0	9	**57**	25	2	7
BE	Cheapest	**16**	0	6	**31**	25	25	13
	Second	**65**	0	18	**37**	29	6	9
FR	Cheapest	**26**	0	12	**50**	15	15	8
	Second	**34**	0	9	**44**	29	9	9
PO	Cheapest	**23**	0	**48**	39	4	9	0
	Second	**31**	0	16	**42**	16	16	10
IR	Cheapest	**12**	0	**67**	25	8	0	0
	Second	**23**	0	17	**61**	13	4	4
GE	Cheapest	**16**	0	19	**31**	19	19	13
	Second	**13**	0	31	23	**46**	0	0
AU	Cheapest	**9**	0	**44**	**44**	11	0	0
	Second	**12**	0	17	**50**	17	8	8

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are cheapest. Bold numbers indicate the price differential range with the highest frequency

Table 26 shows the number of counted models for which the various countries are the cheapest or the second cheapest, after adjusting for taxes. The most notable finding is that Denmark would no longer be the cheapest or the second cheapest country for the majority of the models as in Table 7 (although it would still be the cheapest country for many models). Instead, Greece, Italy, Spain and Luxemburg appear to become cheap countries for many models if one adjusts for the differences in taxation rates across countries. Portugal and Ireland now show few models for which prices are the lowest, in contrast to the analysis in Table 7, where we did not adjust for the fact that they have relatively high taxes.

Table 27 The most expensive and the second most expensive countries – Number of counted models and corresponding price differential ranges. Adjusted for taxes

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
UK	Most exp.	**296**	0	6	36	**41**	14	3
	Second	**100**	0	15	**51**	16	3	15
IR	Most exp.	**43**	0	21	**58**	21	0	0
	Second	**138**	0	8	37	**40**	11	4
GE	Most exp.	**56**	0	**50**	39	11	0	0
	Second	**123**	0	23	**43**	24	8	2
AU	Most exp.	**53**	0	19	**72**	8	2	0
	Second	**87**	0	25	**44**	24	5	2
DK	Most exp.	**90**	0	7	**40**	33	11	9
	Second	**48**	0	17	23	**25**	23	13
PO	Most exp.	**52**	0	27	**54**	17	2	0
	Second	**80**	0	16	**45**	28	9	3
FI	Most exp.	**84**	0	4	26	20	23	**27**
	Second	**47**	0	4	**43**	30	17	6
FR	Most exp.	**55**	0	**51**	42	7	0	0
	Second	**39**	0	**41**	**41**	15	3	0
GR	Most exp.	**47**	0	15	**47**	19	4	15
	Second	**35**	0	9	**34**	29	14	14
SW	Most exp.	**15**	0	27	**60**	13	0	0
	Second	**37**	0	16	**38**	24	16	5
NL	Most exp.	**14**	0	36	**57**	7	0	0
	Second	**31**	0	26	**58**	10	0	6
BE	Most exp.	**9**	0	**56**	44	0	0	0
	Second	**29**	0	14	**59**	28	0	0
IT	Most exp.	**10**	0	**50**	**50**	0	0	0
	Second	**19**	0	16	**37**	26	21	0
SP	Most exp.	**2**	0	0	**100**	0	0	0
	Second	**9**	0	33	**56**	11	0	0
LU	Most exp.							
	Second	**4**	0	25	**50**	0	25	0

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are the most expensive. Bold numbers indicate the price differential range with the highest frequency.

Table 27 shows the number of counted models for which the various countries are the most expensive, or the second most expensive, after adjusting for taxes. Denmark,

Ireland and Portugal now become countries that show many models that are the most or the second most expensive, compared to the tax-unadjusted results in Table 8. The Netherlands also has a more significant number of models for which it is the highest or second highest priced. The number of models for which Germany is the most or the second most expensive drops by almost 50 percent, after one adjusts for its low tax regime (although it still maintains a high number of expensive models).

2.7.2.2 Adjustment for exchange rates

For space reasons, we again do not present the plots and histograms on price dispersion after correcting for exchange rates. Instead we summarize the results on the distribution of price dispersion in Table 28.

Table 28 Summary statistics for alternative measures of price dispersion. Adjusted for exchange rates

	Period	Average	Standard deviation	Minimum	Maximum
Price differential range – including all countries	1995-96	32,4	11,4	8,2	89,3
	1997-98	35,7	13,3	8,4	76,4
	1999-00	33,1	11,0	5,7	67,2
Price differential range – excluding most expensive and cheapest country	1995-96	18,4	6,4	4,2	40,9
	1997-98	20,0	7,9	4,2	43,7
	1999-00	18,4	6,1	4,5	41,8
Coefficient of variation	1995-96	8,9	2,6	3,0	20,4
	1997-98	9,4	3,0	2,7	20,8
	1999-00	8,6	2,5	1,8	15,2

Note: all measures are expressed in percentage of the average model price.

A comparison with Table 4 shows that the summary statistics usually do not vary much when an adjustment for exchange rates is made. Only for the period 1999-2000 some notable differences occur. In particular, the price differential range across all countries declines from on average 38.8 percent without adjusting for exchange rates to 33.1 percent after adjusting for exchange rates. This is mainly due to the fact that the pound appreciated considerably over that period. Consequently, stabilizing the

exchange rate of the pound to our reference exchange rate level, namely the average over 1993-2000, would lead to lower prices under our assumption that exchange rate pass-through is incomplete. Note that when we applied the alternative reference exchange rate, namely the exchange rate at the start of the EMU on January 1st, 1999, then the average price differential range would be comparable to Table 4, even for the period 1999-2000. This is because the pound had already appreciated by that time.

Table 29 The cheapest and the second cheapest countries – Number of counted models and price differential ranges. Adjusted for exchange rates

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
DK	Cheapest	**510**	0	4	16	**37**	30	13
	Second	**62**	2	10	19	**47**	15	8
FI	Cheapest	**48**	2	2	19	**56**	17	4
	Second	**194**	0	5	14	**35**	30	15
NL	Cheapest	**57**	0	32	**51**	12	4	2
	Second	**91**	0	18	**27**	19	29	8
GR	Cheapest	**30**	0	20	30	**33**	10	7
	Second	**116**	0	3	27	**37**	25	9
PO	Cheapest	**50**	0	18	**70**	12	0	0
	Second	**47**	0	13	**34**	32	9	13
SP	Cheapest	**29**	0	31	**55**	14	0	0
	Second	**59**	2	5	**41**	32	17	3
IT	Cheapest	**23**	0	30	**43**	22	0	4
	Second	**57**	0	19	**37**	35	7	2
IR	Cheapest	**21**	0	**57**	29	14	0	0
	Second	**50**	4	16	**32**	26	12	10
LU	Cheapest	**5**	0	**80**	0	0	0	20
	Second	**43**	2	35	**37**	14	9	2
SW	Cheapest	**11**	18	**36**	18	9	0	18
	Second	**33**	0	9	21	**36**	18	15
BE	Cheapest	**7**	0	**43**	29	29	0	0
	Second	**22**	9	18	18	**27**	18	9
AU	Cheapest	**7**	0	**71**	14	0	0	14
	Second	**18**	0	**39**	17	17	28	0

UK	Cheapest	**11**	9	**36**	**36**	9	9	0
	Second	**13**	0	**62**	23	8	0	8
FR	Cheapest	**9**	0	11	**33**	**33**	11	11
	Second	**14**	0	7	29	**36**	14	14
GE	Cheapest	**8**	**50**	38	0	0	0	13
	Second	**7**	29	**43**	14	0	14	0

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are cheapest or second cheapest. Bold numbers indicate the price differential range with the highest frequency.

Table 29 shows the number of counted models for which the various countries would have been the cheapest and the second cheapest after adjusting for exchange rates. There are not many strong differences relative to Table 7. The United Kingdom is the cheapest country for a lower number of cases if one adjusts for exchange rates using the 1993-2000 average as the reference exchange rate. This is because the cases where the UK appeared the cheapest before adjusting for exchange rates (Table 7) occurred mainly during 1995-1998, when the pound was undervalued relative to our reference exchange rate. A similar (though less pronounced) phenomenon holds for Italy.

Table 30 The most expensive and the second most expensive countries – Number of counted models and corresponding price differential ranges. Adjusted for exchange rates

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
UK	Most exp.	**336**	0	7	19	**32**	29	13
	Second	**106**	0	9	27	**35**	17	11
GE	Most exp.	**112**	0	11	31	**45**	13	0
	Second	**218**	0	8	22	**33**	28	9
AU	Most exp.	**51**	2	18	**33**	29	18	0
	Second	**103**	1	8	26	**33**	25	7
FR	Most exp.	**77**	0	18	**43**	26	10	3
	Second	**75**	1	17	**32**	**32**	15	3
GR	Most exp.	**78**	5	**31**	19	18	13	14
	Second	**34**	0	**29**	26	21	21	3
PO	Most exp.	**35**	6	17	31	23	23	0
	Second	**48**	6	**23**	17	19	25	10

IR	Most exp.	**20**	0	10	**45**	**45**	0	0
	Second	**63**	0	13	19	**37**	16	16
FI	Most exp.	**62**	0	6	18	**26**	19	31
	Second	**13**	0	15	15	15	**31**	23
IT	Most exp.	**19**	0	26	16	21	**37**	0
	Second	**41**	0	15	**46**	20	2	17
SW	Most exp.	**18**	0	0	39	**50**	11	0
	Second	**34**	0	15	24	**35**	21	6
BE	Most exp.	**4**	0	25	25	**50**	0	0
	Second	**37**	3	22	27	**30**	14	5
SP	Most exp.	**5**	20	20	**40**	20	0	0
	Second	**28**	11	4	18	**36**	11	21
NL	Most exp.	**4**	25	**50**	0	25	0	0
	Second	**10**	0	10	**60**	20	10	0
DK	Most exp.	**3**	0	0	**67**	33	0	0
	Second	**8**	0	25	**50**	13	13	0
LU	Most exp.	**2**	0	0	0	0	**100**	0
	Second	**8**	0	13	0	**50**	25	13

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are the most expensive and the second most expensive. Bold numbers indicate the price differential range with the highest frequency.

Table 30 shows the number of counted models for which the various countries would have been the most expensive and the second most expensive after adjusting for exchange rates. The United Kingdom still appears to be the most or the second most expensive country for most of the models. Although the number of counted models for which the United Kingdom is the most expensive declines compared to Table 8 (which is unadjusted for exchange rates), the number of models for which the UK is the second most expensive rises. The result is only a slight overall decline for expensive models in the UK. Greece and Portugal are countries that show relatively more models that are expensive after one adjusts for exchange rate fluctuations, whereas Finland and Ireland show relatively fewer models.

2.7.2.3 Adjustment for both taxes and exchange rates

Exchange rates are now in fact stabilized for the EMU countries, while also the other countries show relative exchange rate stability. For completeness, it may therefore be instructive to also consider price dispersion after adjusting for both exchange rates and

taxes. This is done in Table 31 to Table 33. The economic interpretation of the findings straightforwardly extends the discussion in section 2.7.2.1 and 2.7.2.2.

Table 31 Summary statistics for alternative measures of price dispersion. Adjusted for taxes and exchange rates

	Period	Average	Standard deviation	Minimum	Maximum
Price differential range – including all countries	1995-96	25,3	10,2	9,6	77,2
	1997-98	29,1	11,5	10,3	88,4
	1999-00	25,8	9,9	9,8	64,3
Price differential range – excluding most expensive and cheapest country	1995-96	16,1	5,5	4,9	48,4
	1997-98	16,8	5,9	4,2	37,0
	1999-00	15,2	4,5	5,8	29,6
Coefficient of variation	1995-96	7,4	2,6	3,5	23,0
	1997-98	8,0	2,9	3,1	23,7
	1999-00	7,0	2,4	2,7	17,1

Note: all measures are expressed in percentage of the average model price.

Table 32 The cheapest and the second cheapest countries – Number of counted models and price differential ranges. Adjusted for taxes and exchanges

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
GR	Cheapest	**129**	1	22	**49**	19	7	3
	Second	**84**	0	33	**37**	25	5	0
IT	Cheapest	**108**	0	27	**54**	12	3	5
	Second	**103**	0	25	**53**	15	6	1
SP	Cheapest	**99**	0	30	**47**	18	3	1
	Second	**88**	0	25	**56**	14	1	5
LU	Cheapest	**64**	2	28	**36**	22	3	9
	Second	**116**	0	24	**38**	25	7	6
DK	Cheapest	**88**	0	22	**42**	31	6	0
	Second	**57**	0	11	**53**	21	7	9
FI	Cheapest	**87**	0	16	**51**	26	7	0
	Second	**39**	0	26	**44**	28	3	0
NL	Cheapest	**50**	0	40	**46**	8	4	2
	Second	**66**	2	32	**36**	20	8	3
SW	Cheapest	**56**	0	23	**38**	25	5	9

	Second	**56**	0	25	**52**	18	2	4
BE	Cheapest	**14**	0	14	**50**	29	0	7
	Second	**68**	0	22	**44**	16	9	9
FR	Cheapest	**34**	0	15	**47**	21	6	12
	Second	**36**	0	22	**42**	22	8	6
PO	Cheapest	**30**	0	**53**	33	3	10	0
	Second	**27**	0	26	**44**	11	7	11
UK	Cheapest	**27**	0	**22**	15	19	**22**	**22**
	Second	**27**	0	**33**	22	**33**	4	7
IR	Cheapest	**15**	0	**60**	27	7	7	0
	Second	**24**	4	**54**	38	4	0	0
GE	Cheapest	**16**	0	**25**	**25**	**25**	13	13
	Second	**16**	0	**31**	**31**	25	13	0
AU	Cheapest	**9**	0	**56**	44	0	0	0
	Second	**19**	0	32	**47**	0	16	5

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are cheapest or second cheapest. Bold numbers indicate the price differential range with the highest frequency.

Table 33 The most expensive and the second most expensive countries – Number of counted models and corresponding price differential ranges. Adjusted for taxes and exchange rates

Country	Rank	Number of models	Fraction of the counted models in the price differential range of:					
			0-10%	10-20%	20-30%	30-40%	40-50%	>50%
UK	Most exp.	**266**	0	20	**48**	28	5	0
	Second	**106**	0	24	**45**	16	5	10
GE	Most exp.	**60**	0	**55**	42	3	0	0
	Second	**127**	0	30	**46**	20	3	2
IR	Most exp.	**62**	0	32	**53**	15	0	0
	Second	**116**	0	11	**52**	32	3	3
PO	Most exp.	**65**	2	28	**57**	12	2	0
	Second	**83**	0	22	**39**	28	10	2
AU	Most exp.	**52**	0	35	**56**	8	2	0
	Second	**93**	1	32	**51**	13	2	1
DK	Most exp.	**91**	0	10	**37**	34	9	10
	Second	**47**	0	17	**36**	21	15	11
FI	Most exp.	**80**	0	15	16	21	**24**	**24**
	Second	**37**	0	11	**38**	24	16	11
GR	Most exp.	**56**	0	14	**48**	16	11	11
	Second	**57**	0	23	**40**	16	14	7

FR	Most exp.	**49**	0	**55**	37	8	0	0
	Second	**51**	0	**51**	39	10	0	0
SW	Most exp.	**14**	0	29	**64**	7	0	0
	Second	**32**	0	**41**	**41**	13	3	3
NL	Most exp.	**14**	0	**57**	43	0	0	0
	Second	**22**	0	36	**45**	14	0	5
BE	Most exp.	**6**	17	**50**	33	0	0	0
	Second	**23**	0	43	**48**	9	0	0
IT	Most exp.	**8**	0	**50**	**50**	0	0	0
	Second	**20**	0	**45**	30	15	10	0
SP	Most exp.	**3**	0	**67**	33	0	0	0
	Second	**9**	0	33	**56**	0	0	11
LU	Most exp.							
	Second	**3**	**33**	0	**33**	0	**33**	0

Notes: Total number of models during 1995-2000 is 826. The countries are ranked according to the total number of models for which they are the most expensive and the second most expensive. Bold numbers indicate the price differential range with the highest frequency.

Conclusions. A tax adjustment based on the assumed tax pass-through rate leads to lower price dispersion. The price differential range between the most expensive and the cheapest country declines by around 6-8 percent. The other price dispersion measures, the price differential ranges between the second most expensive and the second cheapest country and the coefficient of variation, decline by lower amounts. The tax-adjustment indicates that after a tax harmonization Denmark would no longer be the cheapest or the second cheapest country for the majority of the models, and would in fact become the most or second most expensive for several models.

An exchange rate adjustment also leads to lower measures of price dispersion, but to a lower extent. Furthermore, the results indicate that the United Kingdom would still remains the most or second most expensive country for a similar number of models after exchange rates would be stabilized.

2.7.3 Systematic price differentials

We now turn to an analysis of systematic price differentials after correcting for taxes and exchange rates. This analysis thus parallels section 2.5, where we analyzed systematic price differentials without adjusting for taxes and exchange rates. For space reasons, we concentrate on the general overview of the whole market, parallel to

subsection 2.5.2. We do not repeat the analysis by segment (section 2.5.3) and by country of origin (section 2.5.4), since no main new insights are obtained apart from what we find in our general overview of the whole market.

2.7.3.1 Adjustment for taxes

Figure 22 and Table 34 consider the evolution of systematic price differentials across the countries in the EU, after adjusting for the differences in taxes.

See Figure 22 in chapter 4.

Table 34 Fisher indices by market, adjusted for taxes, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		106,3	101,3	102,2
BE	101,7	100,3	97,0	98,8
DK	103,5	103,0	100,4	103,7
FI		104,4	101,4	101,1
FR	102,3	99,6	98,0	98,3
GE	105,5	105,8	103,0	104,1
GR	99,5	101,0	94,5	94,1
IR	102,4	102,3	105,5	101,7
IT	92,3	92,4	99,6	98,2
LU	101,1	99,3	96,0	98,5
NL	104,1	103,4	97,4	98,2
PO	99,4	101,5	100,6	102,1
SP	94,0	97,7	95,9	94,1
SW		99,5	101,6	101,3
UK	100,4	98,4	114,5	116,2

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

The most notable change occurs for Denmark. Whereas Denmark was systematically less expensive than the EU9 average by around 20 percent, it now becomes in line with the EU9 average, i.e. around 3 percent more expensive during most years. Some other high tax countries also would become more in line with EU9 average if taxes

would become harmonized. This is especially true for Finland, which is around 8 percent less expensive than EU9 average without a tax adjustment, and becomes in line with EU9 average after the adjustment. The general car price level in Greece, the Netherlands and Portugal would also become more in line with EU9 average if taxes were harmonized. Ireland would shift from a country that is moderately below EU9 average to a country moderately above EU9 average if taxes were harmonized.

Generally speaking, the systematic car price differentials would become lower if taxes were harmonized. Many countries would have a general car price index no larger than 2 percent below or above the EU9 average during the last four years. Upward exceptions would be: Germany, around 3-4 percent above the EU9 average, and more if one were to exclude the high weight of Germany itself in the car market from the EU9 group; Ireland, around 2-5 percent above EU9 average; and especially the United Kingdom, around 15 percent more expensive than the EU9 average. Downward exceptions would be: Greece, still around 6 percent less expensive than EU9 average after adjusting for its high tax regime; and Spain, around 5 percent less expensive regardless of a tax adjustment.

2.7.3.2 Adjustment for exchange rates

Figure 23 and Table 35 show the evolution of systematic price differentials across the countries in he EU, after adjusting for the exchange rate fluctuations.

