

Prices and EMU

EMU study



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*This study has been prepared by HM Treasury to
inform the assessment of the five economic tests*

This study has benefited from review by Professor Holger Wolf, working in a personal capacity as an academic consultant to HM Treasury. All content, conclusions, errors and omissions in this study are, however, the responsibility of HM Treasury alone.

This is one of a set of detailed studies accompanying HM Treasury's assessment of the five economic tests. The tests provide the framework for analysing the UK Government's decision on membership of Economic and Monetary Union (EMU). The studies have been undertaken and commissioned by the Treasury.

These studies and the five economic tests assessment are available on the Treasury website at:

www.hm-treasury.gov.uk

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EXECUTIVE SUMMARY

Background 1 The creation of a single currency eliminates exchange rate risk and related transaction costs from purchases across the currency area. It also removes the need for exchange rate conversion when comparing prices across countries. These factors mean that businesses and consumers may be better able to compare prices and purchase the most competitively priced goods from across the single currency area. This could potentially lead to enhanced market efficiency and competition. Consumers would benefit from lower prices, increased quality and/or greater choice. There could also be a dynamic gain, with a shift of resources away from inefficient producers to the most efficient firms within the single currency area.

2 The creation of the Single Market for goods and services in the European Union (EU), along with domestic economic reform, has done much to enhance competition in the EU. The UK Government's White Paper *Realising Europe's Potential: Economic Reform in Europe* (HM Treasury, 2002) contains a detailed discussion of the impact of the Single Market programme on competition, including an analysis of consumer prices in the EU. And the UK Government's latest report reviews progress in this key area.¹ Existing academic work has also been drawn on wherever possible.

Prices and EMU 3 This study extends that work by incorporating recent inflation data to assess the latest trends in prices and also, importantly, to consider the likely impact on UK price trends if the UK were to join EMU (Economic and Monetary Union). It examines what explains relative price level movements between European economies during the 1990s and what has happened to euro area prices since the introduction of the euro – whether they have converged and how euro area price dispersion compares with dispersion in other monetary unions such as the United States.

4 Analysis of this issue is particularly relevant to the growth, stability and jobs test – the fifth of the Government's five economic tests for EMU entry – which includes consideration of the potential microeconomic gains from EMU; and to the second test on flexibility, which considers the role of prices as one of the various adjustment mechanisms available in EMU.

Analytical issues 5 The impact of joining a single currency on prices could have a number of dimensions. Joining EMU could be expected to have some immediate effect on prices because of changeover costs. However, these effects are by their very nature transitional, and less significant than the longer-term effects which could occur as EMU strengthens the Single Market.

6 The theory of arbitrage – and in particular the 'law of one price' – suggests that when there are no underlying barriers to trade, prices should converge to be identical across regions, once adjusted for the costs of trading between regions. Membership of EMU, by reducing currency costs and exchange risks, should – in theory – boost trade activity and competition, putting additional pressure on prices to converge across the euro area.

7 However, other costs of trading (such as transport) would remain. EMU does not, in itself, remove other barriers which place limits on price convergence. So significant variations in prices could be expected to remain within the euro area, particularly in sectors which are less exposed to trade.

¹ *Meeting the Challenge: Economic Reform in Europe* (HM Treasury, 2003b).

8 There is also evidence that prices are ‘sticky’ in response to changes in the nominal exchange rate. When nominal exchange rates change, firms do not always pass on the impact on prices – instead they often choose to insulate consumers from currency volatility. This means that, at any point in time, underlying relative prices can be significantly affected by recent changes in the nominal exchange rate. This makes it difficult to make relative price comparisons across countries.

9 This study includes, at Annex D, a new paper by Professor Holger Wolf of Georgetown University. Professor Wolf is a leading authority on the analysis of price levels and price differentials and his paper sets out the underlying theoretical framework which provides the analytical foundation for this study.

Aggregate analysis of relative prices

10 The relative price level is the ratio of domestic to foreign prices adjusted for the exchange rate between domestic and foreign currency. Having risen since the mid 1990s, the UK’s relative price level peaked at around 19 per cent above the EU average in 2000. It fell back to around 13 per cent above the EU average in 2002 as a whole, continuing to fall through the year and into 2003 reflecting a decline in relative prices driven by sterling’s depreciation against the euro. In January 2003, the UK’s relative price level is estimated to have been around 8 per cent above the EU average. Over the same period, Germany and France have become less expensive relative to the EU average – and Italy has become cheaper.

11 There is some evidence that, at the aggregate level, relative prices are correlated with relative labour costs and overall tax levels, although there is not a strong link with taxes on consumption. These factors would not be directly affected by EMU membership and, therefore, to the extent that they affect UK relative prices, they would remain a source of price dispersion if the UK were to join EMU.

12 Much of the rise in UK relative prices since the mid 1990s is explained by the appreciation of sterling over this period. Movements in the relative price levels of other major European economies were also affected by nominal exchange rate changes. So while there is limited evidence that prices in euro area countries have converged on the EU average since the mid 1990s, this is partly the result of exchange rate movements.

13 Nevertheless, the coefficient of variation for prices in the EU15² – which gets smaller as prices converge – showed signs of declining during the 1990s. There is more evidence of convergence in some sectors than others. Indeed some sectors have shown signs of price divergence. Price convergence appears to be greater in the geographical core of the euro area (France, Germany, Belgium, the Netherlands and Luxembourg) than in the ‘periphery’. It is possible that this is due to an EMU effect – particularly bearing in mind that there were strong market expectations of EMU going ahead before currencies were actually locked in 1999.

Detailed sectoral analysis of prices

14 Detailed sectoral analysis shows that prices for similar goods vary widely between countries in the EU – to the extent that some supermarket goods can be found at half their maximum EU retail price in other Member States. However, there is no European country which is found to have uniformly high or low prices, although UK prices tend to be at the high end for a number of products. This suggests that sectoral factors, such as the degree of competition in different industries and variations in transport costs for different types of goods, are important in explaining existing price differentials. These would not be directly affected by EMU membership.

² This is one of a broad range of indicators for assessing Europe’s performance in economic reform. See *Structural Indicators of European Reform: Measuring Europe’s Progress* (HM Treasury, 2003a).

15 It is difficult to say which UK sectors might experience the greatest degree of price convergence as a result of a decision to join EMU. Price convergence seems to be higher in industries where there are more large firms and more cross-border trade. However, the main impact of EMU membership on price convergence would be likely to come through reduced exchange rate costs. Such costs may be a larger barrier to trade for small firms and consumers than for large firms.

16 Price dispersion is lower in the US than in the EU, suggesting that there is significant scope for further price convergence within the EU. However, it is difficult to know to what extent the lower degree of price dispersion in the US reflects its longstanding and mature currency union, and to what extent it reflects the lack of internal political boundaries and a more competitive general trading environment. What evidence there is suggests that price convergence takes many years to achieve.

The study in the context of the set of EMU studies

17 The focus of this study is on the demand side of the potential microeconomic gains from EMU. Consumers would benefit from lower prices, greater quality and/or increased choice if EMU were to promote increased competition through the removal of exchange rate costs and increased price transparency. However, there would also potentially be dynamic gains on the supply side. Increased competition might promote cross-border trade and investment, and could lead to changes in the industrial environment as firms restructure in reaction to new markets. These issues are considered in other EMU studies.

Conclusions: prices and EMU

18 The evidence surveyed in the study suggests that there is scope for further price convergence in the EU, and between the UK and other European economies. The effect of EMU on price convergence is likely to be greatest where transaction costs and exchange rate risk form a significant proportion of trading costs.

19 However, while EMU should reduce the extent of price divergence, it will not eliminate it – costs such as those of transport and information and local differences in taxes and wages will not necessarily be affected by EMU. Moreover, remaining price differentials are likely to vary across sectors. Overall, the process of price convergence is likely to take a considerable amount of time.

20 These conclusions, in turn, suggest some implications for the relationship between EMU and competition. A single currency has the potential to intensify competition, particularly by increasing the likelihood of cross-border entry into markets. It would only be possible to gain these benefits in full, however, by working in parallel to tackle other barriers to competition in Europe – addressing other impediments to effective competition and well-functioning markets.

21 The Government has pursued reforms to improve competition both in the UK and in the EU. The Enterprise Act has given the UK competition authorities full independence and more effective powers with which to work proactively to promote competition. In Europe, the Government has strongly supported economic reform and has pressed for structural improvements to product, capital and labour markets to make them work better. Earlier this year, the Government reported on progress in *Meeting the Challenge: Economic Reform in Europe* (HM Treasury, 2003b).

22 This study is an input into the assessment of the flexibility test – the second of the Government’s five economic tests for EMU entry – and the growth, stability and jobs test – the fifth of the five tests.

INTRODUCTION

1.1 The potential impact of EMU on prices is a key element of the potential microeconomic gains from a currency union. The creation of a single currency eliminates exchange rate risk and transaction costs from purchases across the currency area. It also removes the need for exchange rate conversion when comparing prices across countries. These factors mean that businesses and consumers may be better able to compare prices and purchase the most competitively priced goods from across the single currency area. This facilitates trade and puts pressure on price differentials across the single currency area.

The aims and structure of the study

1.2 This study explores the causes of price differentials in the EU at present and assesses how far, in what sorts of sectors and how quickly EMU membership might encourage greater convergence between prices in the UK and the euro area. After setting out the theoretical background in Section 2, the study examines price differentials in the EU at aggregate and disaggregated levels. It extends research in this area by undertaking new analysis of trends in aggregate relative price levels in the major EU economies over the past decade. The study also explores evidence from the United States, and what it suggests about how prices might converge in the euro area. In general, the amount of academic research and analytical work on these issues tends to be more limited than on issues explored in other EMU studies.