See Figure 23 in chapter 4.

Table 35 Fisher indices by market, adjusted for exchange rates, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		104,0	100,5	101,4
BE	102,9	99,3	97,5	99,1
DK	81,2	79,4	77,9	79,2
FI		92,5	90,8	91,2
FR	103,8	99,5	98,0	98,3
GE	107,1	105,5	104,2	105,1
GR	94,4	97,3	93,2	93,6

IR	98,4	98,8	98,7	96,5
IT	91,3	95,0	98,9	97,7
LU	102,9	98,9	97,2	99,5
NL	101,1	98,0	94,3	95,0
PO	94,8	95,8	95,9	97,9
SP	91,4	96,8	96,6	95,0
SW		98,3	99,7	99,7
UK	104,2	104,4	110,3	108,9

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

A first observation that emerges from Figure 23 is that the evolution of the exchange rate adjusted price indices is smoother. Price differentials between countries would thus become less volatile if exchange rates were stabilized. This can be seen from comparing the exchange rate adjusted evolution of the price indices in Finland, Greece, Italy, Sweden and the United Kingdom with the exchange rate unadjusted evolution (Figure 12 versus Figure 23). This is also consistent with the observation that the exchange rate unadjusted price indices in Figure 12 show a smooth evolution for the countries who joined the EMU since January 1st 1999.

The second observation that emerges from Figure 23 and Table 35 relates to the price level for the United Kingdom. The United Kingdom would appear as a cheaper country on average during the later years, as compared to case where no exchange rate adjustments were made. Yet it appears as a more expensive country during the earlier years. Over the whole period, the price level in the United Kingdom would have been about 5-10 percent above the EU9 average, if exchange rates had been stabilized around the reference exchange rate level for the pound. Recall that the reference exchange rate level was the average value over 1993-2000. If we had chosen other reference levels then our conclusion regarding the United Kingdom would have been different. For example, if we had chosen the exchange rates at the beginning of the EMU as the reference levels at which exchange rates were stabilized, then the United Kingdom would have appeared more expensive than the EU9 average by around 15-20 percent. A similar finding would be obtained if we had chosen a longer period than 1993-2000 for computing the average value of the pound as the reference level. This is because the period 1993-1996 was a rather unusual period with a quite low value

for the pound compared to previous and subsequent years, even taking into account inflation.

2.7.3.3 Adjustment for both taxes and exchange rates

For completeness, Figure 24 and Table 36 show the evolution of systematic price differentials across the countries in he EU, after adjusting for both taxes and exchange rate fluctuations. The economic interpretation of the findings straightforwardly extends the discussion in section 2.7.3.1 and 2.7.3.2.

See Figure 24 in chapter 4.

Table 36 Fisher indices by market, adjusted for taxes and exchange rates, relative to EU9 average

	1993-1994	1995-1996	1997-1998	1999-2000
AU		105,1	101,6	102,4
BE	102,7	99,0	97,3	98,9
DK	104,4	102,2	100,1	103,1
FI		102,2	100,0	100,1
FR	103,4	99,2	97,8	97,8
GE	106,3	104,6	103,4	104,3
GR	97,6	100,3	96,2	97,3
IR	103,6	103,5	103,4	101,3
IT	91,0	94,8	98,7	97,6
LU	102,1	98,1	96,3	98,6
NL	105,0	101,7	97,9	98,7
PO	98,9	101,0	101,0	102,8
SP	92,2	97,4	96,9	95,4
SW		99,7	100,2	99,9
UK	103,8	103,8	109,7	108,2

Note: average values over 2 year periods. For a detailed discussion on the methodology for computing the Fisher price indices, see section 2.5.1.

Conclusions. A tax-adjustment leads to lower systematic price differentials. Many countries would have a general car price index no larger than 2 percent below or above the average, if taxes were harmonized. Upward exceptions would be Germany,

Ireland, and especially the United Kingdom. Downward exceptions would be Greece and Spain. An exchange rate adjustment leads to a smoother evolution of systematic price differentials over time, but the long-term level of systematic price differentials does not diminish by much.

2.8 The RHD regulation in Ireland and the United Kingdom

In this section we use the database on RHD surcharges published in the series of car price reports from the European Commission to conduct a detailed study on price differentials over the period November 1997-May 2000. The purpose is twofold: (1) to shed light on the evolution of the RHD surcharge over time and the differentials between brands; (2) to adjust our measurement of price dispersion for the RHD surcharge.

2.8.1 RHD surcharges in European countries

We first consider the common Euro price of the RHD surcharge. This means that we include 13 countries, i.e. we exclude Ireland and the UK. In those two countries there is of course no visible RHD surcharge, yet it may still be expected that certain production costs related to the RHD specification are included in the prices in Ireland and the UK. To the extent that this is indeed the case, one should not interpret the RHD surcharge as reflecting higher production costs, but rather as reflecting administrative costs or other factors.

As a first indication, we calculate the evolution of the unweighted average price in Euro using the 6-months average exchange rate. The results are displayed in Figure 25. We observe a rather stable average price with the exception of a sharp increase in the last period November 1999 - May 2000.

See Figure 25 in chapter 4.

An unweighted price index for the RHD surcharge, defined as the unweighted average for a set of RHD model surcharges in each country, relative to the EU13 average

(Ireland and the UK are excluded) is shown in Figure 26. The figure displays the results for the different groups of countries (groups A, B, C and D) introduced earlier in this price study. Several points can be made relating to Figure 26.

See Figure 26 in chapter 4.

A general observation is that the systematic variation in the RHD surcharge (if available) is low compared to the price variation of the car itself. Consider the countries from group A and B (defined by an exchange rate closely following the DM) in the top part of Figure 26. One can see that RHD surcharges in group A (Austria, Germany and the Netherlands) are close to the European average. Although those countries' exchange rates were moving already very close before the final stage of the EMU, we observe a relative convergence of the RHD-surcharge in the last period. The RHD surcharge in the Netherlands, a high tax country, is persistently slightly above the European average. RHD surcharges in group B (Belgium, France, Luxemburg and Denmark) are close to the European average and move closely together except for the Nov 1997 and May 2000 periods.

The bottom part of Figure 26 shows the fraction of RHD price differentials relative to the EU13 average for country groups C and D. The RHD surcharge set by manufacturers in Finland and Sweden exceeds slightly the European average although the first concerns a high tax country. The group of southern European countries (Group D) shows a diverse pattern. Italy is consistently more expensive whereas the other countries vary around the European average.

Figure 27 and Figure 28 show the evolution of price differentials of the RHD-charge by brand presented by country of origin: French cars (PSA and Renault); German cars (BMW, Mercedes and Volkswagen); Italian cars (Fiat); Ford and GME; Japanese cars and "other cars".

See Figure 27 in chapter 4.

See Figure 28 in chapter 4.

The analysis per brand confirms what is suggested by the MMC (1999) report. Generally speaking, the RHD surcharges vary considerably more across brands than across countries (comparison of Figure 27 and Figure 28 with Figure 26). The brands from French origin presented in the top left panel of Figure 27 were priced slightly above average except for the last period where they were below EU13 average. There is a significant dispersion between brands from German origin, as can be seen from the top right part of figure 3. BMW, Mercedes and VW move very close together over the sample period and become on average more expensive than the EU13 average. Audi charges more than double of the EU13 average RHD-surcharge. During the last period, the charges by Audi become more in line with the other brands from German origin. Ford and GME set RHD-prices substantially below the EU13 average, as can be inferred from the bottom panel of Figure 27. Ford charges consistently about 40% less, whereas GME charges between 20% to 60% below EU-average. The top left panel of Figure 28 shows that the Italian brands charge prices close to the European average. The brands of Japanese origin are of special interest as some of their cars are conceptually designed with RHD implying that we may expect no RHD surcharge or even a lower price for a RHD car than for a LHD car. The Japanese brands show an enormous diversity in their RHD-pricing over time and across brands. In November 1997 one brand is setting a price equal to zero whereas another brand charges on average to about 4 times the EU13 average. The difference declines over time but remains important compared to the other origins. Some brands are charging substantially larger prices than the EU-average whereas others a substantially lower price. The group “other origin” is also an interesting case. Rover prices the RHD-surcharge about 50% lower than the EU average. However, it claimed in the MMC (1999) study that it had no differing costs since its production was split more or less evenly between LHD and RHD cars. Volvo charges a substantially lower RHD-surcharge than EU-average whereas SEAT charges persistently higher RHD prices.

2.8.2 Adjustments for the RHD surcharge

In this section we reconsider price dispersion of the car models themselves, after adjusting for the RHD surcharge. We add up the RHD surcharge for each model in each country to the car price, except for Ireland and the United Kingdom. As discussed above, there is no visible surcharge in these countries, yet higher production costs associated to the RHD may be included in the car price.

Table 37 presents the summary statistics for alternative measures of price dispersion, only for the period 1999-2000.[53] Comparing these results with Table 4, we infer that the average price differential range including all countries drops with about 5 percent points to 34.3 percent. The average price differential range excluding the most expensive and the cheapest country remains more or less the same, and the coefficient of variation drops by about 1 percent point. This follows from the fact that the United Kingdom, with the RHD regulation, was frequently observed to be at the most expensive end.

Table 37 Summary statistics for alternative measures of price dispersion – adjusted for the RHD surcharge

	Period	Average	Standard deviation	Minimum	Maximum
Price differential range – including all countries	1999-00	34,3	12,5	0,0	75,1
Price differential range – excluding most expensive and cheapest country	1999-00	19,3	6,4	4,1	40,9
Coefficient of variation	1999-00	9,0	2,7	1,8	17,8

Note: Total number of models during November 1997—May 2000 is 409. All measures are expressed in percentage of the average model price.

This is further confirmed in Table 38 and Table 39, which analyze the price differential range of the cheapest and second cheapest and most expensive and second most expensive country respectively.

[53] We have data from November 1997 onwards. Yet we do not present the results from November 1997 to November 1998, since they are not directly comparable to Table 4, which also includes the May 1997 data.

Table 38 The cheapest and the second cheapest countries – Number of counted models and price differential ranges

Country	Rank	Number of models		Fraction of the counted models in the price differential range of:					
		YES	NO	0-10%	10-20%	20-30%	30-40%	40-50%	>50%
DK	Cheapest	**151**	154	1	5	23	**32**	28	12
	Second	**10**	16	0	0	**40**	30	20	10
IR	Cheapest	**76**	27	12	**42**	30	11	4	1
	Second	**63**	16	5	6	**46**	33	10	0
NL	Cheapest	**60**	79	5	18	**53**	15	8	0
	Second	**51**	52	6	22	**39**	16	12	6
ES	Cheapest	**29**	34	3	10	31	**41**	14	0
	Second	**48**	56	2	15	**42**	21	17	4
GR	Cheapest	**10**	10	0	0	**40**	20	30	10
	Second	**51**	62	0	4	14	**43**	27	12
BE	Cheapest	**12**	18	0	8	42	**50**	0	0
	Second	**32**	34	9	16	**50**	22	3	0
FI	Cheapest	**2**	8	0	0	**50**	**50**	0	0
	Second	**40**	51	0	8	25	13	38	18
PO	Cheapest	**19**	25	0	5	**53**	26	16	0
	Second	**22**	27	0	14	27	**45**	14	0
FR	Cheapest	**16**	16	0	**31**	**31**	25	13	0
	Second	**12**	13	0	**25**	**25**	**25**	**25**	0
IT	Cheapest	**12**	12	0	17	**50**	33	0	0
	Second	**14**	16	0	14	**57**	21	7	0
SW	Cheapest	**10**	16	10	30	**40**	10	10	0
	Second	**14**	18	0	**43**	29	14	14	0
LU	Cheapest	**2**	7	0	0	**100**	0	0	0
	Second	**17**	20	6	**35**	**35**	24	0	0
UK	Cheapest	**7**	1	14	**71**	0	14	0	0
	Second	**12**	2	8	**67**	0	17	0	8
AU	Cheapest	**6**	3	0	33	**67**	0	0	0
	Second	**10**	12	0	20	**30**	**30**	20	0
GE	Cheapest	**5**	7	**60**	20	0	20	0	0
	Second	**4**	12	25	**50**	25	0	0	0

Notes: Total number of models during November 1997—May 2000 is 409. The countries are ranked according to the total number of models for which they are cheapest or second cheapest. Bold numbers indicate the price differential range with the highest frequency.

YES indicates the column where the RHD surcharge adjustment has been made for the 409 models. NO indicates the column where the RHD surcharge has not been made for the 409 same models, for comparison purposes.

The following conclusions can be drawn from Table 38. Denmark remains the country with the highest number of models in which it is cheapest. If Denmark is the cheapest country, the international price differential range is most frequently in the 30-40% range. The most important change compared to Table 7 is that Ireland now obtains the second ranking in terms of the number of cases in which a country is cheapest. The international price differential in that case is for 42% of the cases in the 10-20% range. The country ranking of the UK, however, does not increase compared to Table 7. A general observation is that the price differential range of 20-30% becomes more important than in Table 7.

Table 39 The most expensive and the second most expensive countries – Number of counted models and corresponding price differential ranges

Country	Rank	Number of models		Fraction of the counted models in the price differential range of:					
		YES	NO	0-10%	10-20%	20-30%	30-40%	40-50%	>50%
UK	Most exp.	**302**	359	3	12	**33**	27	18	6
	Second	**34**	23	9	15	**35**	26	15	0
GE	Most exp.	**45**	21	2	22	**49**	20	7	0
	Second	**131**	132	0	5	**31**	30	27	7
SW	Most exp.	**11**	7	0	27	27	**36**	9	0
	Second	**41**	32	0	27	10	**39**	15	10
IT	Most exp.	**20**	8	15	**55**	25	0	5	0
	Second	**25**	27	0	20	**52**	8	20	0
FR	Most exp.	**4**	2	0	**100**	0	0	0	0
	Second	**41**	30	2	24	**41**	17	5	10
AU	Most exp.	**3**	1	0	33	**67**	0	0	0
	Second	**38**	29	0	11	**39**	37	8	5
PO	Most exp.	**12**	5	25	17	**33**	17	8	0
	Second	**25**	25	12	28	**40**	8	12	0
IR	Most exp.	**4**	4	**25**	**25**	**25**	0	**25**	0
	Second	**24**	64	0	17	**42**	33	4	4
FI	Most exp.	**7**	5	**29**	**29**	14	14	14	0
	Second	**4**	6	**25**	**25**	**25**	0	**25**	0

GR	Most exp.	**4**	3	0	**50**	25	25	0	0
	Second	**6**	7	17	33	**50**	0	0	0
SP	Most exp.	**1**	1	0	**100**	0	0	0	0
	Second	**8**	6	38	13	50	0	0	0
NL	Most exp.	**3**	0	0	0	0	**67**	0	33
	Second	**5**	3	20	20	**40**	0	20	0
LU	Most exp.		0						
	Second	**8**	6	0	**38**	25	25	13	0
DK	Most exp.	**1**	1	0	0	0	**100**	0	0
	Second	**6**	6	0	33	17	**50**	0	0
BE	Most exp.		0						
	Second	**4**	4	0	25	**50**	25	0	0

Notes: Total number of models during November 1997—May 2000 is 409. The countries are ranked according to the total number of models for which they are the most expensive and the second most expensive. Bold numbers indicate the price differential range with the highest frequency.

YES indicates the column where the RHD surcharge adjustment has been made for the 409 models. NO indicates the column where the RHD surcharge has not been made for the 409 same models, for comparison purposes.

The comparison of Table 8 and Table 39 shows that the United Kingdom remains the most expensive country. However, the international price differential range now is most often in the 20-30% range compared to the 40-50% range in Table 8. Ireland drops in the ranking and is less often at the expensive end if one adjusts for the RHD surcharge. Italy and Sweden show more frequent models at the expensive end if one adjusts for the RHD surcharge, just below Germany. The most often encountered price differentials drop towards the 20-30% range.

Generally speaking, Table 38 and Table 39 show that the ranking of the countries does not change very much in terms of the number of expensive or cheap models, with the exception for Ireland and the United Kingdom. This is because of what we saw on Figure 26, namely that there are no large differences in the RHD surcharge across countries.

Conclusions. International price differentials for the RHD surcharge are low compared to price differentials for the car models themselves. An analysis by brand shows important price variability. An adjustment of car prices for the RHD surcharge shows that price dispersion drops to a moderate extent.

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4. LIST OF FIGURES

Figure 1

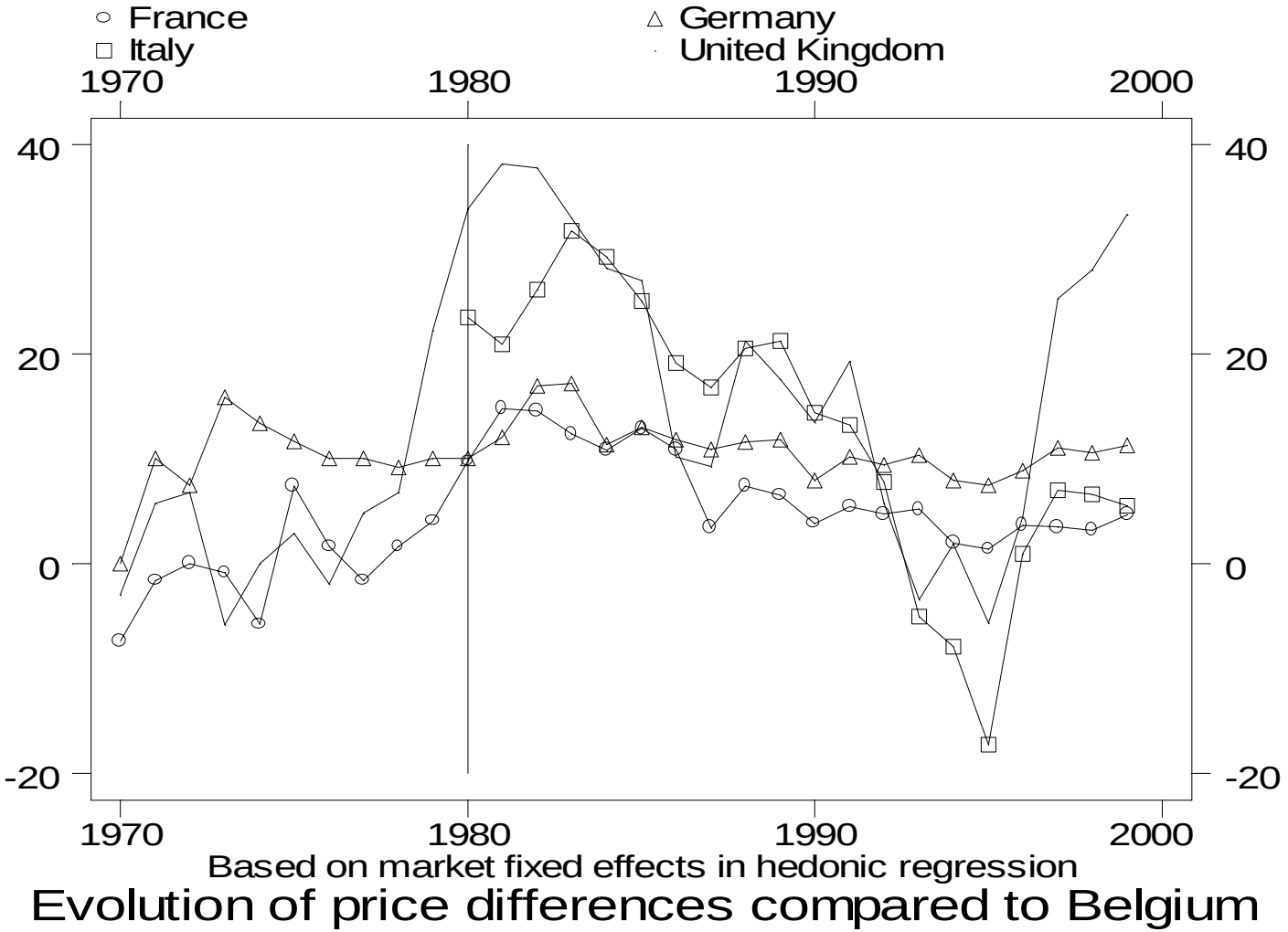
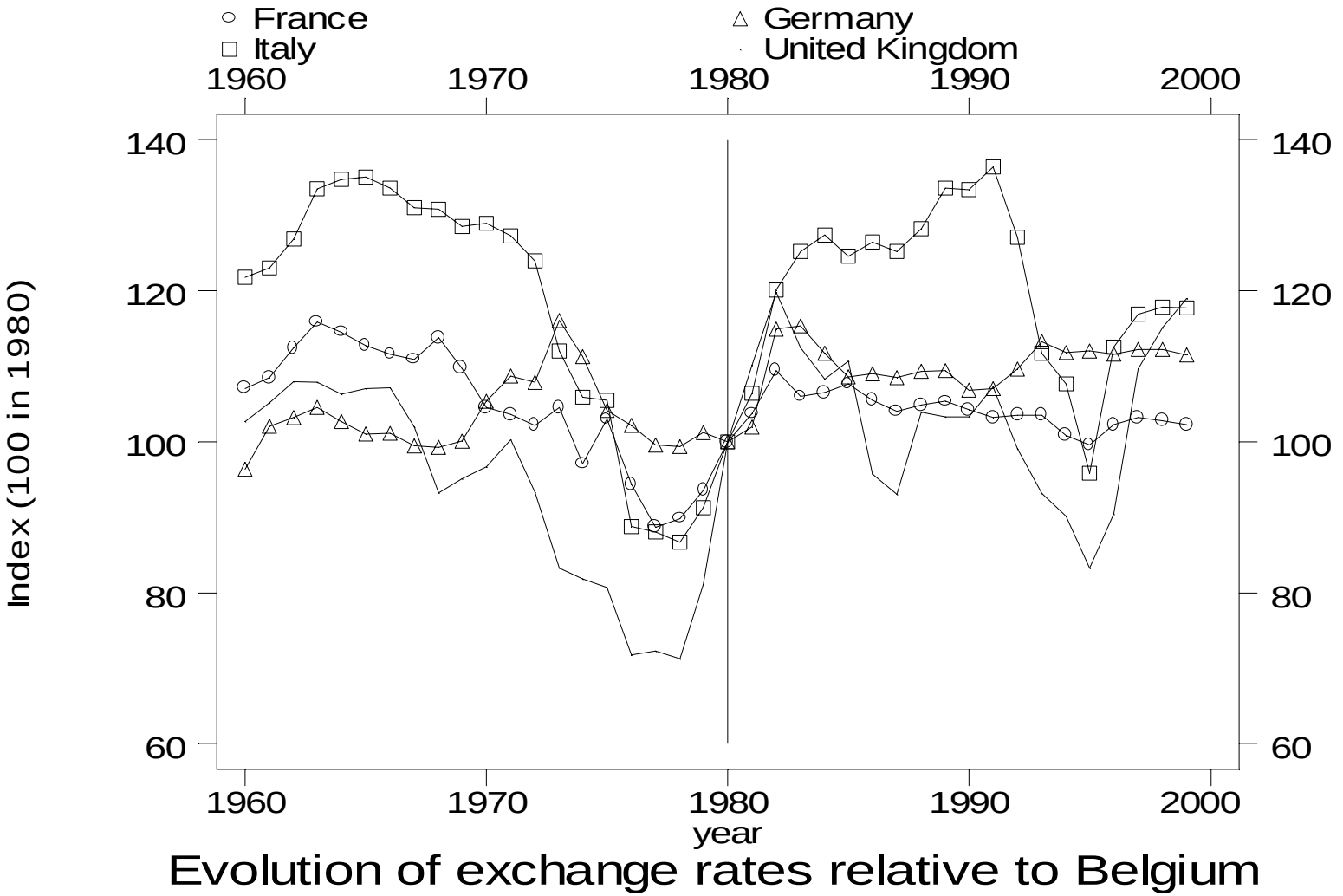


Figure 2



Evolution of exchange rates relative to Belgium

Figure 3

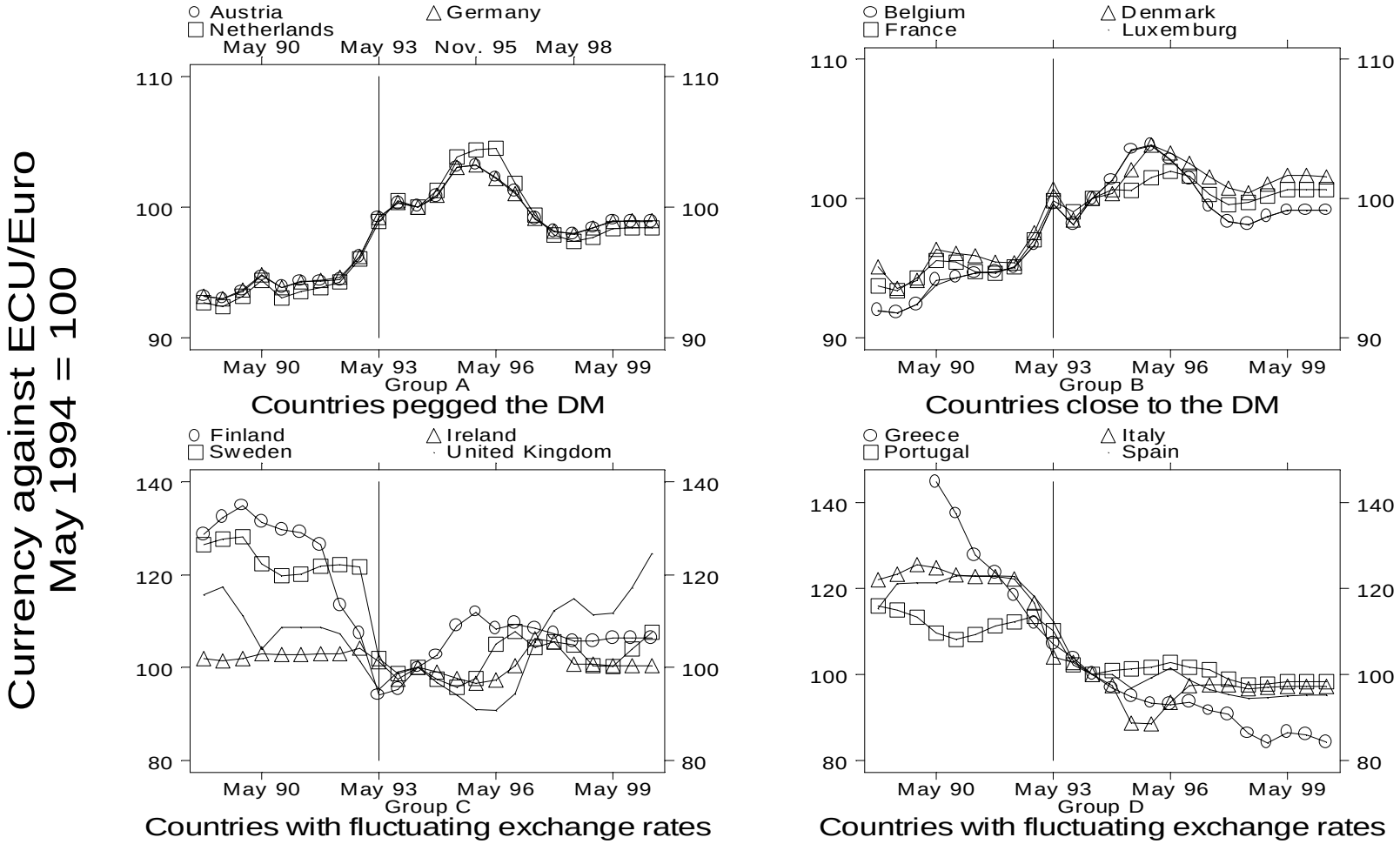
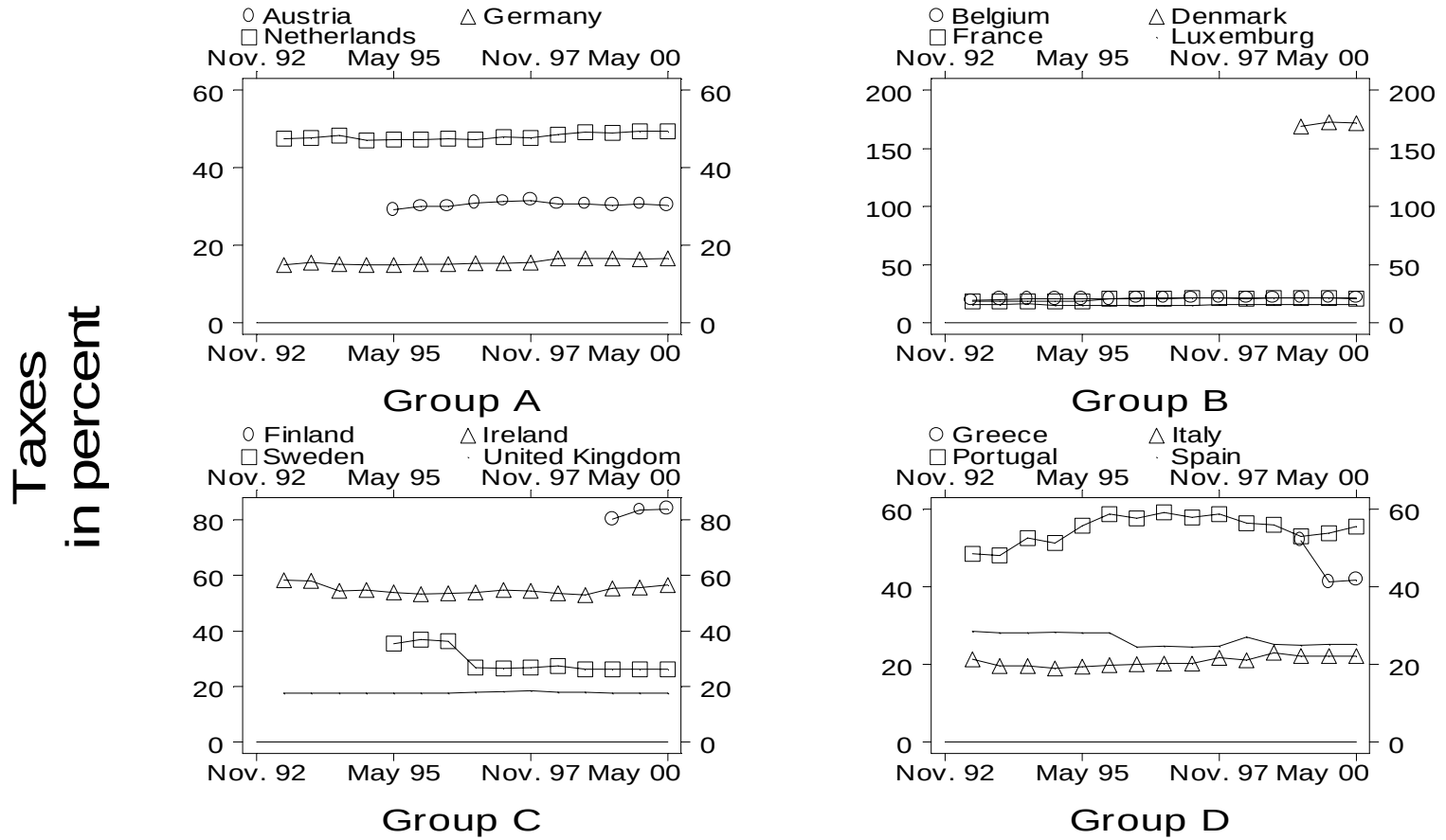

Currency against ECU/Euro
May 1994 = 100
Austria
Germany
Netherlands
May 90
May 93
Nov. 95
May 98
110
100
90
May 90
May 93
May 96
May 99
Group A
Countries pegged the DM
Belgium
Denmark
France
Luxemburg
Group B
Countries close to the DM
Finland
Ireland
Sweden
United Kingdom
140
120
100
80
Group C
Countries with fluctuating exchange rates
Greece
Italy
Portugal
Spain
Group D
Countries with fluctuating exchange rates
Evolution of exchange rates

Figure 4



All segments

Evolution of taxes

Figure 5

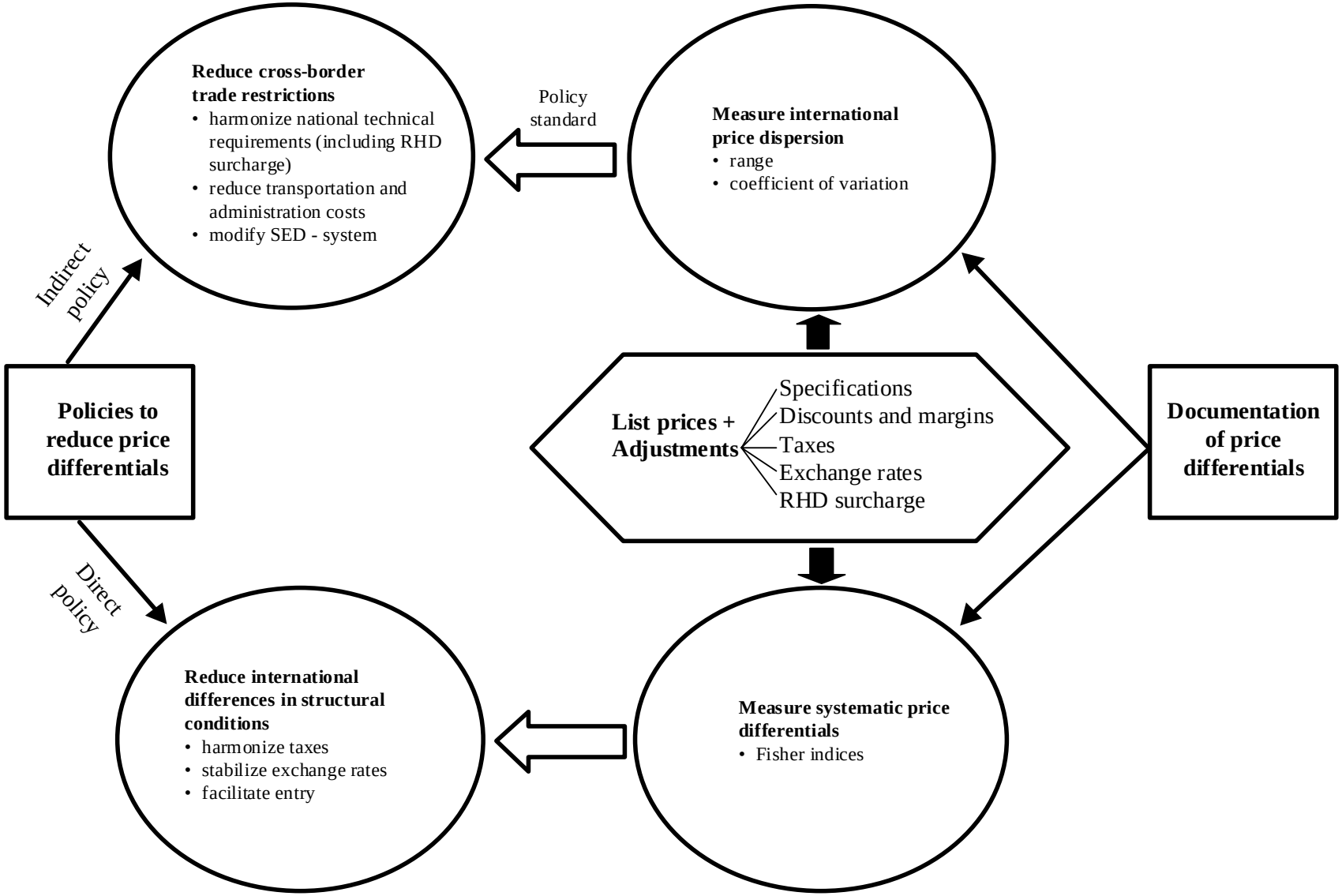

Reduce cross-border trade restrictions
• harmonize national technical requirements (including RHD surcharge)
• reduce transportation and administration costs
• modify SED - system
Policy standard
Measure international price dispersion
• range
• coefficient of variation
Indirect policy
Policies to reduce price differentials
List prices + Adjustments
Specifications
Discounts and margins
Taxes
Exchange rates
RHD surcharge
Documentation of price differentials
Direct policy
Reduce international differences in structural conditions
• harmonize taxes
• stabilize exchange rates
• facilitate entry
Measure systematic price differentials
• Fisher indices