Prices, price dispersion and competition

1.3 Price differentials and price dispersion can indicate restrictions on competition. For instance, retailers might use their (individual or collective) market power to segment markets and so charge different prices as a way of achieving higher profits. Conversely, it might be expected that, to the extent that EMU had an effect on competition, it would serve to enhance competitive pressures by removing exchange rate risk and transaction costs from transactions within the currency area. The October 1997 assessment noted that:

“The single currency could deepen competition in some parts of the Single Market. It will reduce transaction costs and exchange rate uncertainty on trade within the euro-zone. It will also make prices more transparent and easier to compare across the Single Market.” (HM Treasury, 1997, page 7.)

1.4 The economic evidence strongly supports a positive relationship between effective competition and productivity, innovation and efficiency. This relationship operates both through strengthening the incentive for firms to reduce costs and to increase quality, and through allocating resources more efficiently between successful and unsuccessful firms.¹

1.5 It was for this reason that the Government reformed the UK competition regime, to drive up domestic competition and so productivity. The reforms outlined in the DTI White Paper *Enterprise and Productivity: A World-Class Competition Regime* (2001) and implemented by the 2002 Enterprise Act gave the competition authorities full independence and more effective powers with which to work proactively to promote competition.

1.6 The Single Market and EU competition policy have also done much to promote competition in Europe. However, research into the EU’s comparative economic performance has frequently highlighted barriers to, and restrictions on, competition as one of the most important obstacles to improved productivity and growth. For instance, a recent McKinsey Global Institute study (McKinsey, 2002) found that insufficient competition (along with restrictive regulation) was the most significant factor in explaining some EU countries’

¹ See, for instance, Nickell (1996); Blundell, Griffith and van Reenan (1995); Geroski (1990); Barnes and Haskel (2000); Caves (1998).

relatively weak productivity performance compared with the US.² Similarly, analysis by the OECD (OECD, 2002) concluded that greater competition could provide a significant boost to EU productivity.

1.7 Strengthening competition is therefore an important means to securing a more productive EU economy and is a key part of the Government's agenda for working towards the goals agreed at the Lisbon Summit in 2000. The UK Government's White Paper *Realising Europe's Potential: Economic Reform in Europe* (HM Treasury, 2002) contains a detailed discussion of the impact of the Single Market programme on competition, including an analysis of prices in the EU. As well as providing information on the likely impact of EMU on prices in the UK and the euro area, the analysis in this study helps in assessing underlying competitive pressures in Europe.

1.8 The study is split into the following sections:

- Section 2 reviews the **theoretical issues** and explores the ways in which entry into EMU might affect UK prices;
- Section 3 looks at **aggregate UK and EU relative price levels**, and at the factors which appear to influence them including the nominal exchange rate, relative labour costs and relative taxes; and
- Section 4 looks in more detail at studies and surveys of **individual sectors of the economy**, and draws a comparison with the US experience.

1.9 The focus of this study is on the demand side of the potential microeconomic gains from EMU. Consumers would benefit from lower prices, greater quality and/or increased choice if EMU were to promote increased competition through reduced exchange rate costs and increased price transparency. However, there would also potentially be dynamic gains on the supply side. Increased competition might promote cross-border trade and investment, and could lead to changes in the industrial environment as firms restructure in reaction to new markets.

The study in the context of the EMU assessment and studies

1.10 The analysis in this study contributes to HM Treasury's assessment of the five economic tests for EMU membership. It is particularly relevant to the fifth test on growth, stability and jobs, which considers the potential microeconomic gains from EMU; and to the second test on flexibility, which considers the role of prices as one of various adjustment mechanisms in EMU.

1.11 Related issues are considered in other EMU studies. The impact of EMU on trade is analysed in the EMU study by HM Treasury *EMU and trade*. The potential impact of EMU on industrial structure and on firms across sectors of the economy is considered in the EMU study by HM Treasury *EMU and business sectors*. Analysis of the microeconomic benefits of monetary union in the US is provided in the EMU study by HM Treasury *The United States as a monetary union*. Finally, exchange rate issues are explored in both the EMU study by Professor Simon Wren-Lewis *Estimates of equilibrium exchange rates for sterling against the euro* and in the EMU study by HM Treasury *The exchange rate and macroeconomic adjustment*.

Professor Wolf's study

1.12 To provide a broader picture of the theoretical issues, this study also includes, at Annex D, a specially commissioned paper by Professor Holger Wolf of Georgetown University. Professor Wolf's work sets out the economic theory of price differentials across locations and discusses the available evidence on international relative prices.

² The study focused on seven sectors, including retailing and banking, in France and Germany.

2

THE THEORY OF PRICES AND ARBITRAGE

Joining EMU could be expected to have some immediate effects on prices because of changeover costs. But these are by their very nature transitional, and less significant than the more dynamic effects which could occur as EMU strengthens the Single Market.

The theory of arbitrage – and in particular the ‘law of one price’ – suggests that when there are no underlying barriers to trade, prices should converge to be identical across regions, once adjusted for the costs of trading between regions.

Membership of EMU, by reducing currency costs and exchange risks, should – in theory – boost trade activity and competition, putting additional pressure on prices to converge across the euro area. However, other costs of trading (such as transport) would remain. EMU does not, in itself, remove other barriers which place limits on price convergence. The EU’s Single Market programme has played a significant role in bringing down these barriers.

Also, there is evidence that prices are ‘sticky’ in response to changes in the nominal exchange rate. When currency rates change, firms do not always pass on the impact on prices – instead they often choose to insulate consumers from currency volatility. This means that, at any point in time, underlying relative prices can be significantly affected by recent changes in the nominal exchange rate. This makes it difficult to make relative price comparisons across countries.

2.1 This section describes the economic theory which is relevant to understanding the behaviour of prices in the UK, how this has been changed by participation in the European Single Market, and how it could change further if the UK were to join EMU.

2.2 The impact of joining EMU on prices could have a number of dimensions:

- there could be **transitional** effects on price levels, reflecting the cost of the changeover itself (e.g. replacing equipment) and clustering of planned price changes to coincide with the introduction of new notes and coins; and
- more enduringly, and occurring **over a longer time period**, savings in the costs of trade – through the removal of currency conversion costs and exchange rate risks, and because greater price transparency makes searching for cheaper deals easier – could boost trade activity and competition. Businesses and consumers would find it easier to take advantage of differences in prices and to purchase from the cheapest locations and sell in more expensive ones. Increased opportunities for this activity – known as ‘arbitrage’ – should have the effect of gradually eroding price differentials within the single currency area.

Prices, competition and productivity

2.3 The effects of EMU on prices are therefore closely related to the effects of EMU on competition. As set out in Section 1, there is a strong base of evidence which suggests that effective competition can drive productivity through strengthening the incentive for firms to reduce costs and to increase quality, and through allocating resources more efficiently between successful and unsuccessful firms.

2.4 For instance:

- Nickell (1996) and Blundell, Griffith and van Reenan (1995) find that competitive pressures (measured in various ways) have a positive impact on the efficiency of firms and on growth in their productivity. Lack of competitive pressure, measured by supranormal profits and size of market shares, has a negative impact on future productivity growth;
- Geroski (1990) concludes that concentration and other measures of market power tend to reduce the rate of innovation and hence of productivity growth;
- Caves and Barton (1990) find that increases in market concentration are associated with reduced technical efficiency, consistent with the view that competition leads firms to adopt more efficient and effective decision-making structures;
- Barnes and Haskel (2000) attribute between 30 and 50 per cent of UK and US productivity growth to entry and exit rates; and
- Caves (1998) finds that new entrants bring with them higher levels of productivity.

2.5 The paper *International Relative Prices: Facts and Interpretation* by Professor Holger Wolf of Georgetown University, included as Annex D to this study, explores some of the theoretical issues around prices in more detail and is drawn on in this section. Sections 3 and 4 of this study build on the theoretical framework set out here to examine the recent behaviour of prices in other European countries, especially those that joined EMU in 1999, and to assess the likely potential for, and limits to, further price convergence in Europe.

Short-term changeover effects

2.6 Data on changes to euro area prices since the establishment of the euro, and in particular the introduction of notes and coins, are still relatively scarce as such a short time has elapsed. Nevertheless, there has been public debate about the introduction of notes and coins, which some allege was used by retailers to introduce higher prices to consumers.

Inevitable changeover costs 2.7 Economic theory suggests at least two reasons why a one-off price increase might be associated with the introduction of a new currency:

- the introduction of a new currency imposes certain ‘menu costs’ – for example, relabelling, updating computer systems and ensuring that staff are aware of changes. These costs may well be passed on to the consumer in the form of one-off price increases; and
- the existence of menu costs means that it is more efficient (regardless of currency change issues) for retailers, producers, and providers of services to update their prices periodically rather than constantly. A business could reduce its overall menu costs by bringing forward or holding back planned price increases¹ to coincide with the currency change, producing an apparent ‘clustering’ of price increases around the introduction of the new currency.²

¹ Measured prices tend to rise over time, in the context of growth. Hence it is more likely that clustered price changes will be in an upward rather than a downward direction.

² Price rises sometimes cluster for other reasons, including seasonal factors. If the introduction of a new currency coincided with one of these seasonal clusters, this could further confuse the picture and exaggerate the effect, if any, of the introduction of the new currency on price rises.

2.8 Additionally, there may be some tendency for prices to change in order to produce more attractive rounded figures in the new currency. In principle, this could be upward or downward, but may combine with normal inflationary pressures to produce a further one-off increase.

2.9 The evidence suggests that, at the aggregate level, the immediate changeover effects associated with the introduction of the euro were only small. For the euro area as a whole, the rate of HICP (harmonised index of consumer prices) inflation for the first half of 2002 was broadly similar (at 1.4 per cent) to the rate for the first half of 2001. Eurostat analysis (reported in European Commission, 2002c) suggests that almost all of the inflation that occurred in the first half of 2002 can be accounted for by factors other than the introduction of euro notes and coins. These factors included bad weather affecting fruit and vegetable prices and increases in car and energy prices. Analyses of those euro-related effects on overall price levels that did occur emphasise rounding effects (e.g., Gallot (2002), for France, found that prices were effectively being set at euro-related prices in some sectors from the second quarter of 2001).