Figure 6

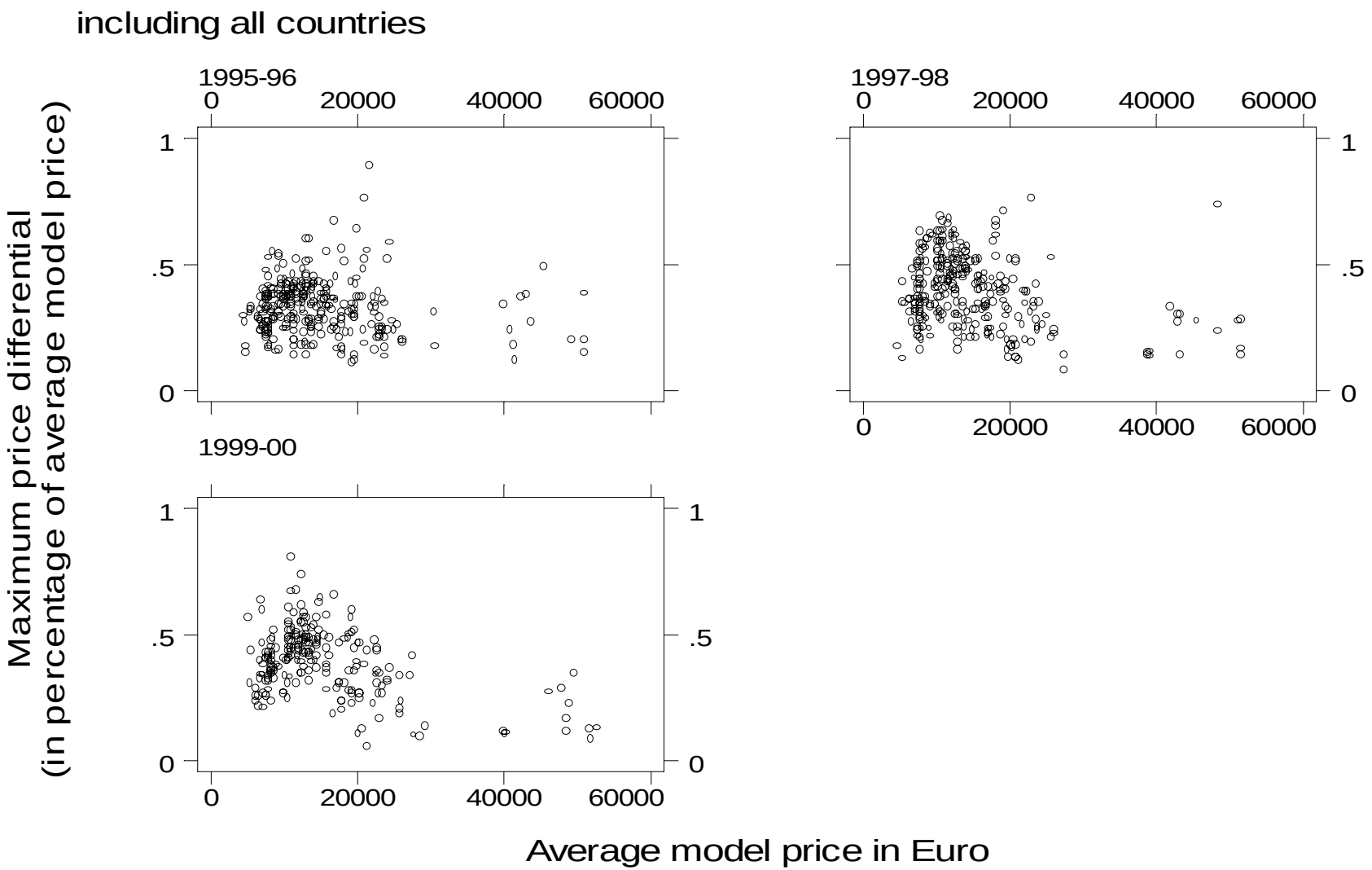
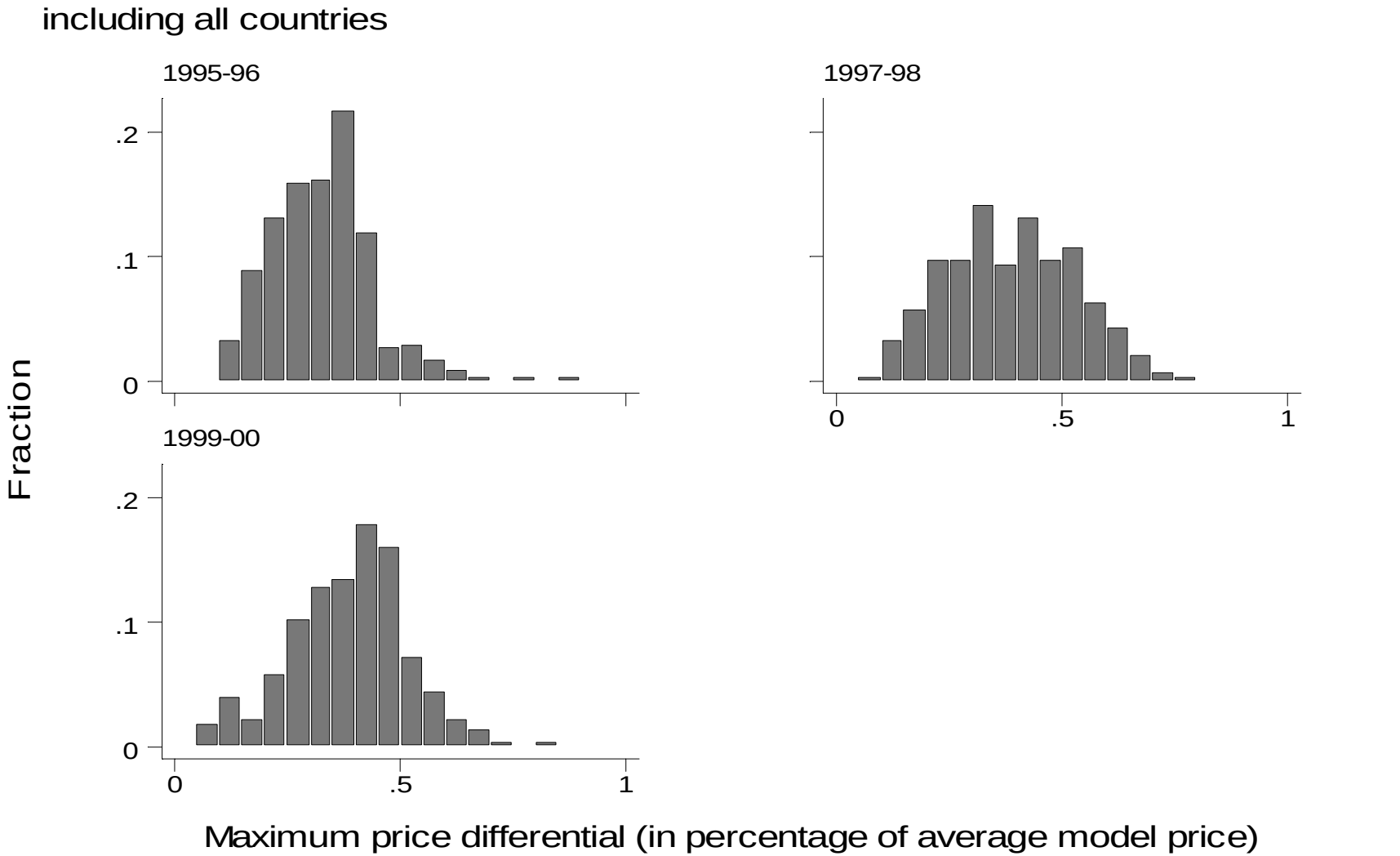

including all countries
1995-96
1997-98
1999-00
0
20000
40000
60000
1
.5
0
Maximum price differential
(in percentage of average model price)
Average model price in Euro
Price dispersion in the European car market

Figure 7



Distribution of price dispersion in the European car market

Figure 8

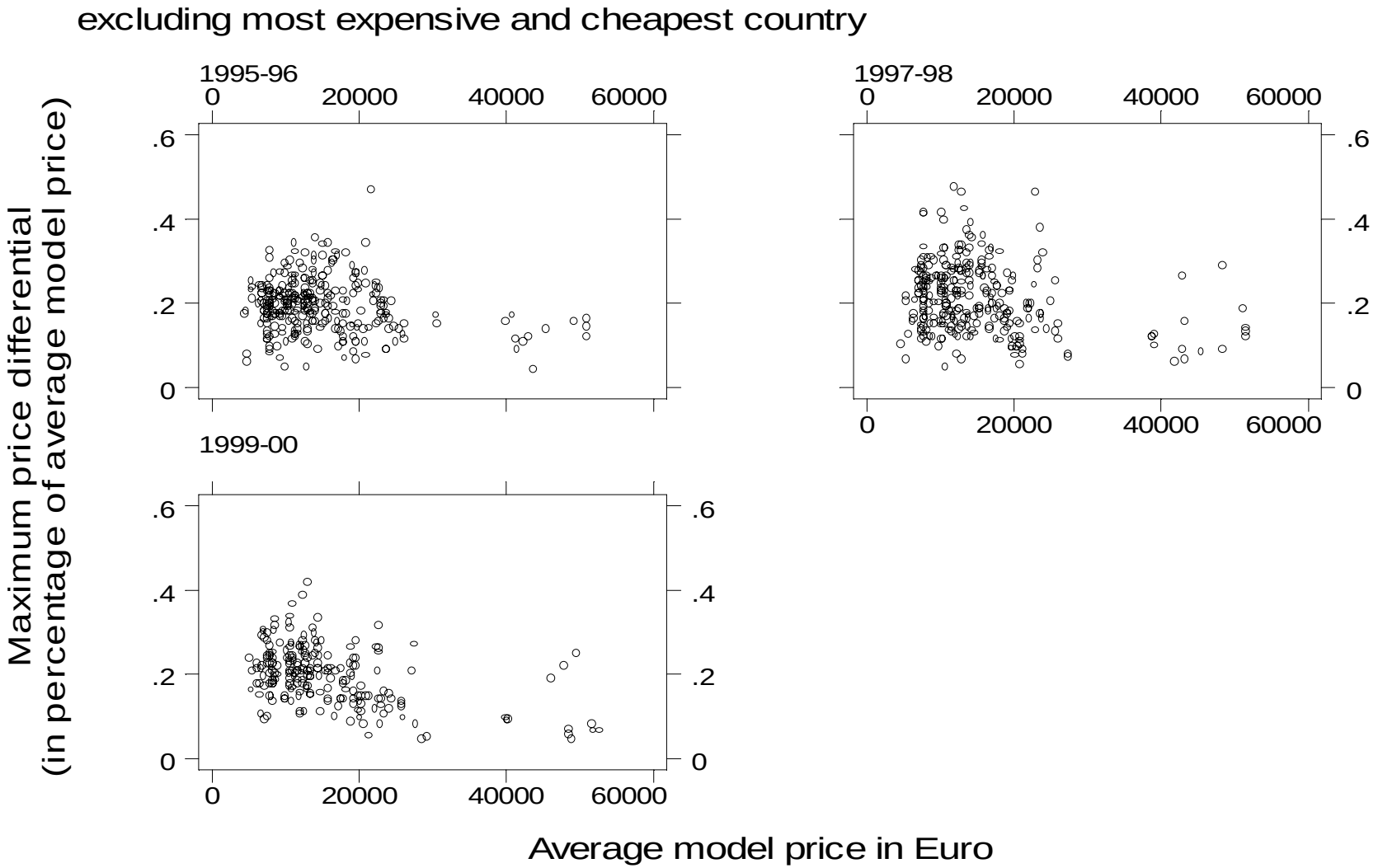
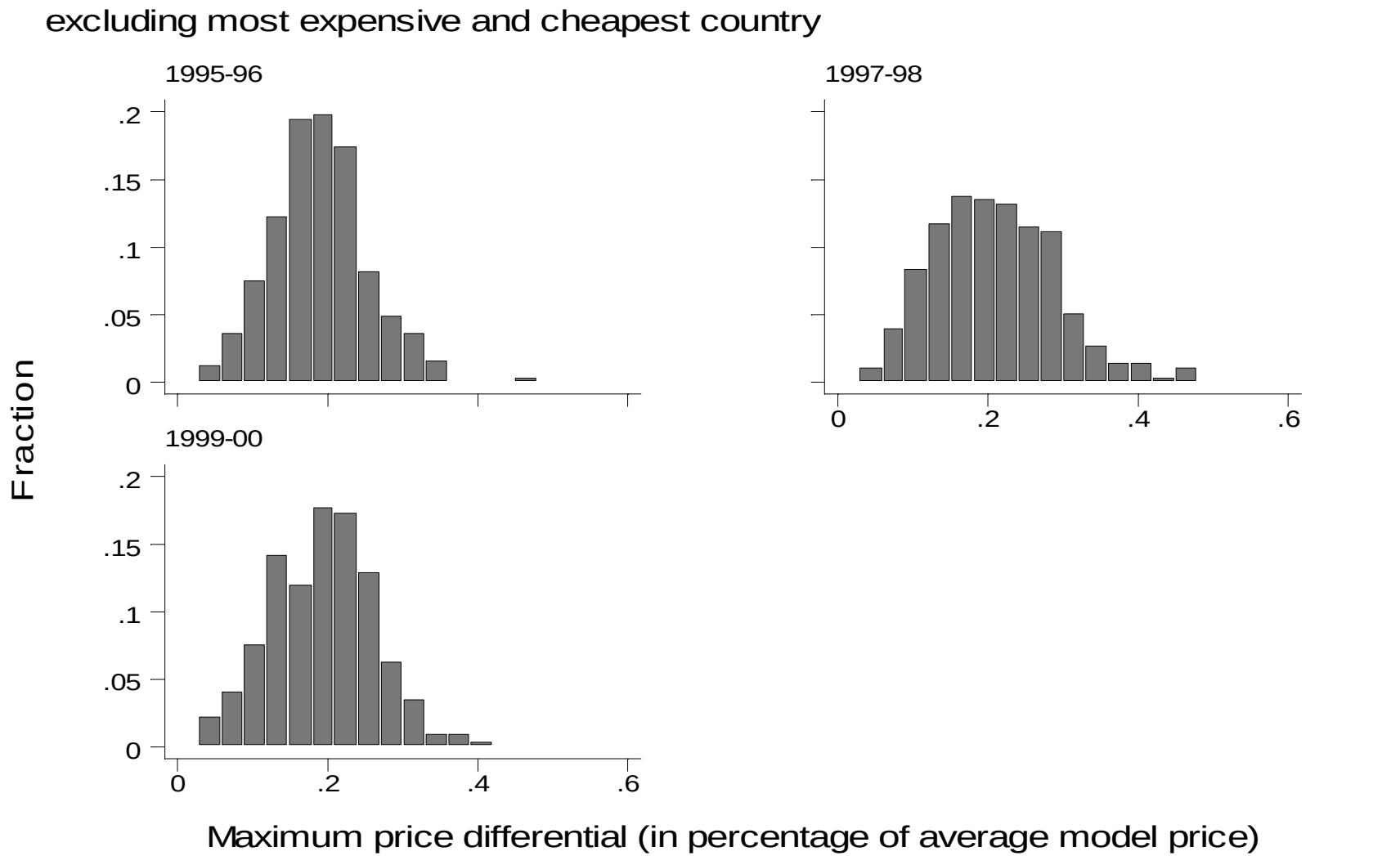
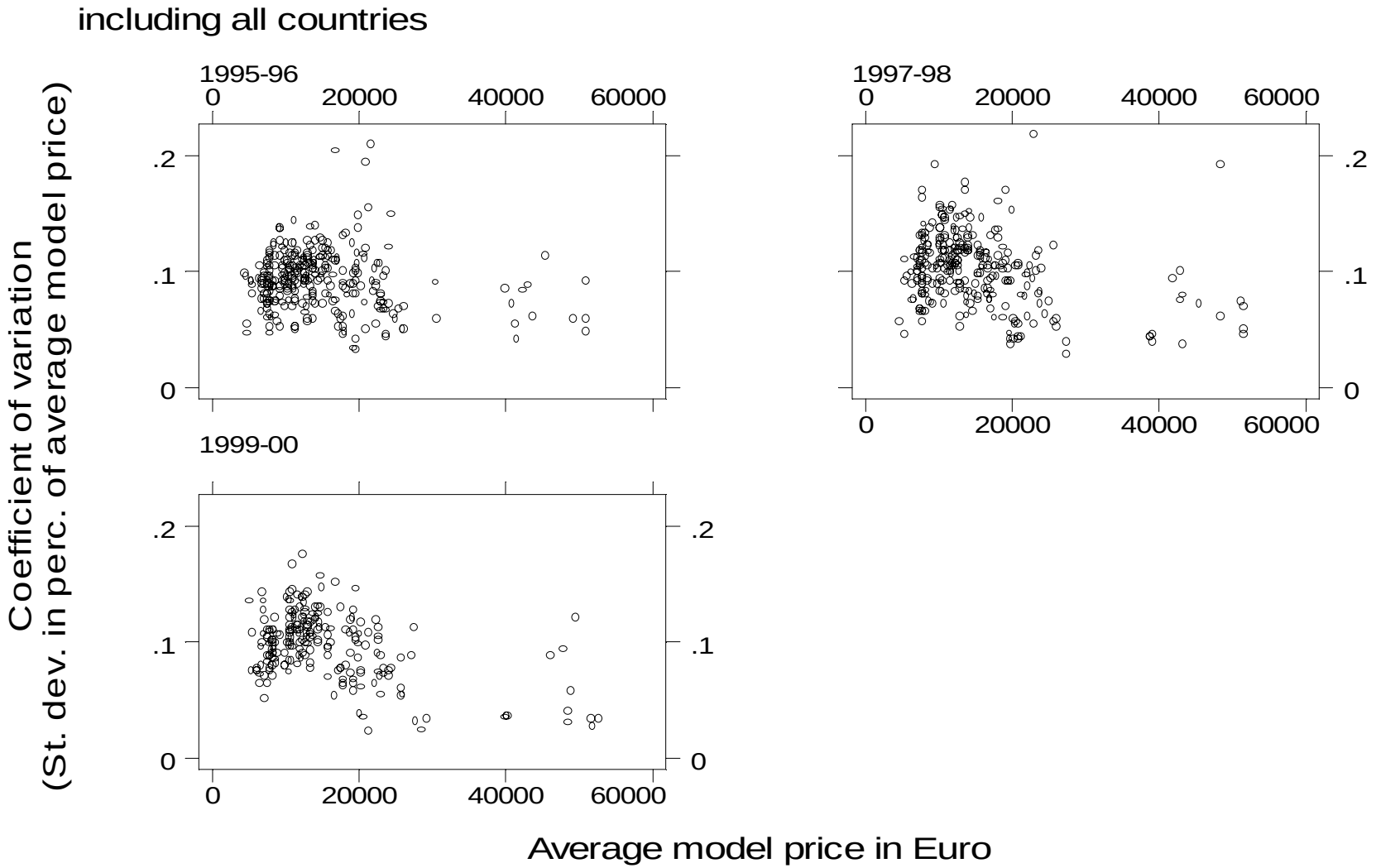

excluding most expensive and cheapest country
1995-96
1997-98
1999-00
0
20000
40000
60000
.6
.4
.2
0
Maximum price differential
(in percentage of average model price)
Average model price in Euro
Price dispersion in the European car market

Figure 9



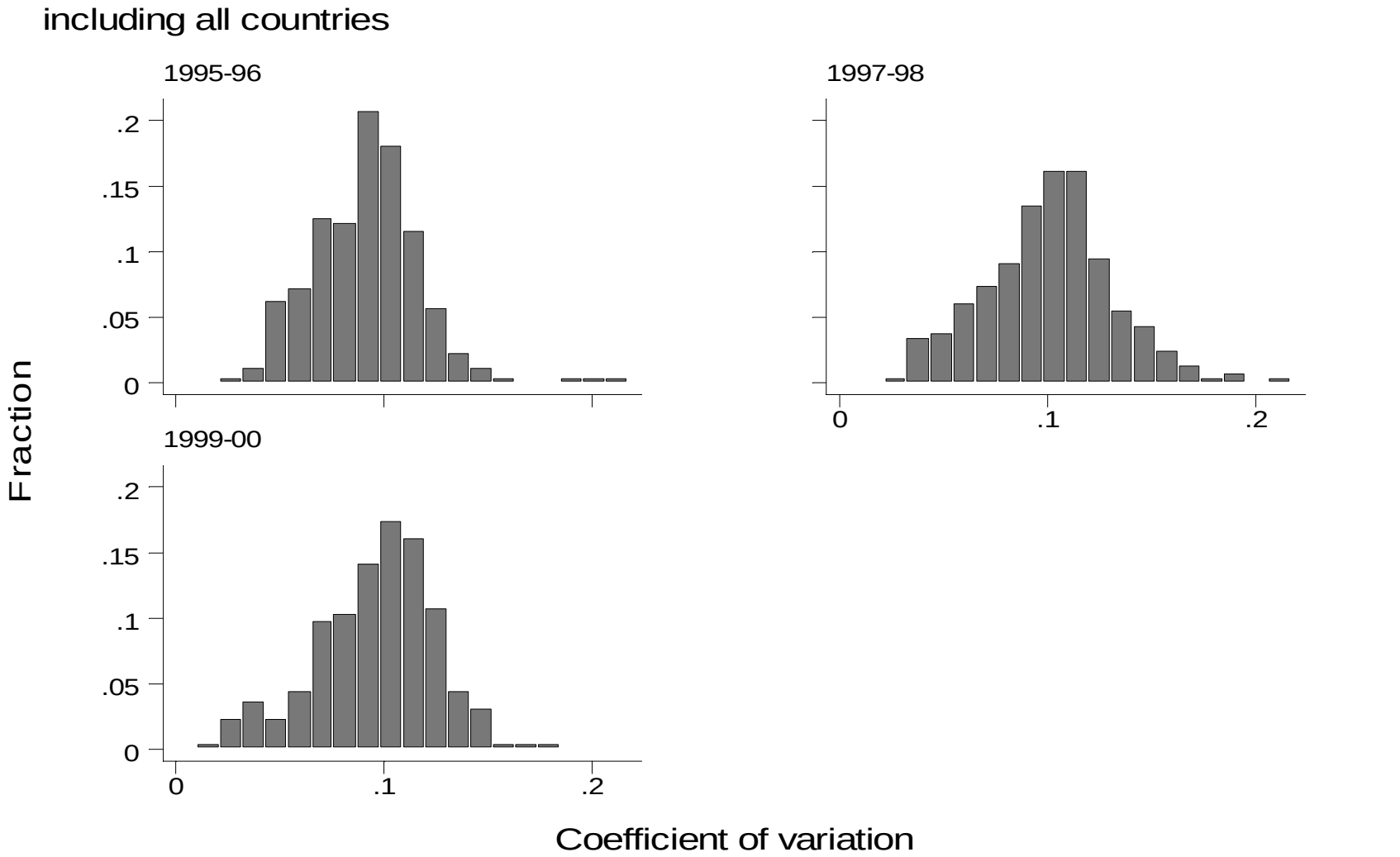
Distribution of price dispersion in the European car market

Figure 10



Price dispersion in the European car market

Figure 11



Distribution of price dispersion in the European car market

Figure 12

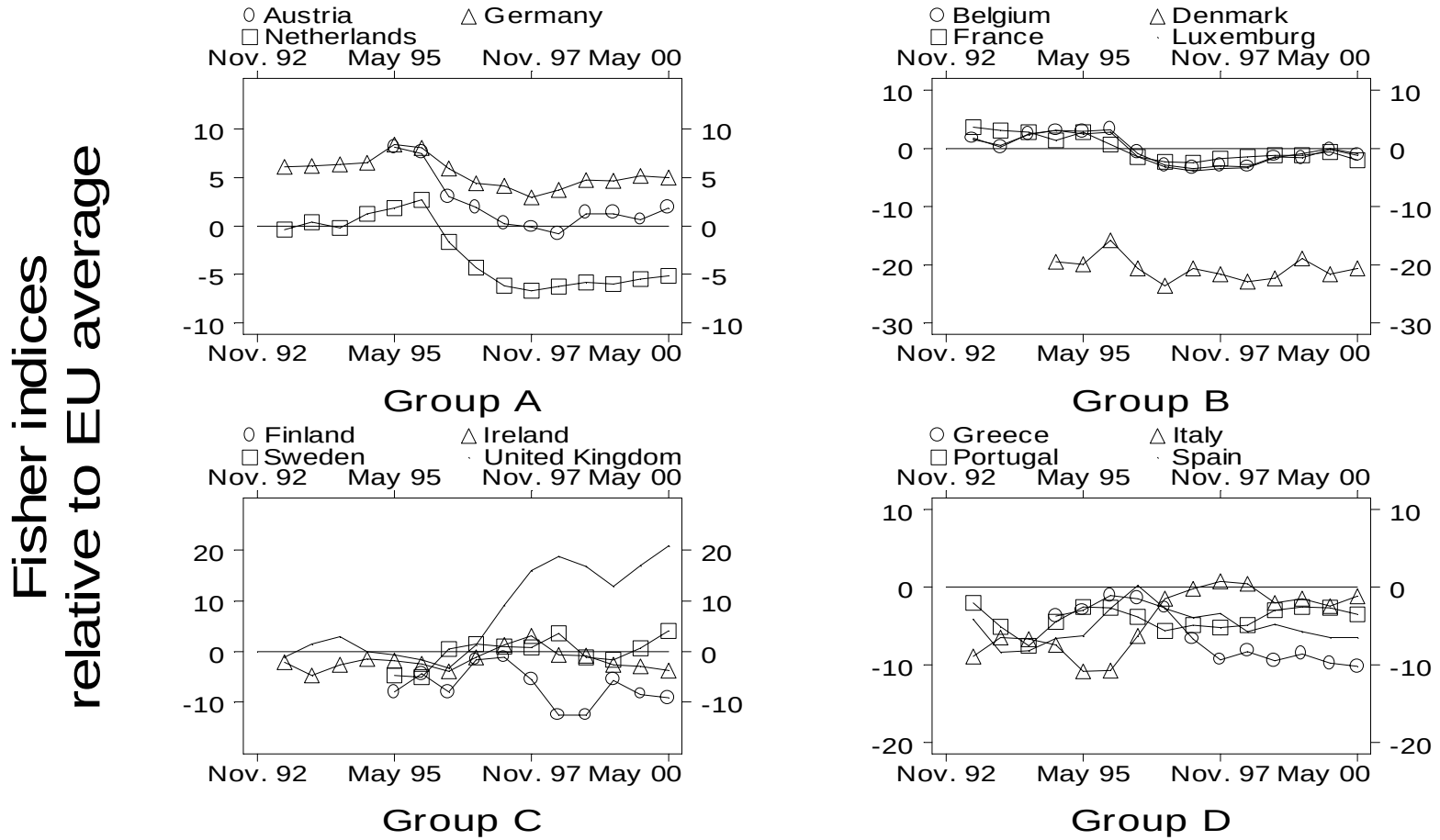
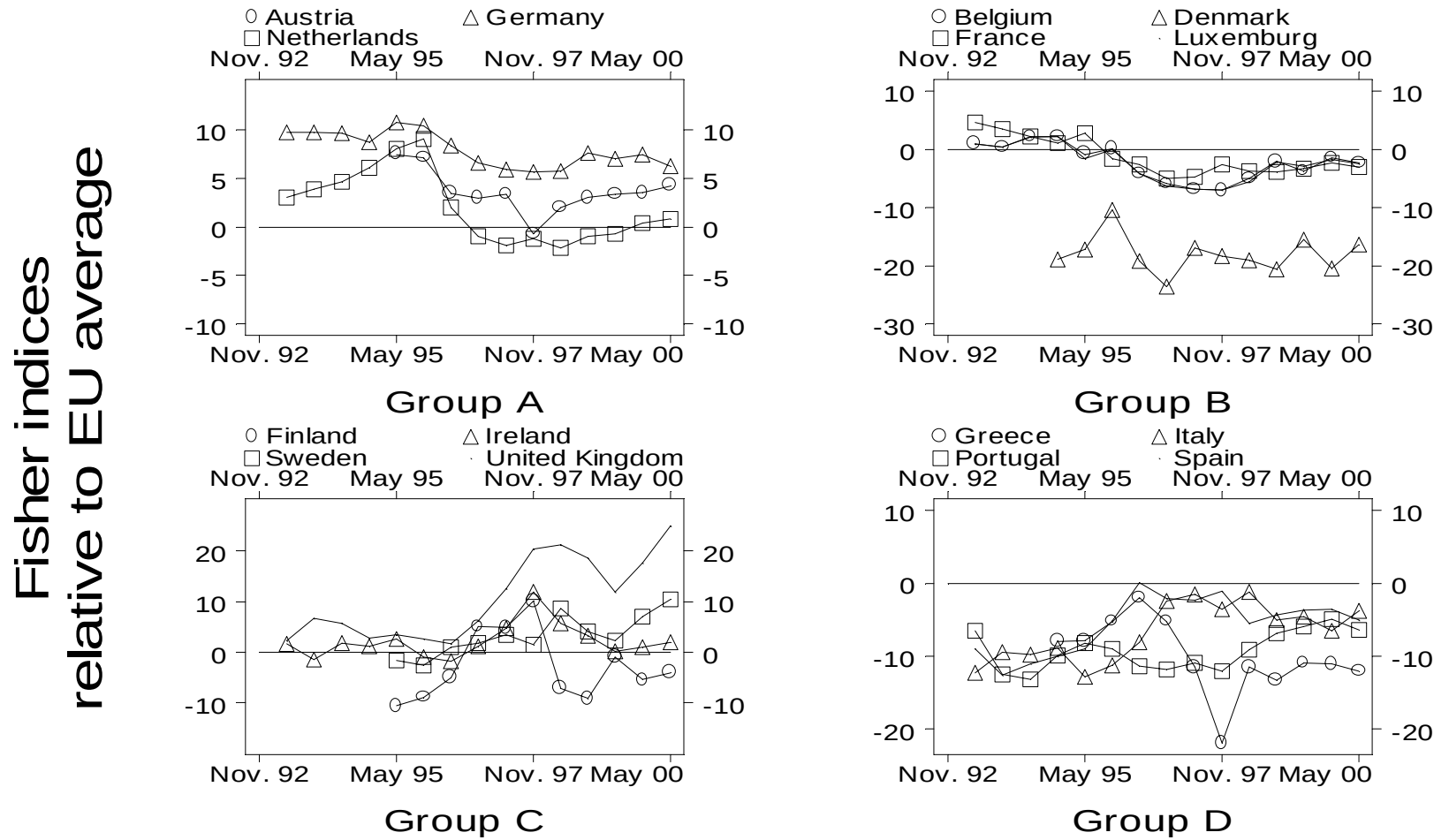

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Nov. 92
May 95
Nov. 97 May 00
Group A
Belgium
Denmark
France
Luxemburg
Group B
Finland
Ireland
Sweden
United Kingdom
Group C
Greece
Italy
Portugal
Spain
Group D
All segments
Evolution of price differentials

Figure 13



Segments A and B

Evolution of price differentials

Figure 14

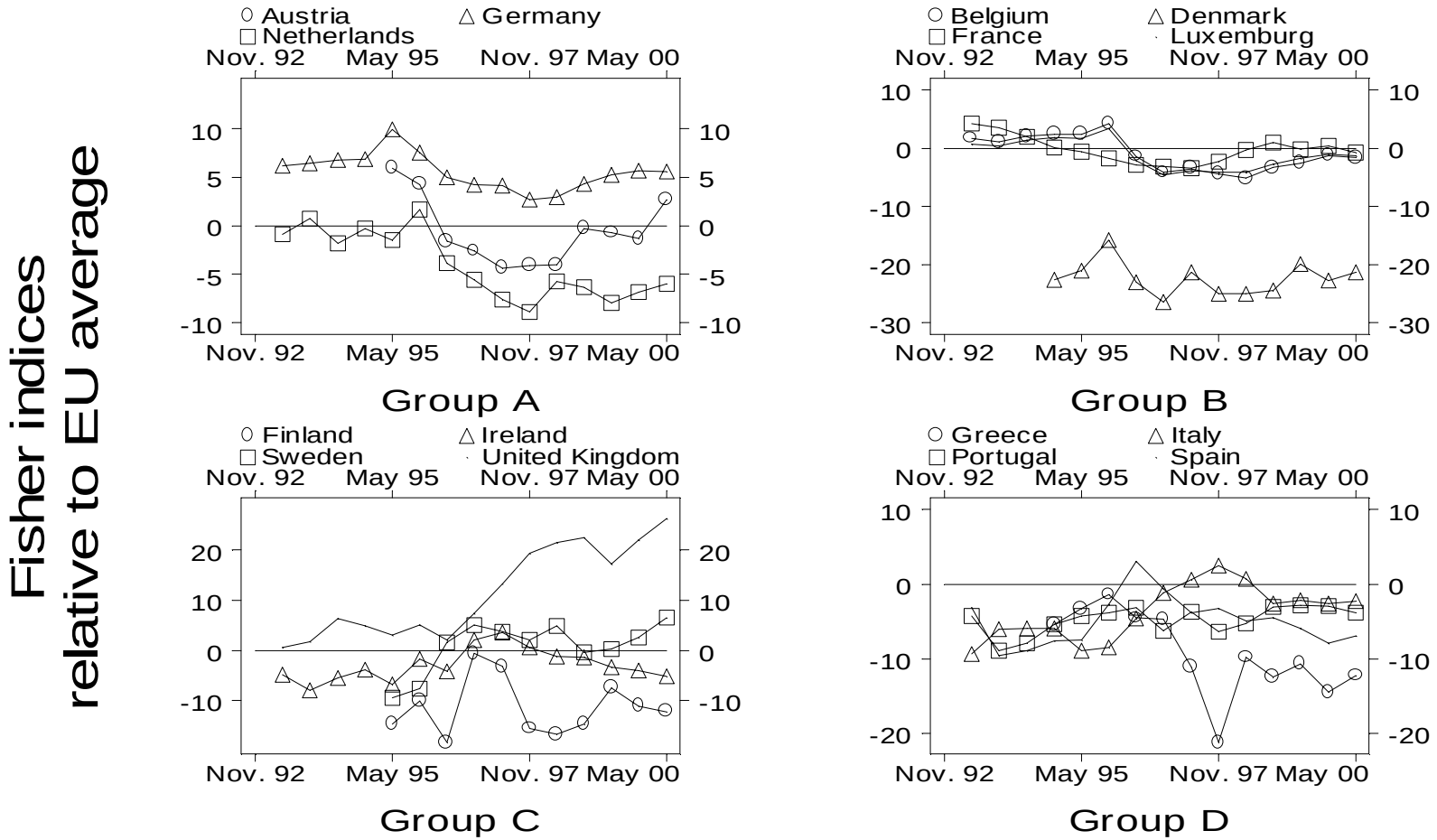

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Nov. 92
May 95
Nov. 97 May 00
Group A
Belgium
Denmark
France
Luxemburg
Group B
Finland
Ireland
Sweden
United Kingdom
Group C
Greece
Italy
Portugal
Spain
Group D
Segment C
Evolution of price differentials

Figure 15

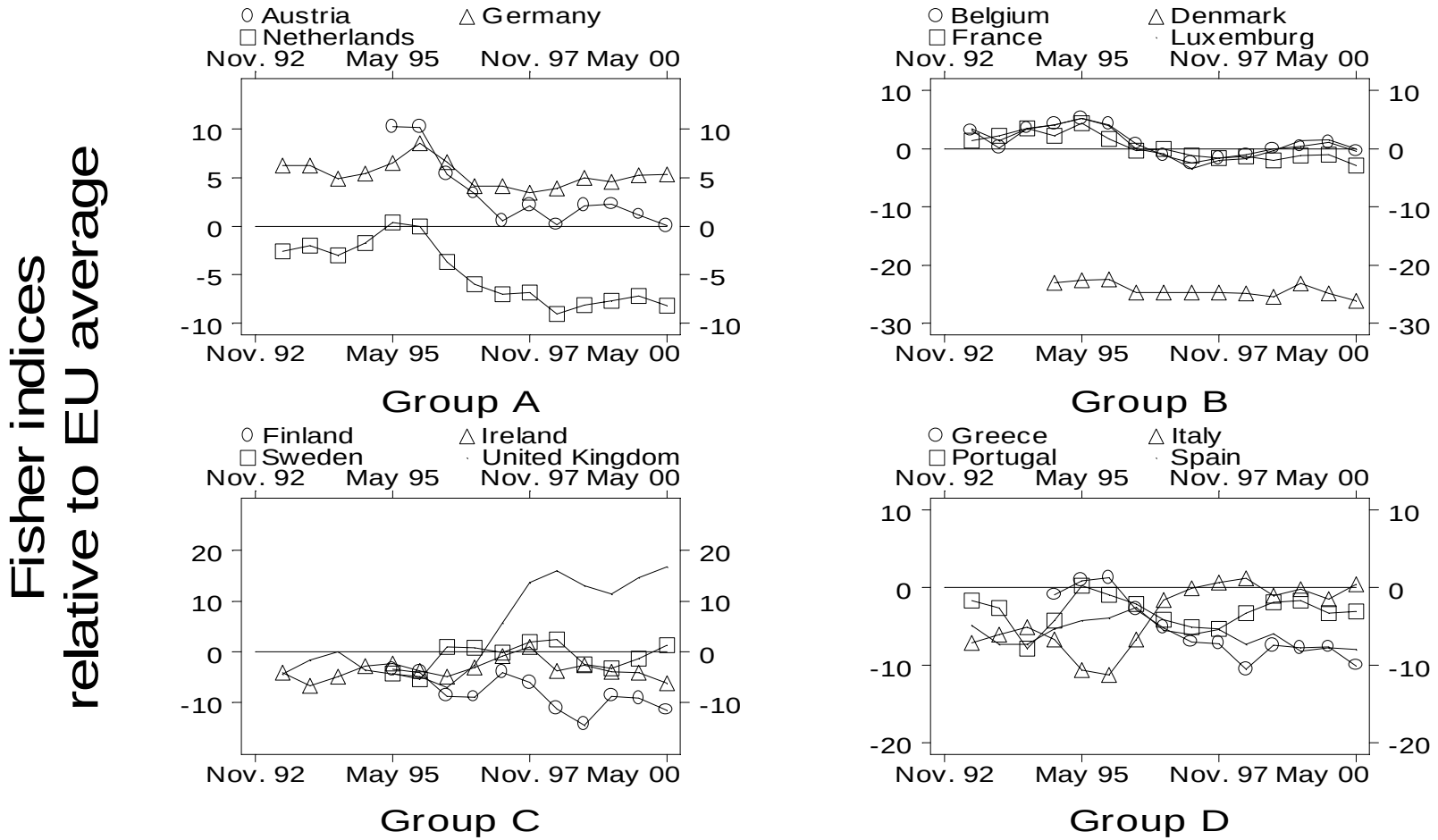

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Belgium
Denmark
France
Luxemburg
Finland
Ireland
Sweden
United Kingdom
Greece
Italy
Portugal
Spain
Nov. 92
May 95
Nov. 97
May 00
Group A
Group B
Group C
Group D
Segment D
Evolution of price differentials