Variation by country and by sector

2.10 The apparent disparity between this evidence and reported consumer perceptions (according to the European Commission's March 2002 Eurobarometer survey, 67.3 per cent of euro area consumers perceived prices as having been rounded up as a result of the changeover) can partly be explained by looking at each country separately and at each month around the changeover.

Table 2.1: HICP annual rate of inflation for euro area countries, per cent

	June 2001	Dec 2001	Jan 2002	June 2002
Austria	2.6	1.8	2.0	1.5
Belgium	3.0	2.0	2.6	0.8
Finland	3.0	2.3	2.9	1.5
France	2.2	1.4	2.5	1.5
Germany	2.7	1.3	2.1	0.7
Greece	4.5	3.5	4.8	3.6
Ireland	4.3	4.4	5.2	4.5
Italy	2.9	2.2	2.3	2.2
Luxembourg	2.7	0.9	2.1	1.3
Netherlands	5.1	5.1	4.9	3.9
Spain	3.8	2.5	3.1	3.4
Portugal	4.6	3.9	3.7	3.5
Euro area	3.0	2.0	2.6	1.8

Source: Eurostat. Provisional data for Germany and the euro area.

2.11 Table 2.1 shows that inflation rose between December 2001 and January 2002 in ten of the twelve euro area countries. France, Greece and Luxembourg experienced an increase of over 1 percentage point. However, by June 2002 inflation was lower than it had been in January 2002 in eleven of the twelve countries, and lower than it had been in December 2001 in six countries. Only Luxembourg and Spain had increases in inflation between December 2001 and June 2002 of more than 0.1 percentage points.

2.12 More importantly, there is variation between sectors. Aggregation means that relatively large increases in the cost of low value goods can be masked by small falls in the cost of higher priced goods. For instance, the European Commission's own assessment of the introduction of euro banknotes and coins reports that year-on-year price rises for restaurants and cafes after the changeover rose to 4.3 per cent – almost double the general inflation rate (European Commission, 2002c, page 17).

Government measures **2.13** During the changeover in the existing euro area, a number of policy solutions have been deployed to minimise exploitative price rises and to encourage consumer confidence, including dual pricing systems, price stability agreements, price monitoring and information campaigns (including campaigns targeted at vulnerable groups).

Longer-term effects: the theory of arbitrage

2.14 One-off effects from the introduction of a new currency on price levels would, by definition, not be enduring, and in any case seem only to have been small in their effect at the aggregate level. Much more important for assessing the likely effect that EMU membership would have on UK prices is the impact that it might have on transaction costs and trade.

2.15 EMU membership has the potential to reduce transaction costs in three ways:

- removing the risk associated with transactions in a foreign currency, and the cost associated with hedging against it;
- eliminating the direct costs associated with changing currencies (e.g. removing the need for currency brokers); and
- providing greater price transparency and making price comparisons easier.

2.16 Lower transaction costs would make it easier to engage in ‘arbitrage’ – the exploitation of differences in prices between locations by the purchasing of goods in a lower priced location and reselling in a higher priced one. This in turn should promote price convergence because demand will rise where prices are lower and supply will increase where prices are higher.

2.17 Put more simply, EMU reduces the costs of trade, thus encouraging more trade, increasing competition and putting pressure on price differences. It is in this sense that a single currency can be seen as an extension of the Single Market.

2.18 The theory of prices can explain how that process would work. A key concept in the theory of prices is the law of one price. In its simplest form, it states that **the price of an identical tradeable good, expressed in a common currency, is identical across all locations.**

2.19 The law rests on the assumption that were prices for a given good to differ between locations, arbitrageurs could profitably buy the good in the cheaper location and sell it in the more expensive, bringing about price convergence by balancing demand and supply in both locations.

2.20 However, the strict form of the law of one price only holds in very restrictive circumstances. More realistically:

- there may be barriers to trade which prevent firms from exploiting price differences between locations; and
- trading between locations itself has additional costs, such as transport costs or currency risk. So even when there are not significant barriers to trade, prices are very unlikely to be identical across locations.

2.21 Taking account of these two factors, a fuller and more realistic version of the law of one price might be put as follows: **in the presence of effective conditions for arbitrage, the absolute difference in the price of a good between two locations does not exceed the ordinary arbitrage costs.** In other words, differences in prices should reflect either the costs of arbitrage (trading between locations is taking place but it has costs) or restrictions on arbitrage (trading is not taking place because of restrictions, such as export or import limitations).

2.22 Arbitrage costs may be quite significant. In any given location, the cost to the wholesaler or arbitrageur will be the factory gate price (which itself is determined by the cost plus mark-up and taxation), plus transportation costs (which will vary according to distance and quantity) and search costs (which should be fixed relative to quantity but which will be affected by language, price transparency, regulation and other ‘familiarity’ factors). Where arbitrage takes place across currency borders, the cost will additionally include currency exchange costs. Box 2.1 sets out these relationships more formally.

2.23 As Professor Wolf emphasises (see Annex D), local costs can drive variation in prices without implying similar variation in mark-up. Higher rents and labour costs in an area would imply, other things being equal, higher prices for the same good. Under the law of one price, such variation still should not exceed the costs of arbitrage. However, to the extent that there are economies of scale in arbitrage, individual customers may be less likely to engage in it than either wholesalers or retailers. Greater variation in retail prices might therefore be expected without necessarily being inconsistent with the law of one price.

Currency-exchange costs and the exchange rate risk premium

2.24 Where arbitrage takes place across currency borders, costs include currency exchange. In the first instance, this refers to the costs of changing from one currency to another (e.g. the difference between ‘buy’ and ‘sell’ rates for currency trading, or the commission charged by a currency exchange service).

2.25 It also includes the exchange rate risk premium. This refers to the possibility that movements in exchange rates will change the price of a good after the decision to buy or sell has been made (for instance, because the value of a currency moves after a contract is signed or after investment in start-up costs, such as establishing a distribution network, has already been made).³

2.26 To guard against this possibility, an exporter selling at a fixed foreign currency price at an unknown future exchange rate may choose a higher mark-up as a hedge against movements in the exchange rate. Put another way, the price is inflated by a risk premium.

³ It would also be possible to incorporate the role of exchange rates in decisions to commit to arbitrage through their effect on discounting of future income streams in assessment of the net present value of a project. However, for the sake of clarity, exchange rate risk is presented here as the cost of the hedge necessary to remove the risk.

Box 2.1: Arbitrage costs

Following the framework set out by Professor Wolf (see Annex D), the price $P_{A(A)}^W$ that a wholesaler will charge for a product A from a factory in the same country, A, is:

$$P_{A(A)}^W = (1 + t_A^W)(1 + m_A^W)(P_A^F + (d_A^W h) + s_A^W)$$

where t_A^W is the tax level in country A, m_A^W is the wholesaler's mark-up, P_A^F is the price charged at the factory gate, d_A^W is the distance between the wholesaler and the retailer, h is the cost of transporting product A for one mile, and s_A^W is the cost to the wholesaler of handling one unit of A.

If the wholesaler chooses instead to purchase from a factory in the other country, B, then the price charged by the wholesaler will be:

$$P_{A(B)}^W = (1 + t_A^W)(1 + m_A^W)(P_B^F + (d_B^W h) + s_A^W + v_{A(B)}^W)$$

following the same notation, with $v_{A(B)}^W$ denoting a premium for the currency exchange costs to the wholesaler.

So the difference in prices will be:

$$P_{A(A)}^W - P_{A(B)}^W = (1 + t_A^W)(1 + m_A^W)(P_B^F - P_A^F + m(d_B^W - d_A^W) + v_{A(B)}^W)$$

It follows that for the wholesaler in A to source from the factory in B rather than A, i.e., for arbitrage to occur, it must be the case that:

$$P_{A(B)}^W < P_{A(A)}^W$$

In other words, the wholesaler must be in a position to charge lower prices once all costs have been taken into account:

$$P_{A(B)}^F - (1 + r) P_B^F > h(d_B^W - d_A^W) + v_{A(B)}^W$$

This shows that the difference in prices, taking account of currency exchange costs, must exceed the additional transport costs as well as any search or transactions costs incurred.

While wholesalers may (for reasons of economies of scale) be the most obvious candidates to act as arbitrageurs, the same principles as set out here would apply to retailers seeking to engage in arbitrage.

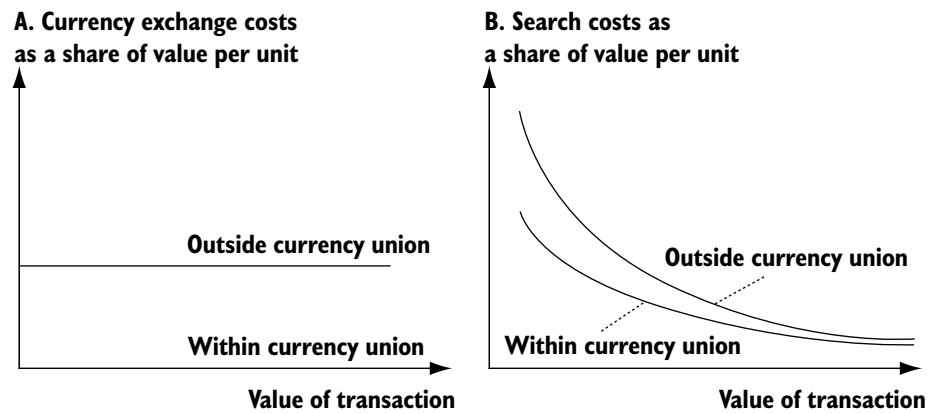
The effect of joining EMU – exchange rate risk and conversion costs

2.27 Joining EMU would eliminate exchange rate risk and conversion costs for UK firms trading within the single currency area. The European Commission estimated the size of the direct costs of exchanging currencies, plus further savings such as on 'in house' specialist personnel, at around 0.4 per cent of European Community gross domestic product (GDP) in 1990.

2.28 However, the impact of removing exchange rate risk is more than a matter of cost. Although firms can purchase reasonably cheap hedges against short-term risk, such hedges are harder to find for time horizons longer than around a year. For consumers, they may not be a viable option at all. In certain markets, it is therefore possible that the removal of exchange rate risk could facilitate price convergence in two ways – both by cutting costs and by removing a barrier which has effectively prevented trade in the past.

2.29 These effects are likely to have a greater impact on small firms, or where transactions are small and/or irregular, than on larger companies which already trade frequently and heavily with the euro area. This is partly because of the nature of the costs involved. Although currency exchange costs are generally proportionate to the size of the transaction, the costs of search, risk management and hedging are sunk costs and decline in importance as the value of the transaction rises.

Chart 2.1: The expected impact of a currency union on arbitrage costs



2.30 Technological change can also reduce arbitrage costs. Box 2.2 examines some of the potential effects of the Internet on arbitrage.

Box 2.2: Arbitrage and the Internet

The Internet is largely unfettered by national borders and has reduced information costs for both producers and consumers, lowering search costs and increasing pressure for price convergence. In particular, advances in the development of ‘shopbots’ which automatically search for the lowest price across multiple online sellers could significantly reduce search costs. In theory, use of the Internet could reduce transport costs for some services (such as software delivery) to zero, increase buyer information levels and shift markets in favour of consumers. However, the Internet is not available to all and not yet very significant (in terms of volume or value added) as a means of concluding purchases. Moreover, there are factors which may constrain cross-border purchases by consumers in the EU and elsewhere in the world. Consumers may be unwilling to use firms with which they are unfamiliar. Firms will need to build up EU-wide credibility to overcome this. Similarly, consumers may be concerned that they will not be able to obtain the same quality of after-sales service from an overseas firm as they would from a local firm.

Other aspects of information and communications technology (ICT) are also having an impact on the producer-consumer relationship. Products are becoming more tailored to individuals by increasingly market-aware firms, for example, through the use of customer loyalty cards which enable producers to target products to individuals or to sub-groups of consumers. Not only do such technologies have an effect on information asymmetries, but they also reduce opportunities for empirically valid studies of price convergence due to decreasing product comparability. More generally, increased heterogeneity of products can reduce price competition and hence increase the level of price dispersion by allowing firms to differentiate the mark-up more effectively across buyers. But it can also bring welfare benefits, in that consumers are more likely to find products that suit their tastes. The main effect is to grant price reductions to preferred buyers, likely resulting in a downward effect on the overall price level, possibly combined with greater price dispersion.

Underlying market conditions: barriers to trade

Pressures for arbitrage 2.31 Market structure can restrict the ability of arbitrageurs to buy and sell between locations and thus limit the operation of the law of one price.

2.32 Theory suggests that if there is perfect competition at all stages, wholesalers and retailers will all be taking advantage of the cheapest prices (net of search and transaction costs) and will then pass these on to the consumer in the form of lower prices for the final product. Conversely, weaker competitive pressures will lessen the pressures for arbitrage. Combined with the declining relative costs to scale of arbitrage discussed above, this means that pressures for arbitrage should be most intense – and so the law of one price can be expected to be most likely to hold – where the scale of the transaction and the competitive pressures involved are greatest.

2.33 This is borne out by empirical studies such as Haskel and Wolf (2001), which looks at the relationship between domestic competition and international price differences in the case of household furnishings sold by IKEA (a highly standardised product across different markets). They find that variations in prices between countries cannot be explained by costs, tariffs or taxes. They conclude that “*international common currency price differentials would thus be expected to affect IKEA prices only if local competitors exploit such differences to reduce their domestic prices*”. This is consistent with the conclusion that, in the absence of strong competition, pressures for arbitrage are reduced.

2.34 There are also reasons to believe that the characteristics of the product or service in question, rather than the market, may affect the pressures on prices. This is particularly true of the distinction between ‘tradeable’ and ‘non-tradeable’ goods, as discussed in Box 2.3.

Exchange rate pass-through 2.35 The relationship between prices in different regions is further complicated by the impact of the nominal exchange rate. In theory – and according to the law of one price – when currency rates change, these should be reflected quickly in final prices, leaving the underlying relative price unchanged. However, in practice this is not always so – final prices can be slow to adjust. Importers and exporters may choose to dampen price fluctuations by adjusting their margins instead, reducing the extent to which their customers experience volatility in the prices they face.⁴ This is possible primarily because firms may fix their prices in local currency.

⁴ They may, of course, dampen short-run volatility while still adjusting their prices to take account of long-run exchange rate changes.

Box 2.3: The Balassa-Samuelson effect

The Balassa-Samuelson effect⁵ can help to explain inflation and real exchange rate differences between economies. The approach distinguishes between two sectors:

- a *traded goods sector*, mainly producing capital intensive goods that are subject to a high level of international competition; and
- a *non-traded goods sector*, mainly consisting of service industries where productivity gains are difficult to achieve and international competition is relatively weaker.

The distinctive feature of the traded goods sector is that its prices are determined on world markets. This means that productivity growth in that sector will push up wages. Since workers within a country can choose to work in either sector, this will also increase wages in the non-traded goods sector. With lower productivity growth in the non-traded sector, the same wage rises will tend to raise prices. Unchanged prices in the traded sector, but higher prices in the non-traded sector, means that the relative price of non-traded goods increases.

The greater the gap between productivity growth in the traded sector and productivity growth in the non-traded sector, the higher will be the country's overall rate of inflation. For initially low-productivity countries, this gap will be relatively large, meaning that inflation rates tend to be higher there than in initially high-productivity countries.

2.36 Campa and Goldberg (2002), for instance, find that 39 per cent of nominal exchange rate movements are passed through into prices in the UK in the short run, and 47 per cent in the long run (this is higher than the US, where the figures are 26 per cent and 41 per cent respectively, and lower than in France, where the estimate is 53 per cent and 121 per cent.)

2.37 In order to be reconciled with the law of one price, the phenomenon of 'sticky' prices must reflect market structures which restrict perfect competition. However, the relationship between market structures and exchange rate pass-through is complex. For example, an importer may be more likely to be able to act as a price-setter and so pass through exchange rate movements if they have significant market power (as Feenstra, Gagnon and Knetter (1996) find for car export and import markets).

2.38 In any event, there would appear to be two main implications of sticky prices for understanding the impact of EMU:

- first, analysis of current differences in relative prices across the euro area and in the UK must take account of the possibility that they may be the result of exchange rate movements, as well as currency or other arbitrage costs. As Section 3 describes, nominal exchange rate movements were a significant factor behind changes in the UK's aggregate relative price level in the 1990s; and
- second, joining EMU would remove the extent to which nominal exchange rate changes can distort underlying relative prices, and should therefore improve price transparency.

⁵ See Balassa (1964), Samuelson (1964) and Harrod (1933).

Conclusions on theory

2.39 The theory suggests that, to the extent that entry into EMU would reduce arbitrage costs, it should promote price convergence.

2.40 However, the exact scale of the impact is hard to assess. Much depends on the extent to which currency transaction costs, as opposed to other costs of arbitrage or underlying restrictions on market activity, are at the root of current price differentials. This is likely to vary between different sectors of the economy.

2.41 A further factor is that in the short term, relative prices between the UK and the euro area are influenced by changes in the nominal exchange rate. In theory such movements should quickly be reflected in final prices, leaving underlying relative prices unchanged. But in practice, final prices are quite sticky – exchange rate changes are not passed through either fully or quickly.

2.42 The remainder of this study looks at the empirical evidence, in an attempt to assess how far, in what sectors and over what timescale EMU membership might affect price convergence:

- Section 3 looks at **aggregate UK and EU relative price levels** and at the factors which appear to influence them, including the nominal exchange rate, relative labour costs and relative taxes; and
- Section 4 looks in more detail at **individual sectors of the economy** and draws comparison with the US experience.

Having risen since the mid 1990s, the UK's relative price level (RPL) peaked at around 19 per cent above the EU average in 2000 before falling back to around 13 per cent above the EU average in 2002 as a whole. The RPL continued to fall through the year and into 2003 reflecting lower relative prices, largely driven by sterling's depreciation against the euro. In January 2003, the UK's RPL is estimated to have been around 8 per cent above the EU average. Over the same period, Germany and France have become less expensive in relation to the EU average – and Italy has become cheaper. This implies that, to the extent that reductions in arbitrage costs would produce an increase in pressure for price convergence, pressure on UK RPLs would be predominantly downwards.

There is some evidence that relative prices are correlated with relative labour costs and overall tax levels, although there is not a strong link with taxes on consumption. These factors would not be directly influenced by EMU membership, and therefore to the extent that they affect UK relative prices, they would remain as a source of price divergence even if the UK entered EMU.

Much of the rise in UK relative prices over the late 1990s is explained by the rise in sterling over the same period. Movements in the relative price levels of other large European economies have also been affected by nominal exchange rate swings during the 1990s. This confirms that prices are 'sticky' – and that relative prices can be heavily influenced by nominal exchange rate changes for several years. It makes any judgement about underlying price convergence quite difficult.

However, the coefficient of variation for prices in the EU15 – which gets smaller as prices converge – showed signs of declining during the 1990s. There is more evidence of convergence in some sectors than others. Indeed some have shown signs of price divergence. Price convergence is greater in the euro area than the EU as a whole – and particularly in the geographical core of the euro area (France, Germany, Belgium, the Netherlands and Luxembourg).

3.1 This section explores differences in relative price levels between countries and over time, and explores the factors which may explain these. This casts some light on how joining EMU could affect UK prices.

3.2 It focuses on aggregate-level data on national relative price levels. Section 4, by contrast, looks at information on particular goods, products and markets.