Figure 16

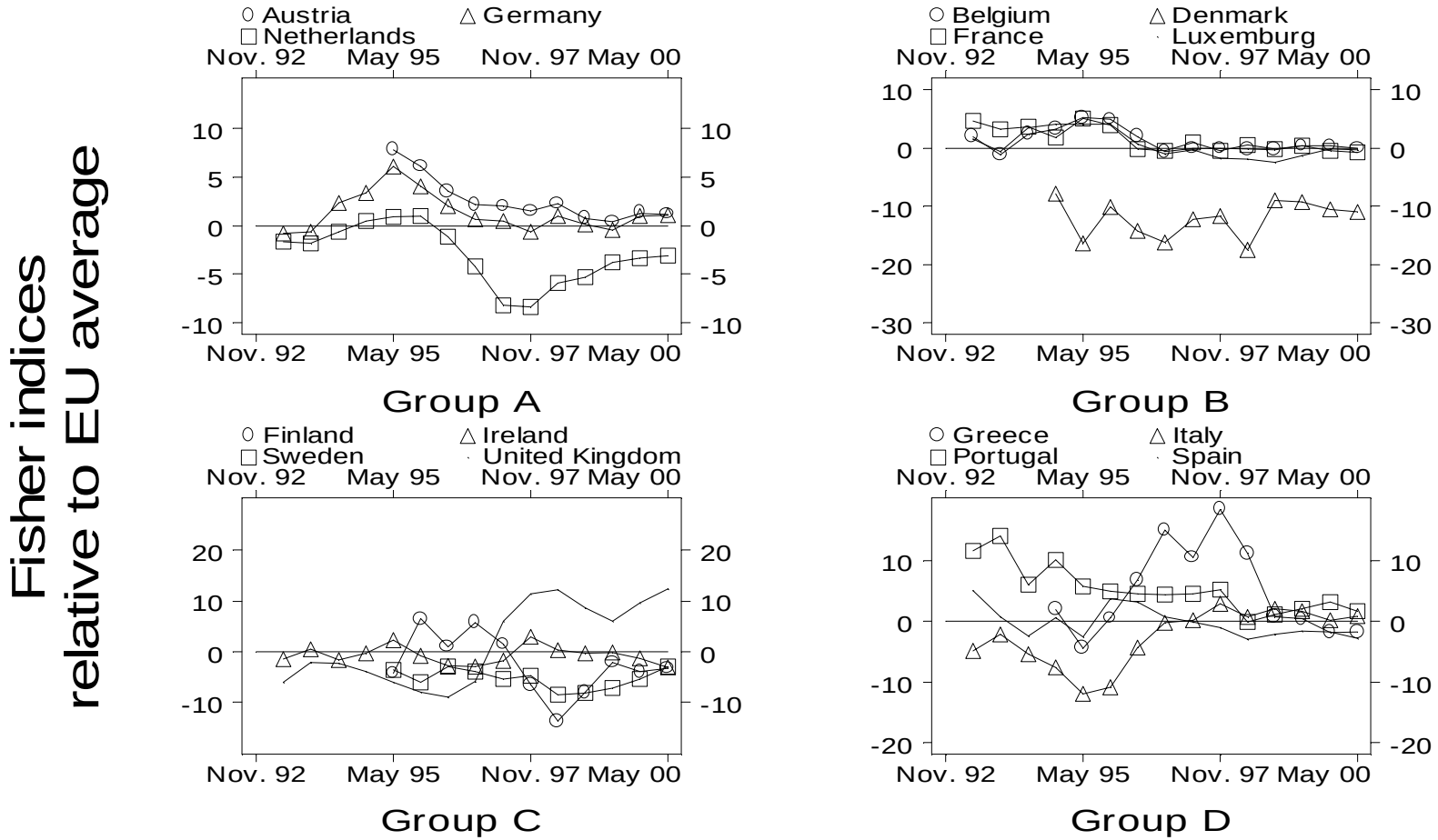
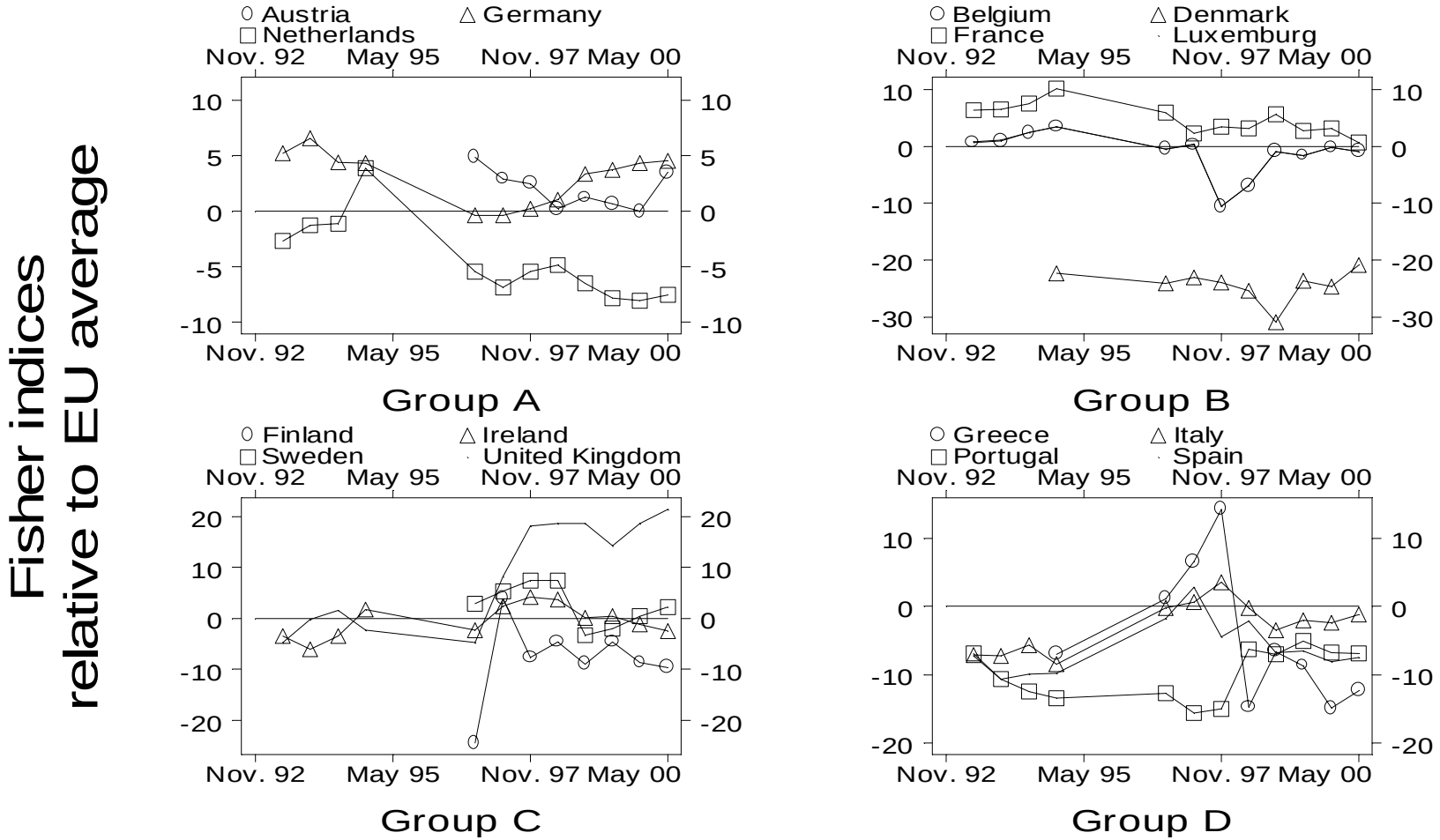

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Nov. 92
May 95
Nov. 97 May 00
Group A
Belgium
Denmark
France
Luxemburg
Group B
Finland
Ireland
Sweden
United Kingdom
Group C
Greece
Italy
Portugal
Spain
Group D
Segments E and F
Evolution of price differentials

Figure 17



French cars

Evolution of price differentials

Figure 18

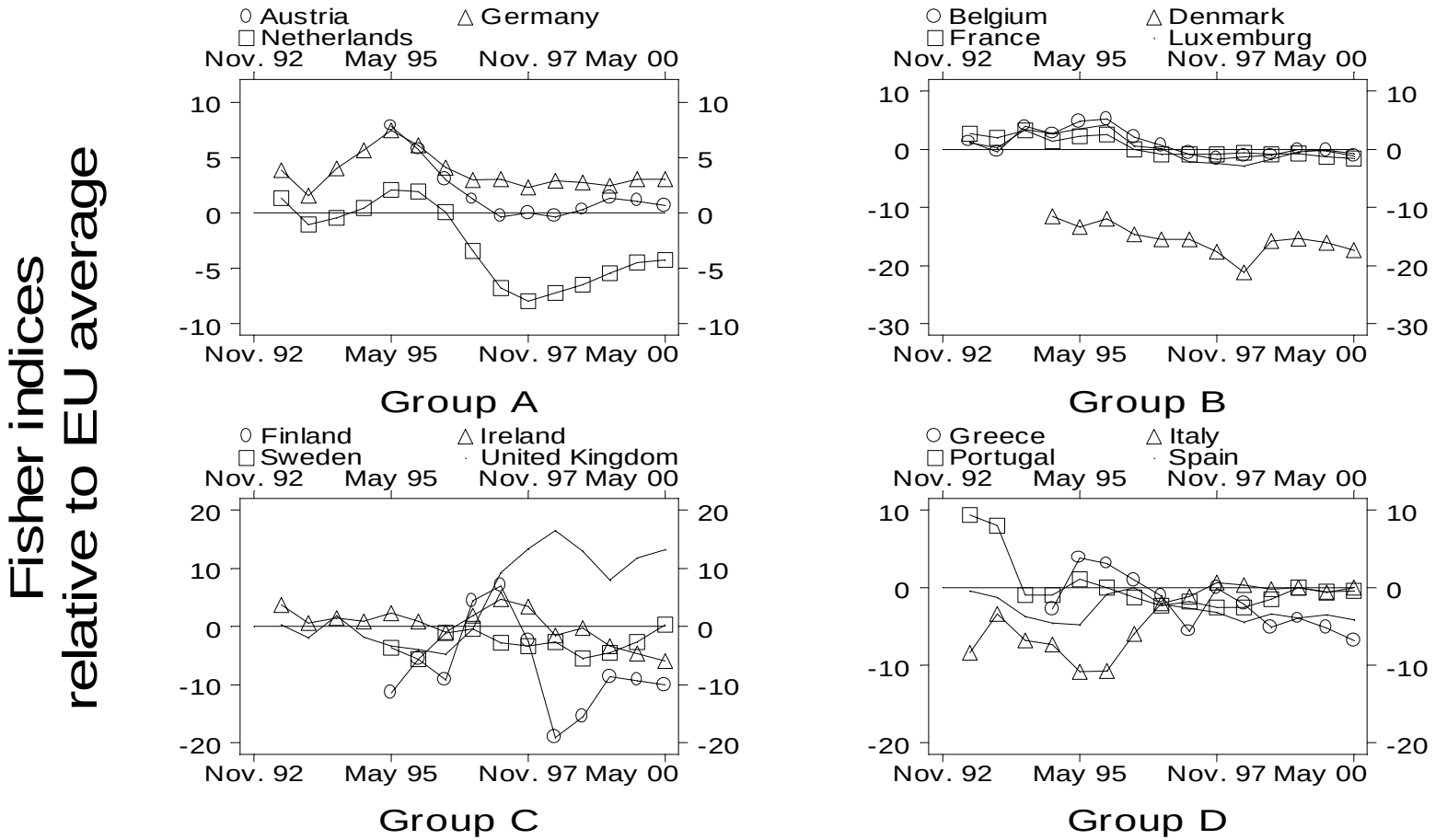

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Belgium
Denmark
France
Luxemburg
Finland
Ireland
Sweden
United Kingdom
Greece
Italy
Portugal
Spain
Nov. 92
May 95
Nov. 97
May 00
Group A
Group B
Group C
Group D
German cars
Evolution of price differentials

Figure 19

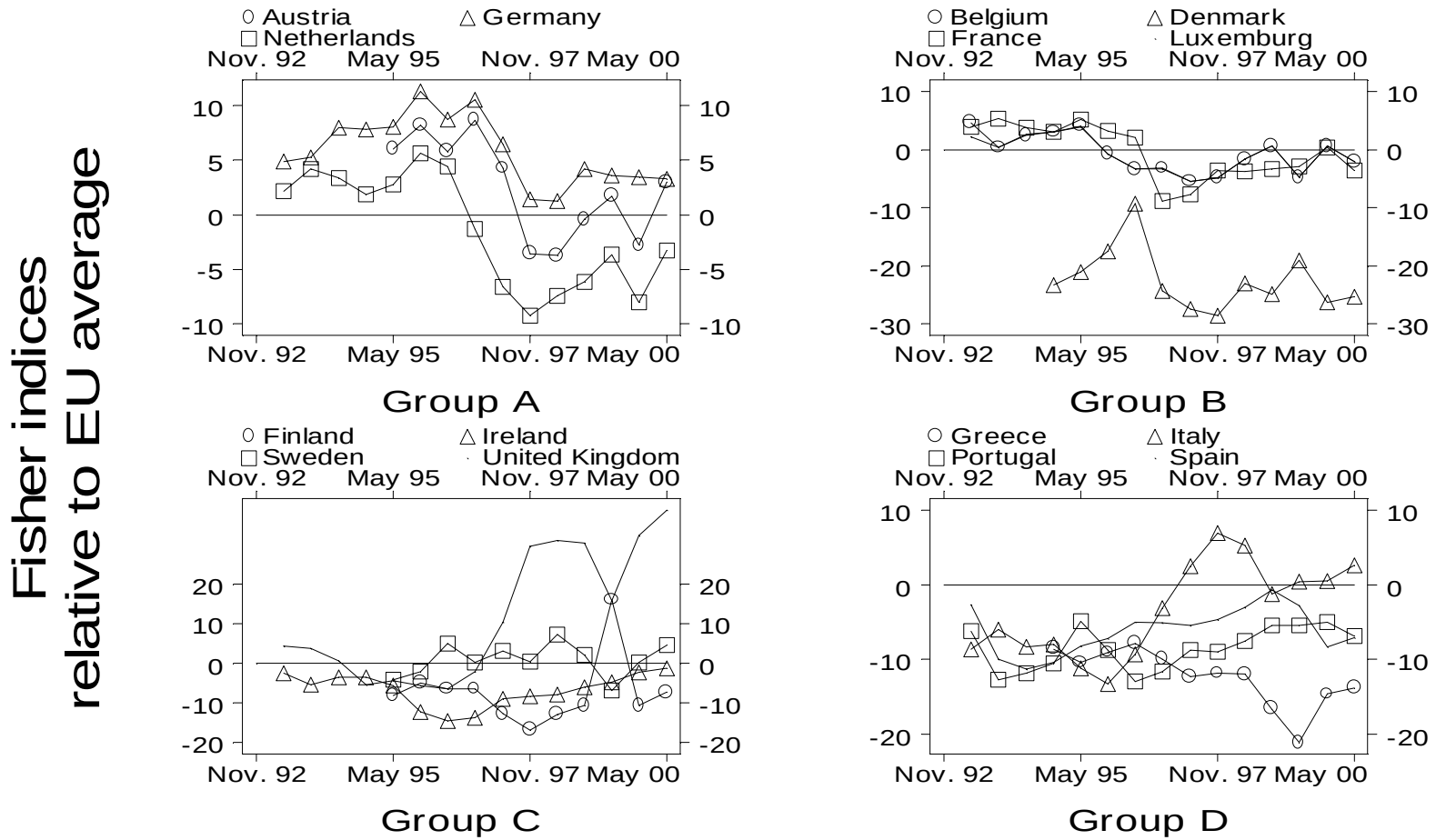
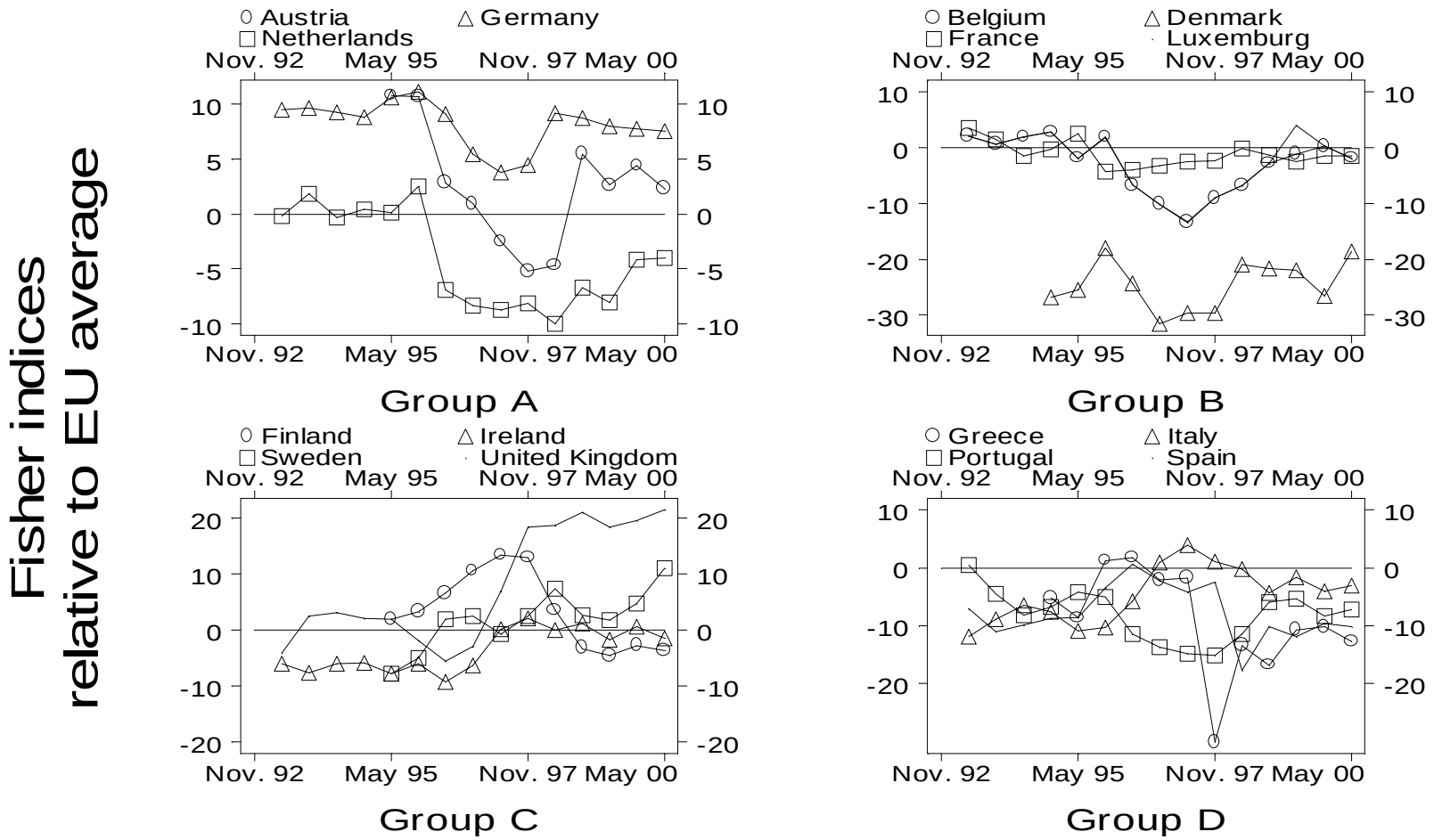

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Nov. 92
May 95
Nov. 97
May 00
Group A
Belgium
Denmark
France
Luxemburg
Group B
Finland
Ireland
Sweden
United Kingdom
Group C
Greece
Italy
Portugal
Spain
Group D
Italian cars
Evolution of price differentials