Defining relative price levels

3.3 The relative price level (RPL) is the ratio of domestic to foreign prices adjusted for the exchange rate between domestic and foreign currency. For the case of the UK, the RPL compared with the euro area is calculated as the purchasing power parity (PPP) exchange rate (the hypothetical exchange rate that would be necessary for price levels to be equal between two countries) divided by the sterling euro exchange rate¹:

$$RPL = \frac{PPP}{\pounds/\text{€}} \cdot 100$$

¹ The relative price level, scaled to equal 100 when price levels are equal, is:

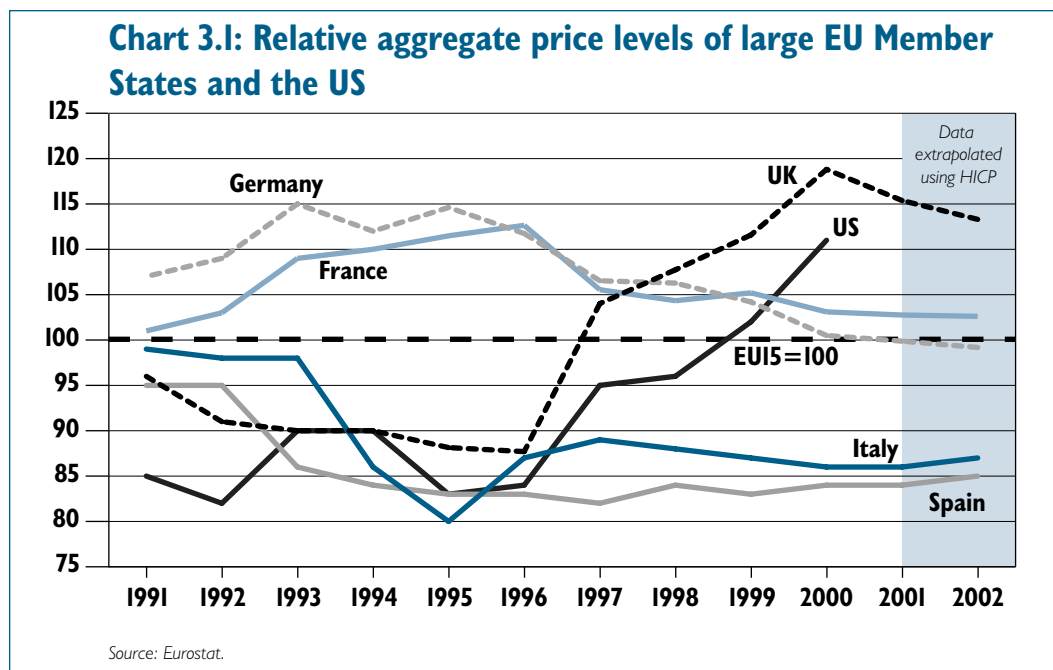
$$RPL = 100 \cdot P/(P_f \cdot e) \quad [1]$$

where P=UK price level, P_f= foreign price level, and e= the exchange rate. The relative price level may also be written in terms of a relationship between the current exchange rate and the purchasing power parity (PPP) rate. Note that by definition the PPP exchange rate is the exchange rate that sets the RPL to equal 100. So in the above, the PPP rate must satisfy the following formula:

$$100 = 100 \cdot P/(P_f \cdot PPP) \quad [2]$$

Combining equations [1] and [2] gives the expression in paragraph 3.3 above. See Annex A for further details.

3.4 The RPL represents the difference in prices which arbitrage aims to exploit, though it does not take account of costs such as transport. Where relative price levels are equal (so, in this equation, 100), a consumer in either country could in principle purchase the same basket of goods and services² for the same nominal price in either country simply by converting currencies³ (although they might have to pay transport or other costs on top). If the RPL for one country is higher than 100, consumers could buy the basket cheaper in the other country again subject to any extra cost.⁴



3.5 Chart 3.1 shows relative prices for aggregate consumption over the 1990s, indexed against the weighted EU average. The UK moved from being below the average price level of the EU15 to above it from the mid 1990s, as did the US from 1999.⁵ Having risen since the mid 1990s, the UK's RPL peaked at around 19 per cent above the EU average in 2000, before falling back to around 13 per cent above the EU average in 2002 as a whole. The RPL continued to fall through the year and into 2003 – in January 2003, it is estimated to have been around 8 per cent above the EU average.

Explaining differences in relative prices

3.6 At the aggregate level, there are a number of factors which may explain differences in relative prices between countries. This section looks in turn at connections between relative prices and:

- labour costs;
- overall levels of taxation;

² These are price levels from the measurement of consumption in the national accounts framework; they are not derived from the HICP indices that measure similar consumption baskets.

³ As set out in the paper by Professor Wolf in this study, if the law of one price held continuously for all products in national price indices, and the composition and weighting of baskets were identical across countries, then the relative price level would be constant at unity (or at 100 in the equation above). This is equivalent to saying that purchasing power parity holds at all times across countries. A substantial literature is devoted to testing for the presence of purchasing power parity; this is discussed in further detail in the Wolf paper, and in the EMU study by Professor Simon Wren-Lewis *Estimates of equilibrium exchange rates for sterling against the euro*.

⁴ Note that the aggregation involved in this process means that these numbers are only estimates. See also the discussion in Schreyer and Koechlin (2001).

⁵ These country specific data deepen the picture shown by the EU's structural indicators, which provide information on the overall dispersion over time but do not show developments for individual countries. See HM Treasury (2003a).

- taxes on consumption; and
- trade intensity.

Box 3.1: Comparing price levels in countries with different tax structures

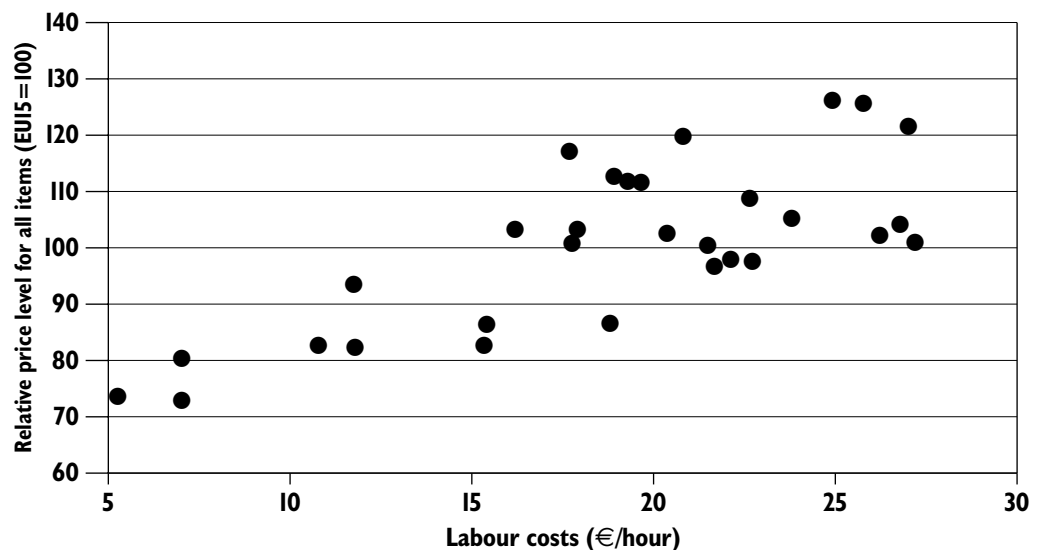
An approach from first principles might suggest that prices excluding indirect taxes might be the best measure of prices for the purpose of comparing competitive conditions. However, more detailed consideration suggests that the appropriate comparison will vary according to the tax structures of the different countries involved and the reason for examining price levels.

For example, a cost of living survey will need to include all taxes for which consumers are liable in each country in order to properly reflect prices in a relevant manner. However, a study which is using prices as the basis of measuring competitive pressures may find prices excluding taxes on consumption more useful.

As an example, take the case of an identical bottle of French wine that is available in both Germany and the UK at the same price inclusive of duty and VAT. The total tax burden in Germany is approximately the same as in the UK but the rate of VAT and excise duty on the wine is greater in the UK. The cost of living survey would show the wine as identically priced in the two countries but a study looking at competition in the wine sector would use the price excluding indirect taxes to show that other things being equal, the wine sector in the UK involved lower margins and probably greater competition than in Germany.

Labour costs 3.7 The theoretical framework for this study suggests that relative price levels will be partially determined by labour costs in a country. Chart 3.2 looks at how relative prices across the EU correlate with labour costs in services and industry. There is some evidence of a positive correlation, suggesting that labour costs may have a significant impact on relative prices and that the Balassa-Samuelson effect has some explanatory value (see Box 2.3).

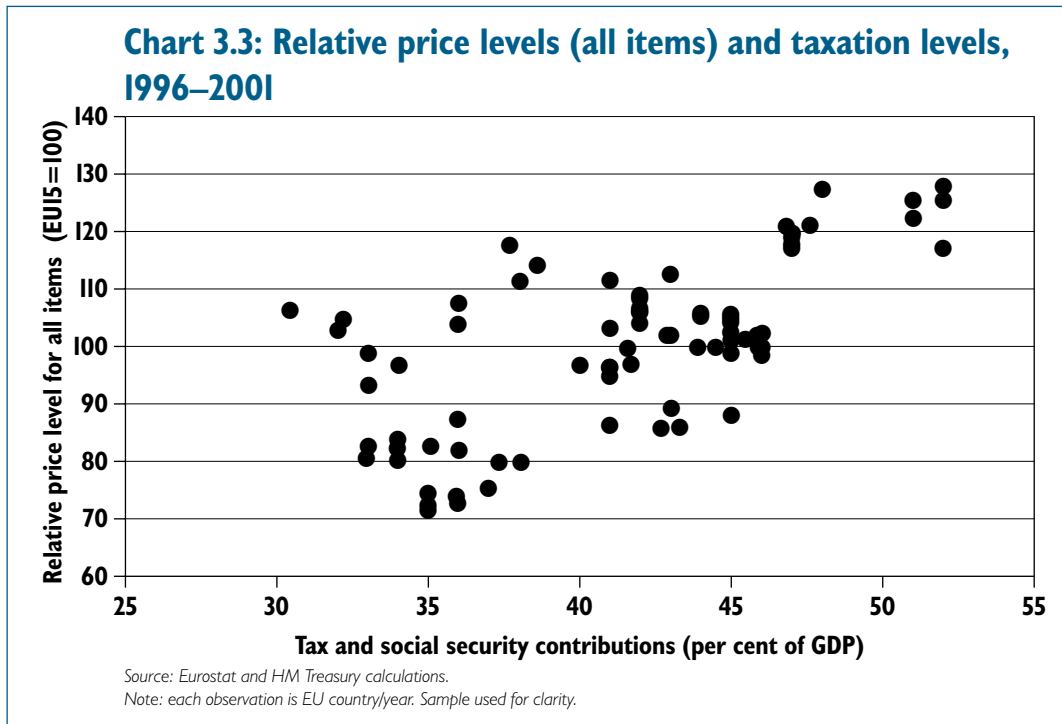
Chart 3.2: Relative price levels (all items) and labour costs, 1992–1999



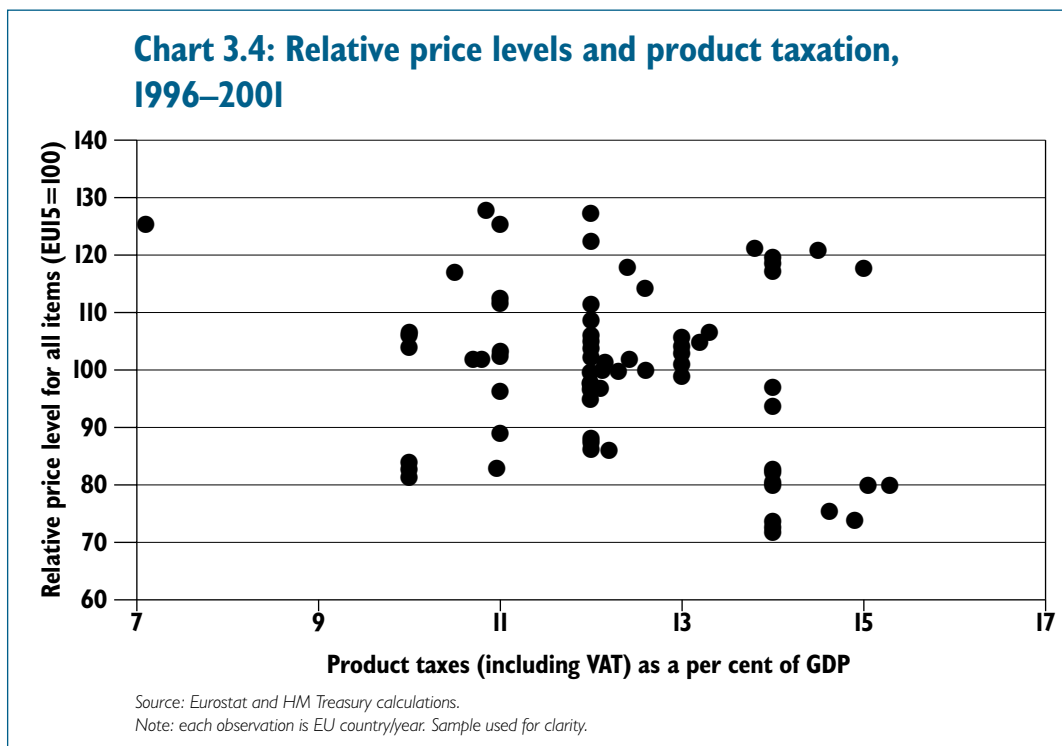
Source: Eurostat and HM Treasury calculations.

Note: each observation is EU country/year. Sample used for clarity.

Taxation 3.8 Taxation is likely to affect price levels. For example, income taxes and social security contributions will increase labour costs and corporation taxes will affect the price mark-up over costs. The data bear out this connection for overall levels of taxation (see Chart 3.3).



Taxation of products 3.9 It does not seem to be the case, however, that this relationship holds for product taxes (which include VAT and excise duties) – despite the fact that these are taxes charged directly on products (see Chart 3.4). The relationship may be stronger for specific products which face high levels of duty, such as alcohol and tobacco.



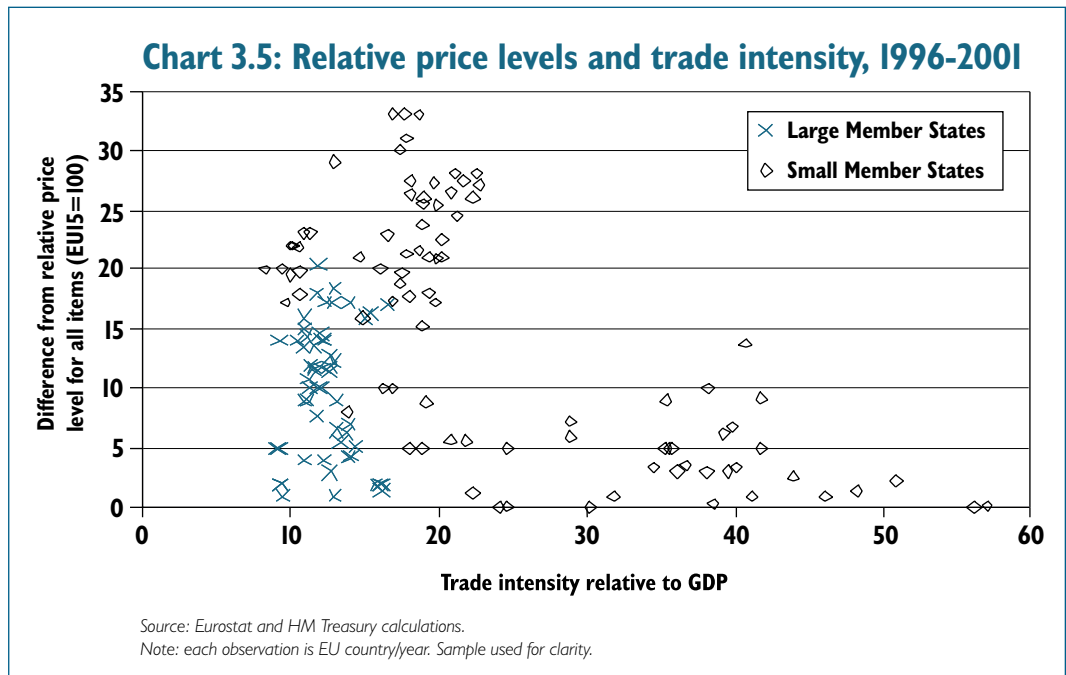
3.10 Variations in labour costs and taxation represent differential local costs. The evidence here suggests that relative price levels are related to these local costs, as theory would suggest – although to overall taxation rather than product taxation. **To the extent that these variations in local costs would remain after entry into EMU, and to the extent that they do indeed affect relative price levels, some variation in relative price levels could be expected to persist.**

Trade intensity 3.11 A firm's mark-up over costs, which determines price levels, will be influenced by the degree of competition in the economy. Through trade, arbitrage will allow the law of one price to function. Hence, the expectation is that prices will be closer when trade is higher.

3.12 In contrast to previous charts, Chart 3.5 adopts a measure for the absolute difference in RPL for each country in the EU, which are also classed as either large or small by their level of GDP. This approach is used to highlight the role of trade, regardless of whether prices were above or below the EU average in 1999.

3.13 Perhaps surprisingly, the chart shows that for large Member States (UK, France, Germany, Italy and Spain), which typically have similar levels of trade intensity, relative prices are not strongly related to trade.

3.14 There appears to be a threshold for trade intensity beyond which it begins to have an impact on relative price levels. For small Members States, a trade intensity above around 25 per cent becomes more closely associated with price convergence. The Member States in this group are the Netherlands, Ireland and Belgium, with Portugal around the threshold. For larger Member States, there is no evidence of a link between trade intensity and relative price level, although all the data points for large Member States are below the threshold. The threshold could reflect a critical level of market power beyond which trade can have a strong impact on local price levels.

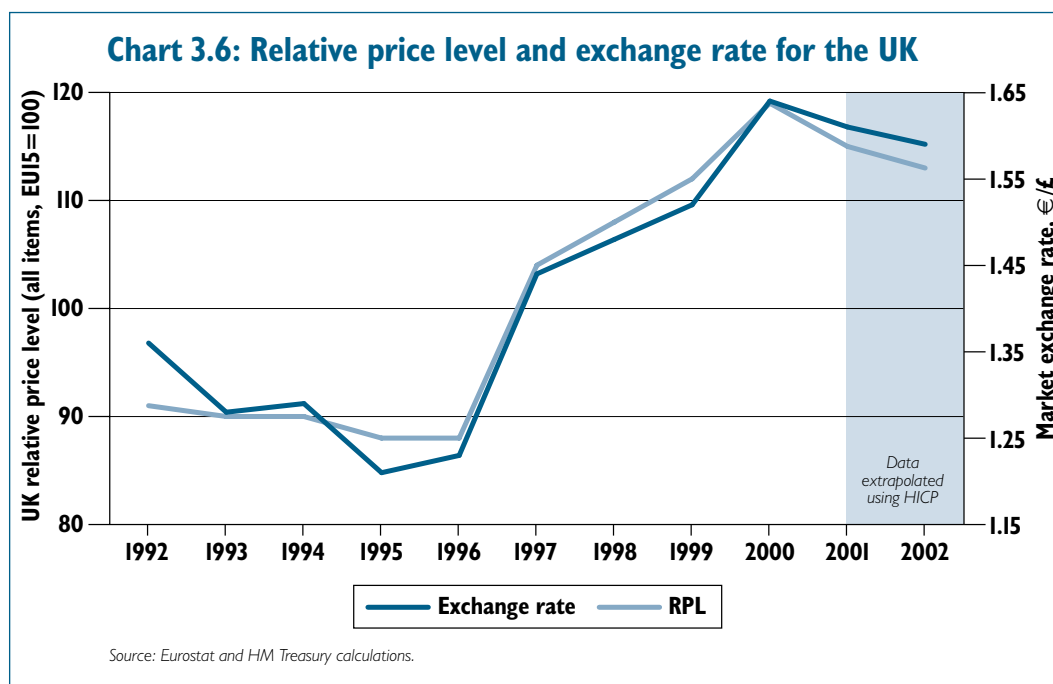


The role of exchange rates in UK relative price levels

UK RPLs and likely pressure from EMU

3.15 As Section 2 discussed, there is evidence that UK prices are ‘sticky’ in the short term, and do not respond rapidly to changes in the nominal exchange rate. This means that when the exchange rate changes, underlying relative prices will also change.