Figure 20



Ford and GME

Evolution of price differentials

Figure 21

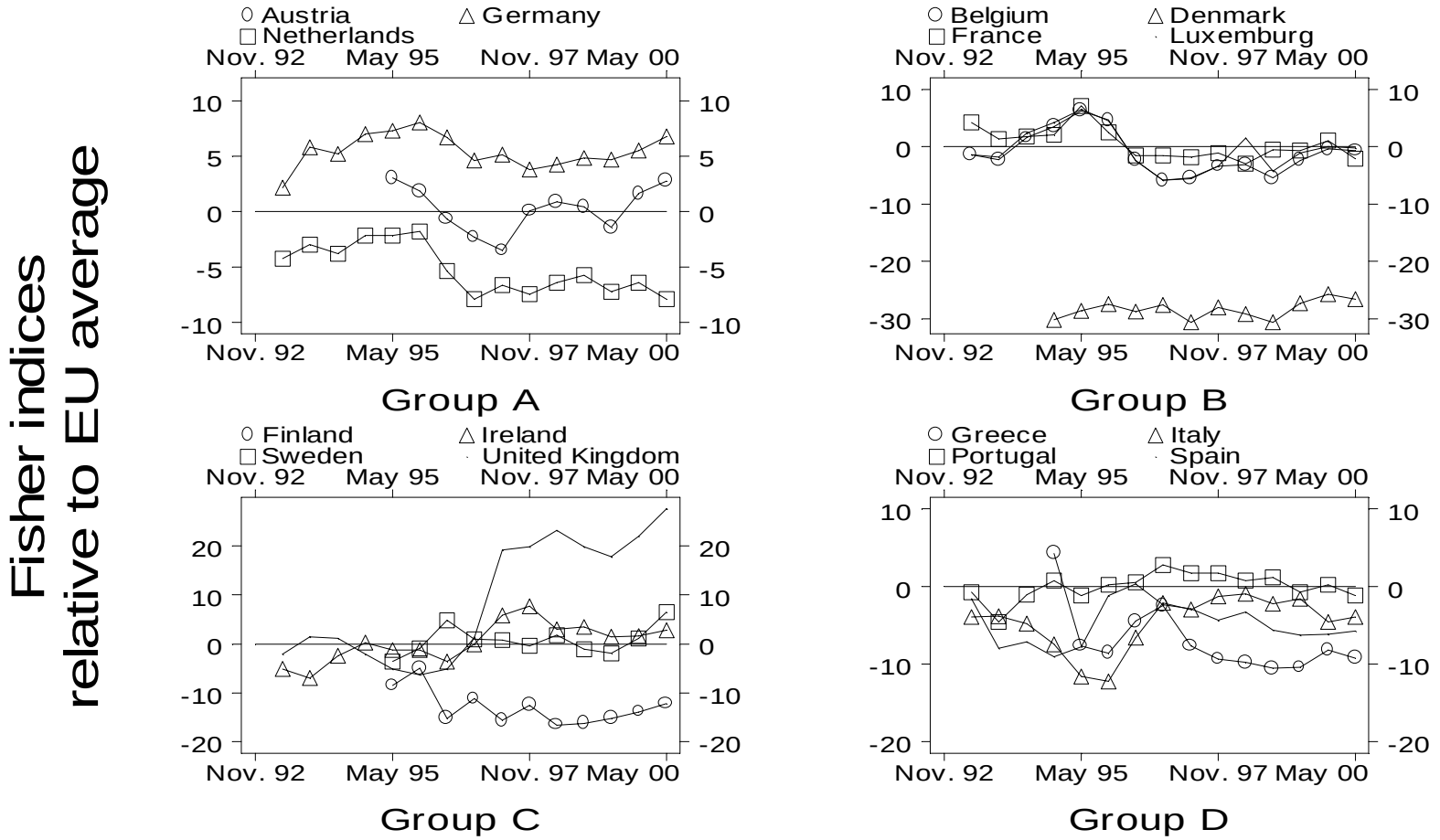

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Belgium
Denmark
France
Luxemburg
Finland
Ireland
Sweden
United Kingdom
Greece
Italy
Portugal
Spain
Nov. 92
May 95
Nov. 97
May 00
Group A
Group B
Group C
Group D
Japanese cars
Evolution of price differentials

Figure 22

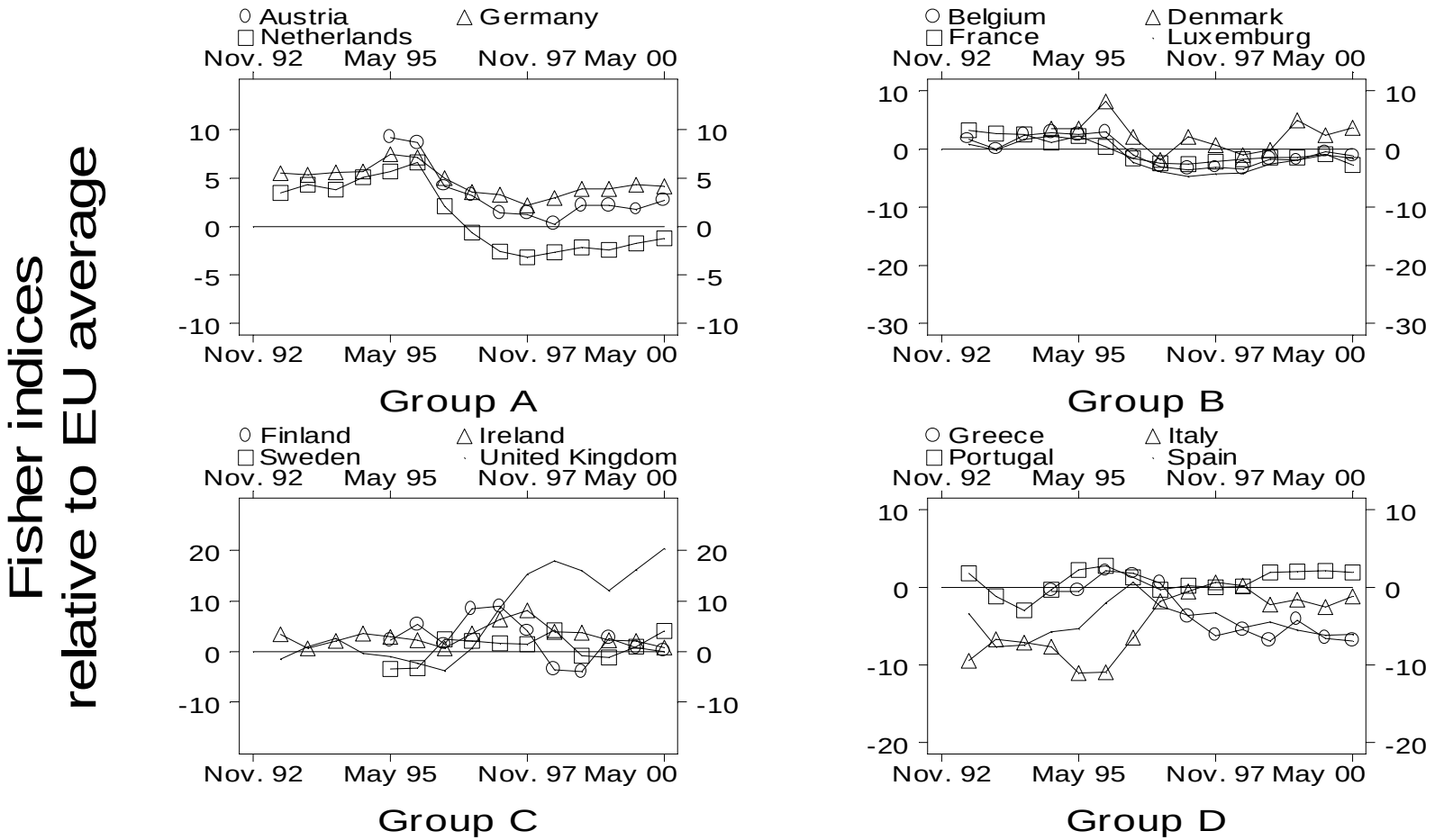
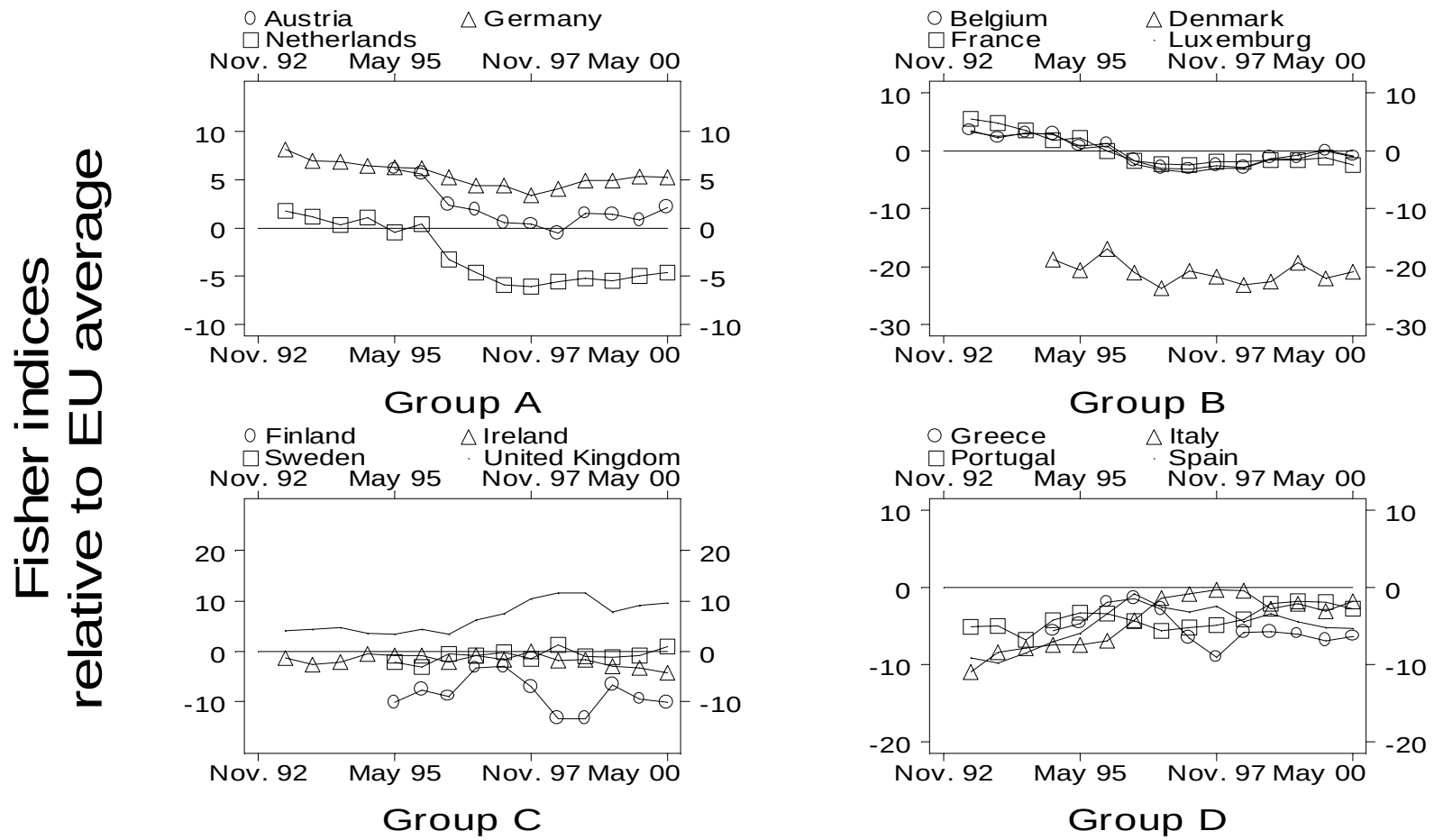

Fisher indices
relative to EU average
Austria
Germany
Netherlands
Belgium
Denmark
France
Luxemburg
Finland
Ireland
Sweden
United Kingdom
Greece
Italy
Portugal
Spain
Nov. 92
May 95
Nov. 97
May 00
Group A
Group B
Group C
Group D
All segments
Evolution of price differentials

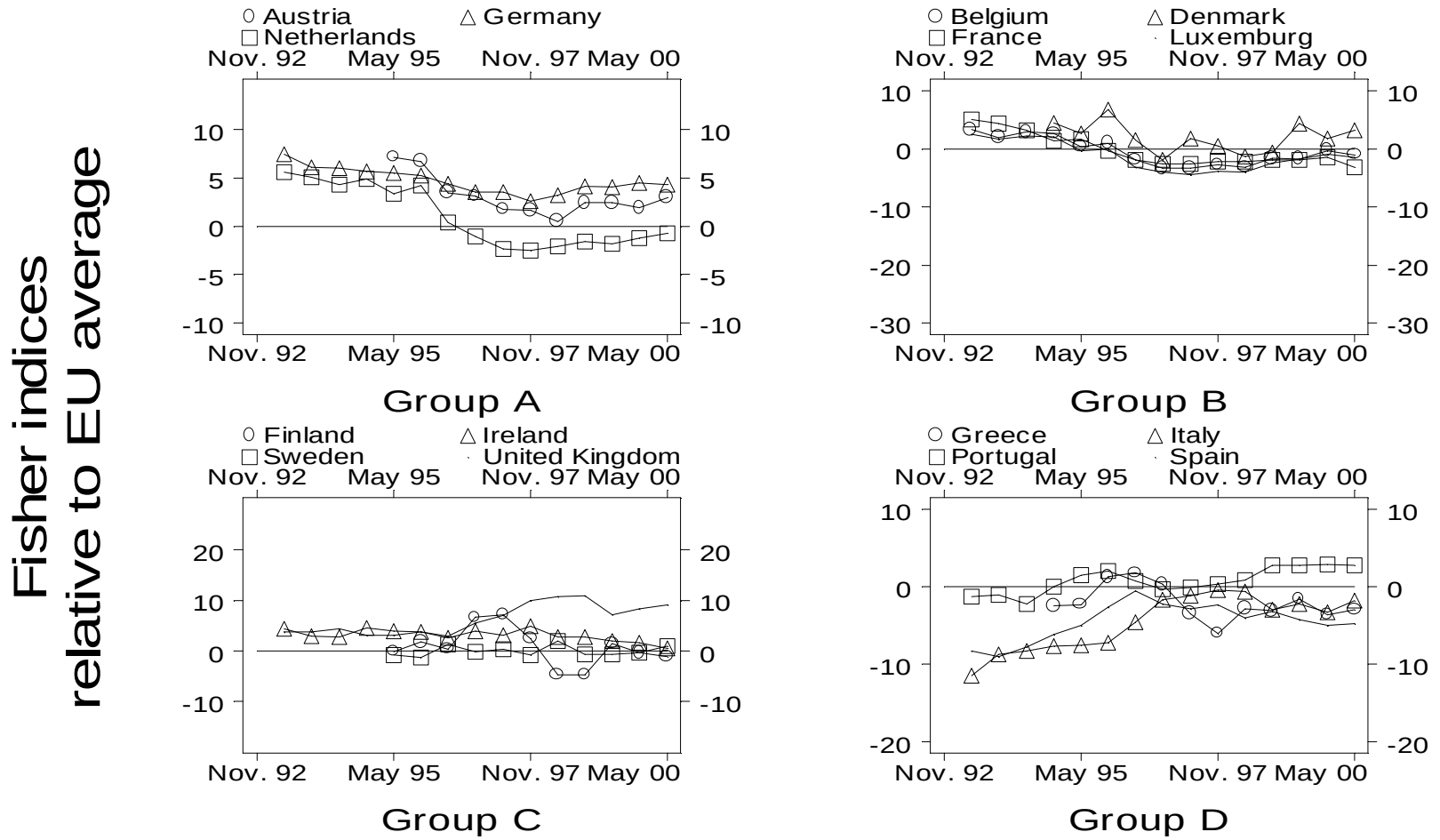
Figure 23



All segments

Evolution of price differentials

Figure 24



All segments

Evolution of price differentials

Figure 25

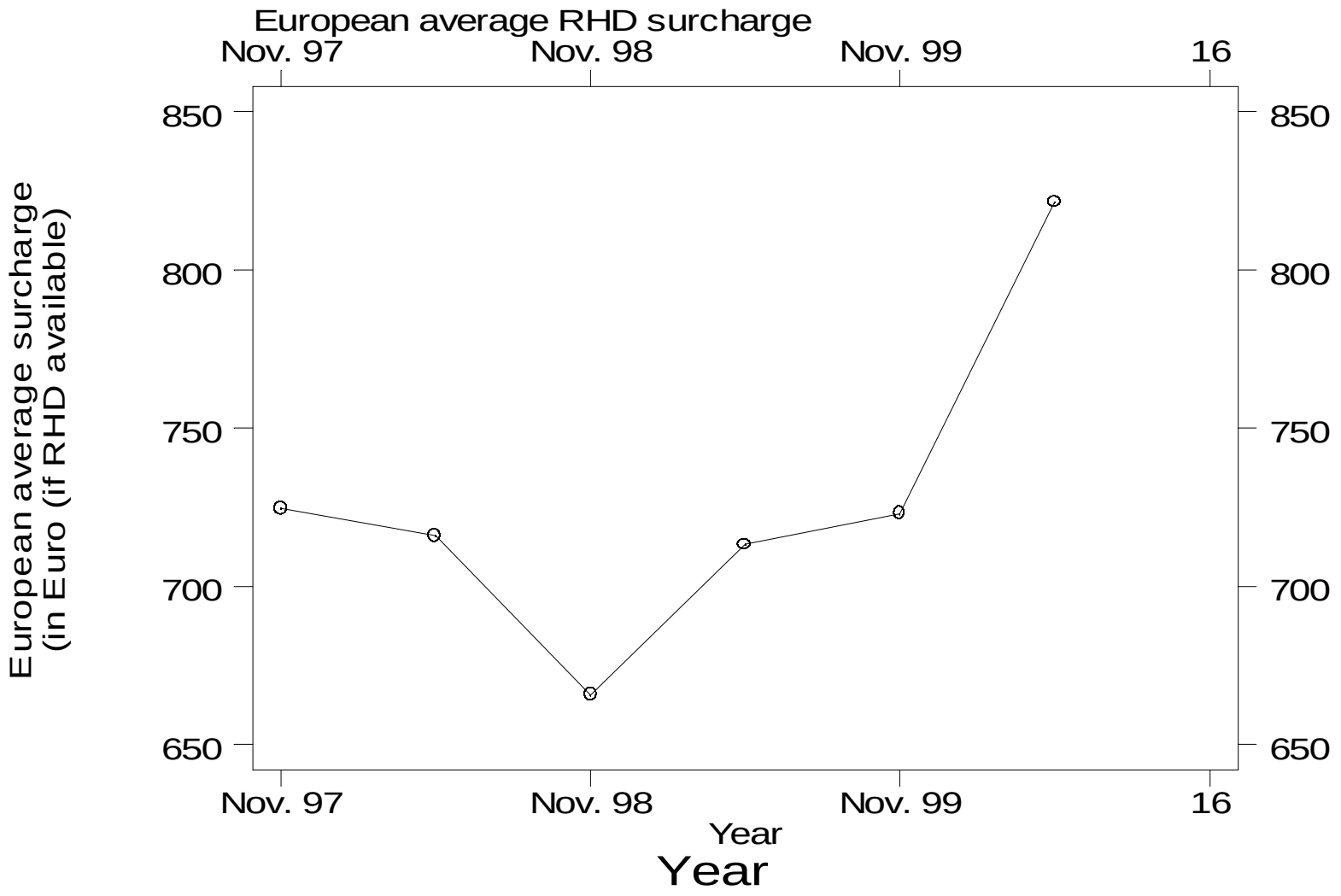

European average RHD surcharge
Nov. 97
Nov. 98
Nov. 99
16
850
800
750
700
650
European average surcharge
(in Euro (if RHD available)
Year
Year