3.16 Chart 3.6 bears this out. It shows that much of the change in the UK’s relative price levels since 1990 has been a result of movements in the exchange rate. Over this time period, exchange rates have been more volatile than prices. In fact, the coefficient of variation of the £/€ exchange rate over the time period was 10.6, as opposed to a coefficient of variation of the PPP of only 2.4. This is strongly related to the evidence found by Engel and Rogers (1995) that failures of the law of one price are closely related to nominal exchange rate variability – and hence that nominal prices are sticky.

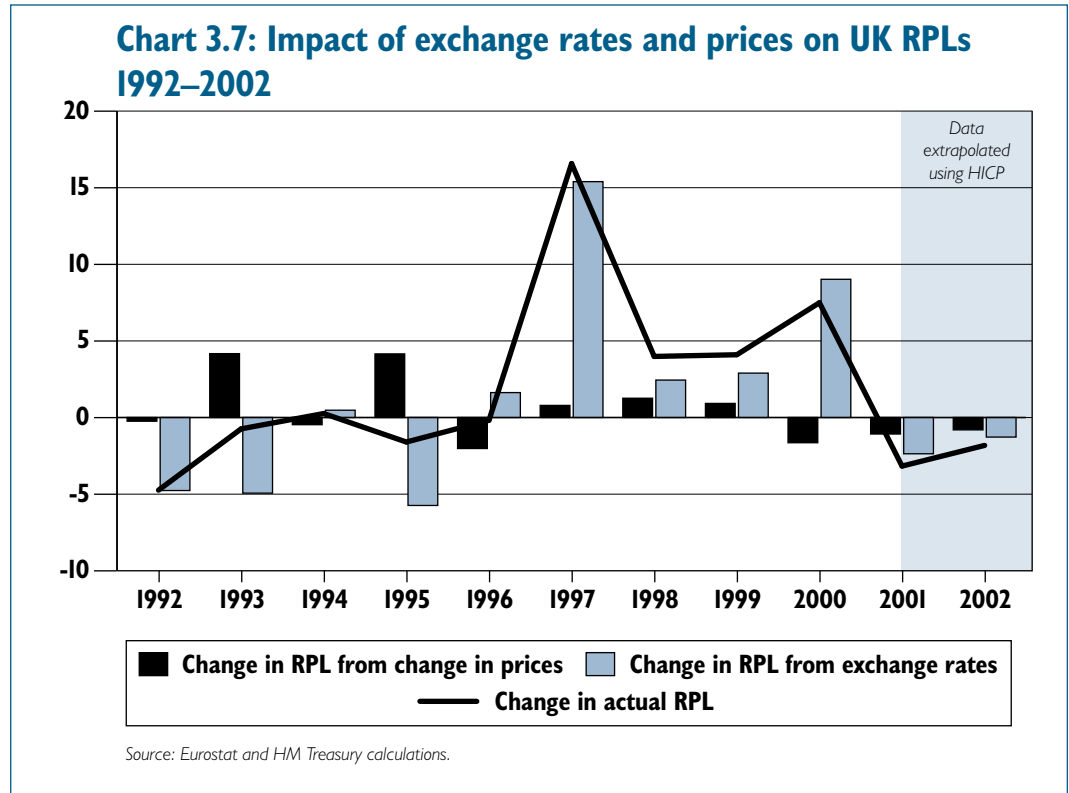


3.17 It is therefore apparent that the rise in the sterling euro exchange rate over the decade has largely determined the rise in UK relative price levels shown in Chart 3.6. One reason for this is that the UK has a broadly similar target for price stability to the rest of Europe. The Bank of England and the European Central Bank (ECB) both aim to limit the consequences of exchange rate changes on their respective price levels. Therefore movements in the relative price level have mirrored movements in the exchange rate more closely than would otherwise be the case.

Price and exchange rate effects

3.18 Chart 3.7 decomposes this effect more systematically, showing how exchange rates and domestic price changes have each contributed to movements in relative prices over the past decade. (The changes in the relative price level resulting from changes in prices are estimated by holding the exchange rate constant for that year. Similarly, the effect of the exchange rate on relative prices is estimated by holding the price ratio constant for that year.)

3.19 The chart shows that the exchange rate has arithmetically been the primary factor determining changes in relative price levels. As can be seen, the relative contribution to the RPL from prices was largest in 1993 and 1995, and in fact the price ratio has been falling since 2000. Although these data are calculated using national accounts data rather than retail price data, this mirrors the relative performance of RPI inflation in the UK and the EU over the same period.



3.20 More detailed analysis of recent trends in the UK exchange rate can be found in the EMU study *Estimates of equilibrium exchange rates for sterling against the euro* by Professor Simon Wren-Lewis, and in the EMU study *The exchange rate and macroeconomic adjustment* by HM Treasury.

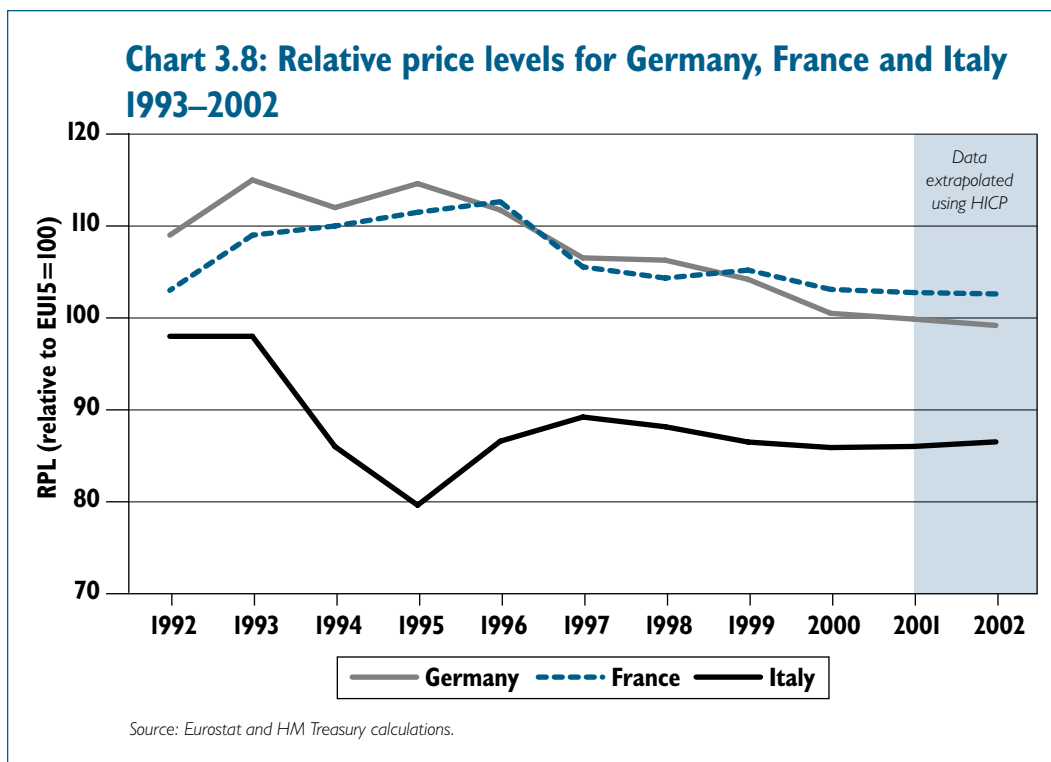
Aggregate relative prices in other EU countries

3.21 The theoretical framework outlined in Section 2 suggests that the effects of the single currency on prices might only be realised gradually and over the longer term. It is probably too soon to draw much from the experience of euro area countries. However, this section explores what evidence there is from France, Germany and Italy. The figures are summarised in Chart 3.8.

France 3.22 The two trends that are particularly striking in the French case are the upward movement in RPL in the period to 1996 which tracks the appreciation of the franc against the euro equivalent, and perhaps more strikingly the movement of the RPL back down towards the EU average since the mid 1990s, also shown in Chart 3.8. This second trend continued beyond the point when exchange rates were fixed, indicating a role for factors other than the exchange rate in determining relative price levels in France. However, it must be considered that this may reflect changes in price levels occurring elsewhere in the EU – these charts compare relative changes in country data against the EU average and so include factors such as UK prices being buoyed by the strength of sterling over much of the period.

Germany 3.23 The German data show a strong similarity with the French data, in terms of the magnitude, direction and timing of the changes in RPL. In addition to very similar trends in the early and mid 1990s to those noted in the French data, the German RPL fell steadily towards the EU average through the second half of the 1990s and actually moved slightly below the EU average in 2002.

Italy 3.24 The Italian data demonstrate a different historical trend from those in Germany and France. There is apparently a closer relationship between exchange rate variations and movements in the relative price level. Since the mid 1990s, Italy's RPL has, if anything, fallen away from the EU average: a relatively cheap country has become cheaper. It is notable, however, that these changes are less significant than changes in the early and mid 1990s and that the Italian economy has experienced a period of price stability relative to the rest of the EU since 1997.



Overall patterns 3.25 These data suggest that prices in Germany and France are demonstrating some degree of convergence with the EU average post EMU entry; but it appears to be a continuation of a trend that began earlier. The EU15 RPL will have changed to some degree over the second half of the 1990s as a result of the strengthening of sterling (the strong relationship between UK relative price levels and the exchange rate was illustrated in Chart 3.6). However, it is possible that EMU may have contributed to convergence in advance of formal entry, particularly given strong expectations that EMU would occur.

Price convergence in different sectors

3.26 The trends can be explored further by looking at price data in individual sectors across the EU.⁶

3.27 As Table 3.1 summarises, there is some indication that price convergence increased between 1995 and 2002. This is particularly marked for the euro area countries where in eleven of the fourteen sectors, price divergence in 2002 was lower than that recorded in 1995. The data for all EU Member States are less categorical at the sectoral level – nine of the fourteen sectors show less price divergence in 2002 than in 1995, while the remaining five show more divergence.