Figure 26

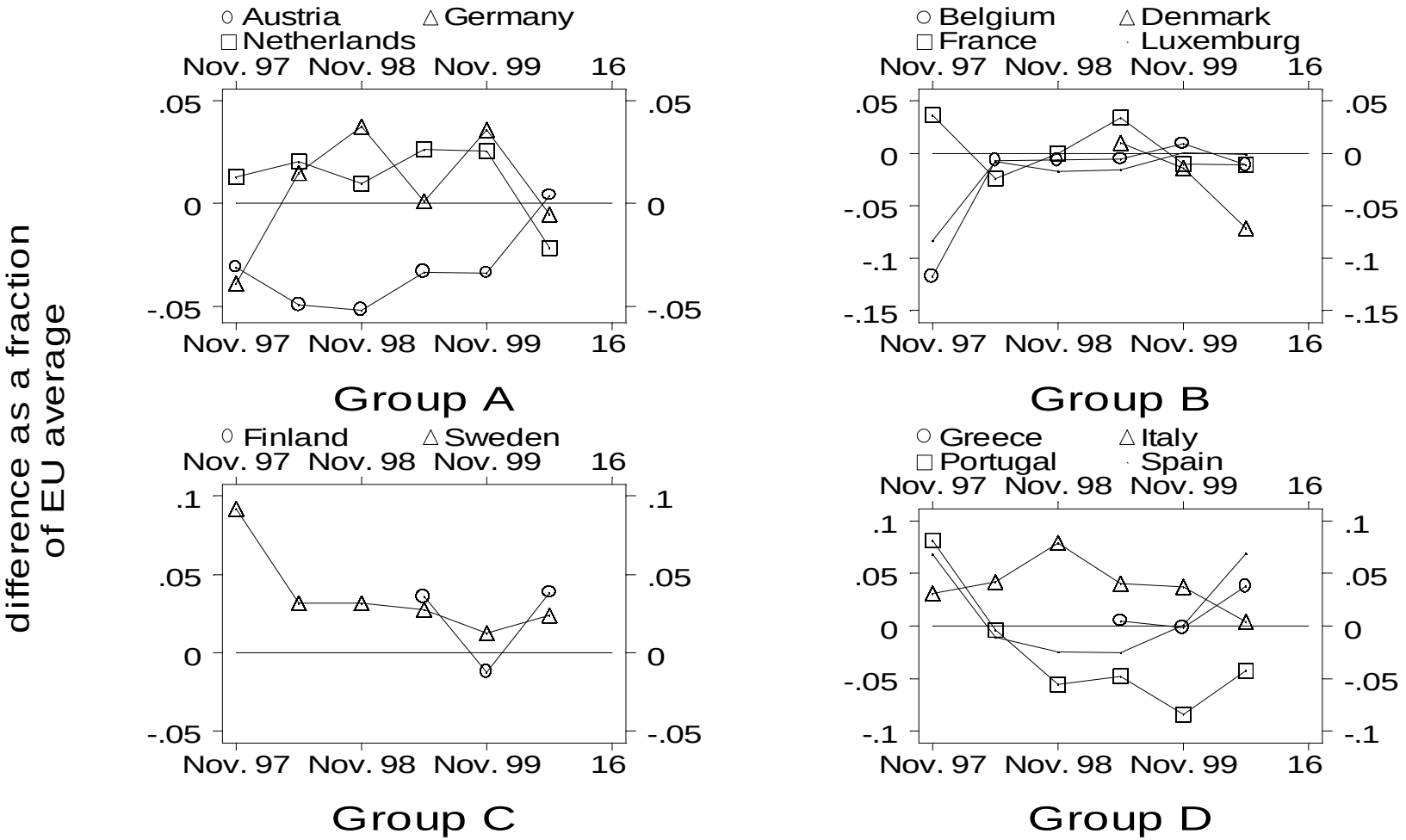
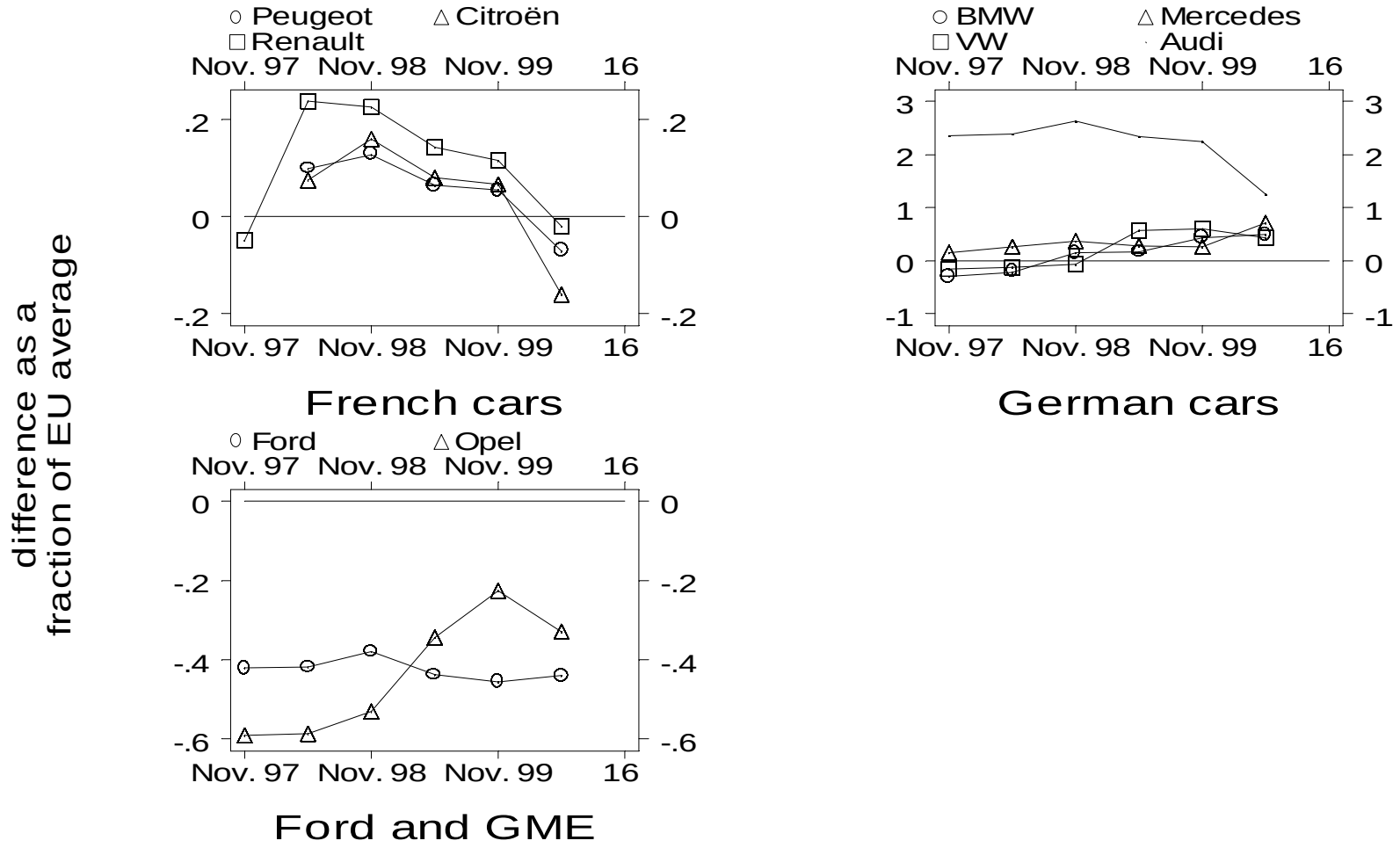

Austria
Germany
Netherlands
Belgium
Denmark
France
Luxemburg
Finland
Sweden
Greece
Italy
Portugal
Spain
Nov. 97
Nov. 98
Nov. 99
16
difference as a fraction of EU average
Group A
Group B
Group C
Group D
All segments
Evolution of RHD surcharge differentials

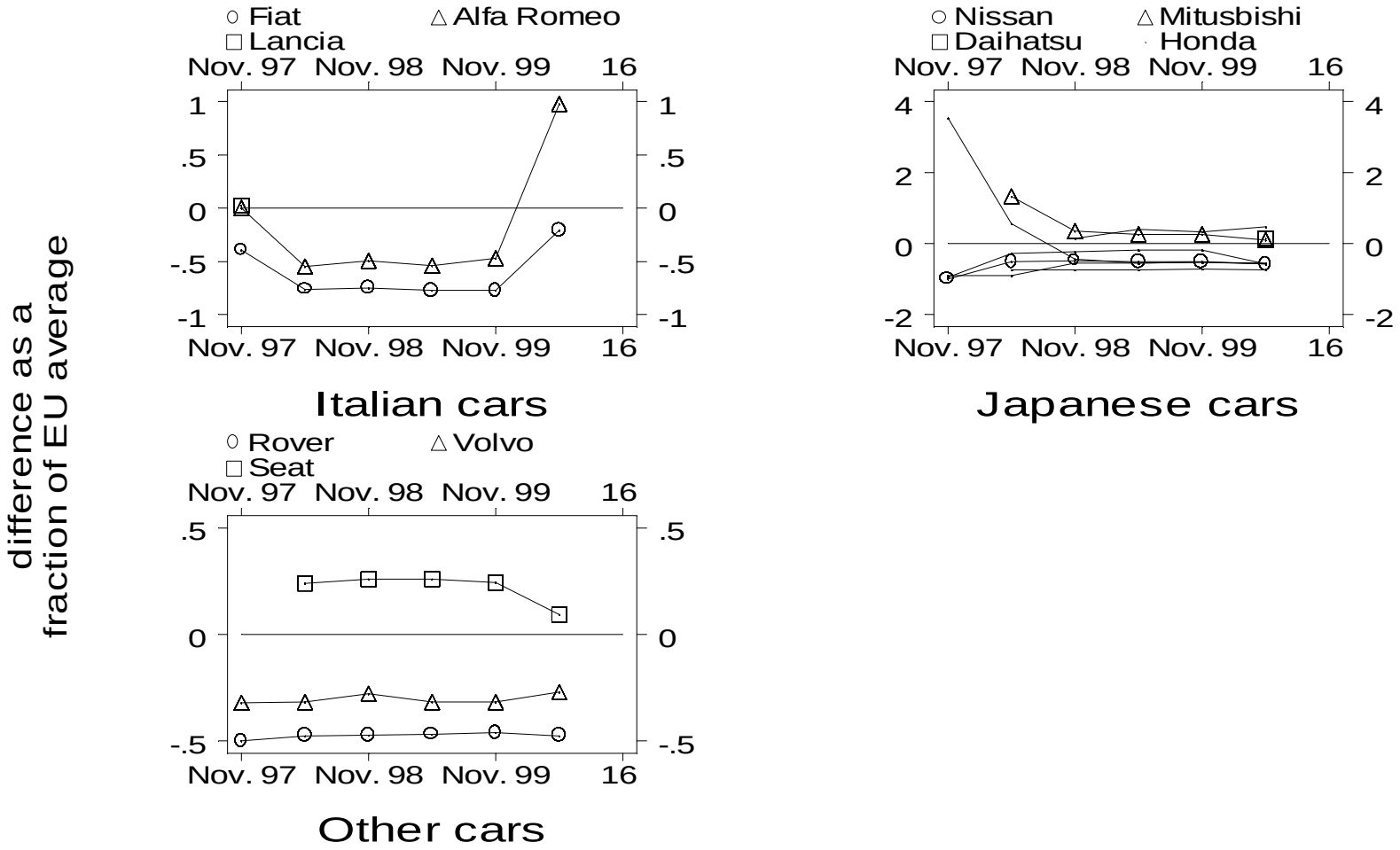
Figure 27



Evolution of RHD surcharge differentials

Figure 28

2



Evolution of RHD surcharge differentials

Figure 29

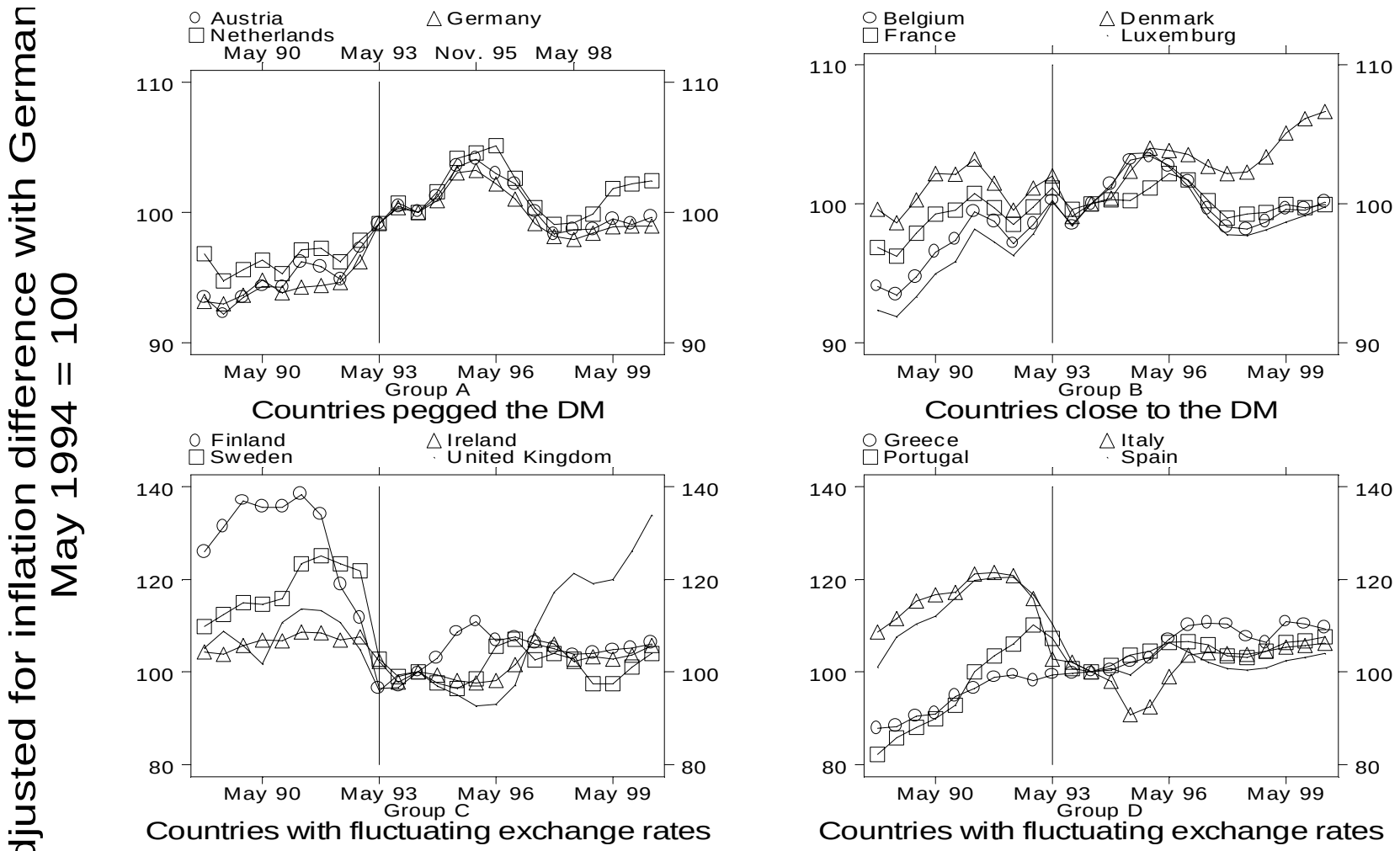
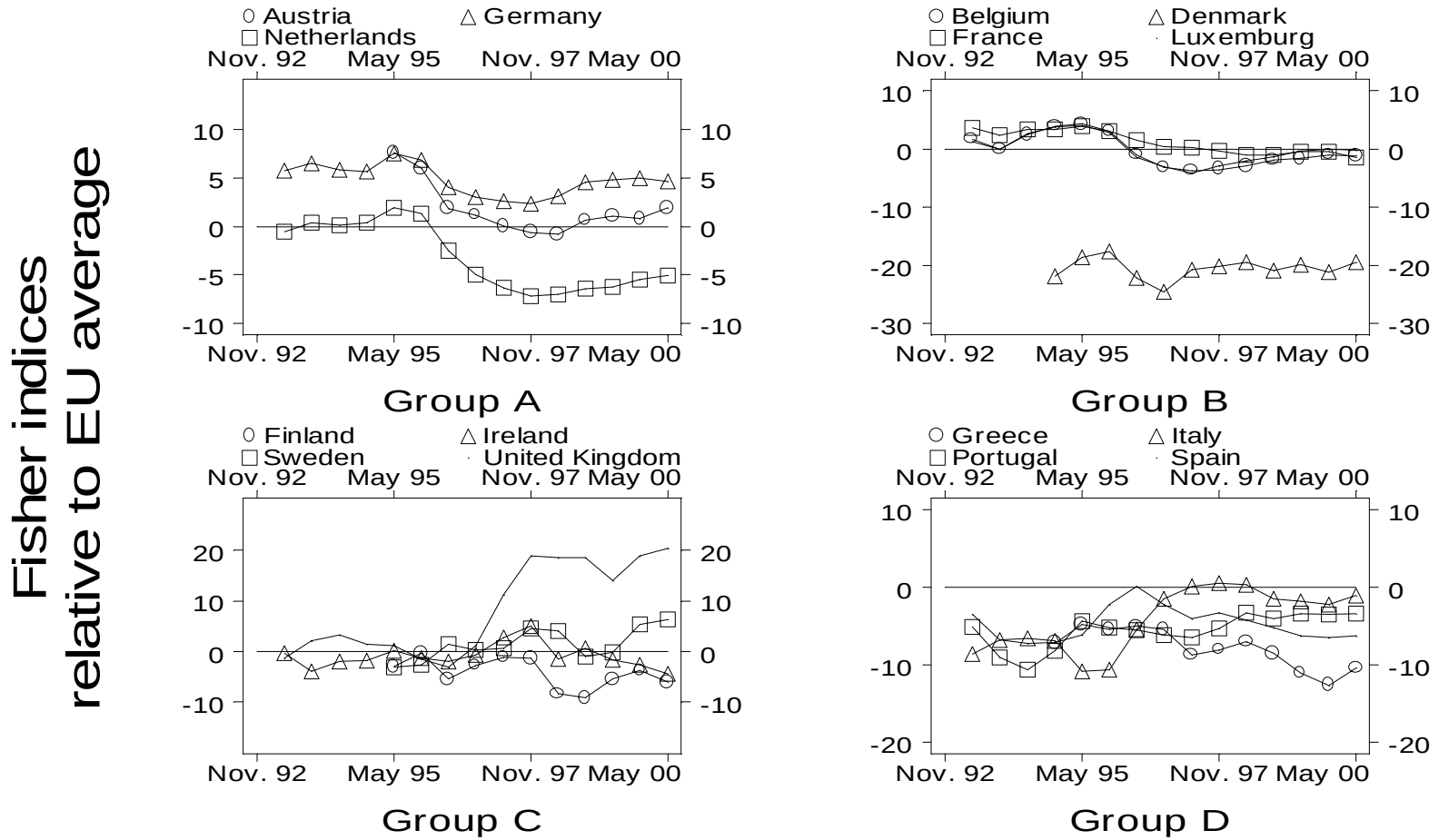

Adjusted for inflation difference with German
May 1994 = 100
Austria
Germany
Netherlands
May 90
May 93
Nov. 95
May 98
110
100
90
May 90
May 93
May 96
May 99
Group A
Countries pegged the DM
Belgium
Denmark
France
Luxemburg
Group B
Countries close to the DM
Finland
Ireland
Sweden
United Kingdom
140
120
80
Group C
Countries with fluctuating exchange rates
Greece
Italy
Portugal
Spain
Group D
Countries with fluctuating exchange rates
Evolution of real exchange rates

Figure 30


Fisher indices
relative to EU average
Austria
Germany
Netherlands
Nov. 92
May 95
Nov. 97 May 00
Group A
Belgium
Denmark
France
Luxemburg
Group B
Finland
Ireland
Sweden
United Kingdom
Group C
Greece
Italy
Portugal
Spain
Group D
All segments
Evolution of price differentials