⁶ Eurostat's detailed RPL data run from 1995 to 2000, but this study uses the HICP index to extrapolate the data to September 2002 (see Annex A for details). The need to match up the RPL and HICP data has limited the scope for disaggregation but the sets as defined match well. Details of the disaggregation and weighting can be found in Annex B.

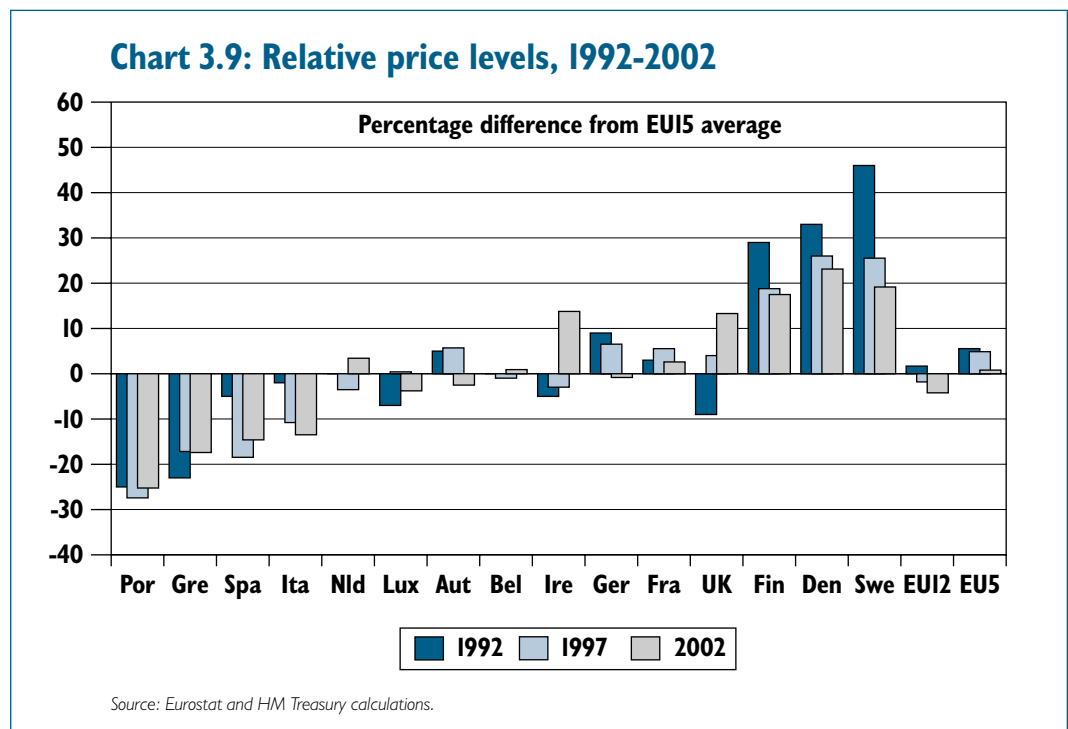
Table 3.1: Price convergence 1995 and 2002

Production-weighted coefficients of variation for disaggregated data

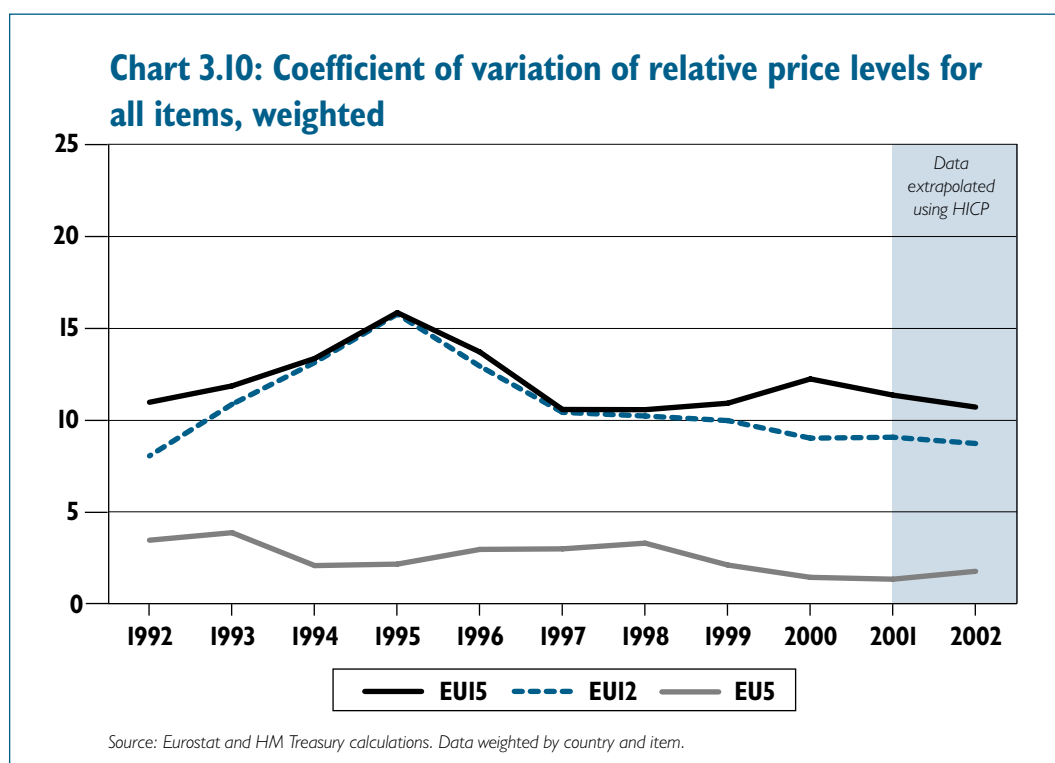
Description	EU		Euro area	
	1995	2002	1995	2002
8 Transport goods	13.2	11.8	10.6	7.2
3 Clothing and footwear	15.0	11.1	14.0	7.0
1 Food and non-alcoholics	12.4	7.6	10.9	7.1
13 Restaurants and hotels	13.8	18.8	14.2	8.0
6 Furnishings and equipment	13.3	10.5	13.5	8.9
12 Recreation and cultural services	16.9	13.3	13.6	8.9
11 Recreation and cultural goods	11.7	7.3	9.1	6.2
14 Miscellaneous goods and services	21.7	10.9	22.9	11.0
7 Health	22.2	13.4	19.5	11.7
5 Fuel and power	15.9	18.1	12.9	15.2
2 Alcohol and tobacco	22.8	36.9	20.6	23.1
4 Rent and maintenance	28.7	19.5	28.2	21.4
10 Communications	14.8	26.9	15.8	23.2
9 Transport services	23.4	27.9	25.3	24.3
Tradeable goods	11.7	8.4	11.0	5.8
Non-tradeables	19.4	12.7	19.7	11.3
All items	15.8	10.7	15.7	8.7

Source: Eurostat and HM Treasury calculations.

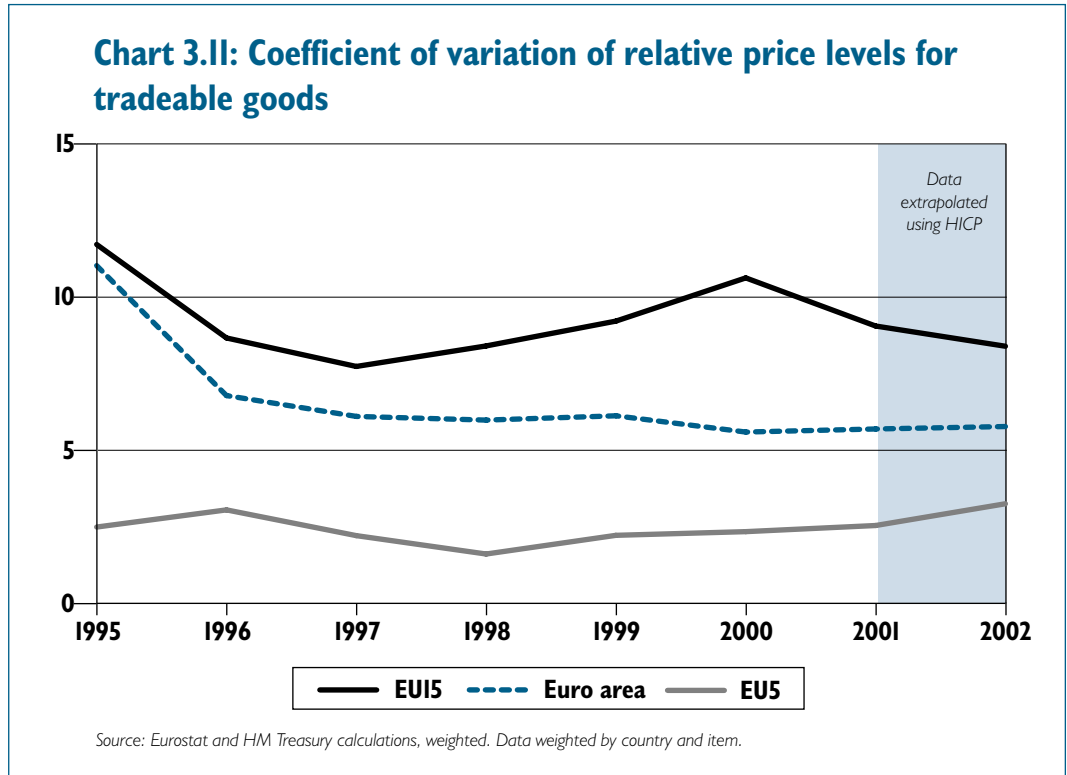
Retail prices 3.28 The movement of relative price levels between 1992, 1997 and 2002 for each Member State is shown in Chart 3.9 below. Whereas some Member States such as Greece and Denmark have moved closer to the EU average since 1992, others, such as Italy and the UK have moved further away, albeit in opposite directions. It is noticeable, however, that some of the countries at the extremes of the distribution of prices have moved closer to the EU average over this period – for example, the Nordic countries are all less expensive than they were at the beginning of the 1990s.



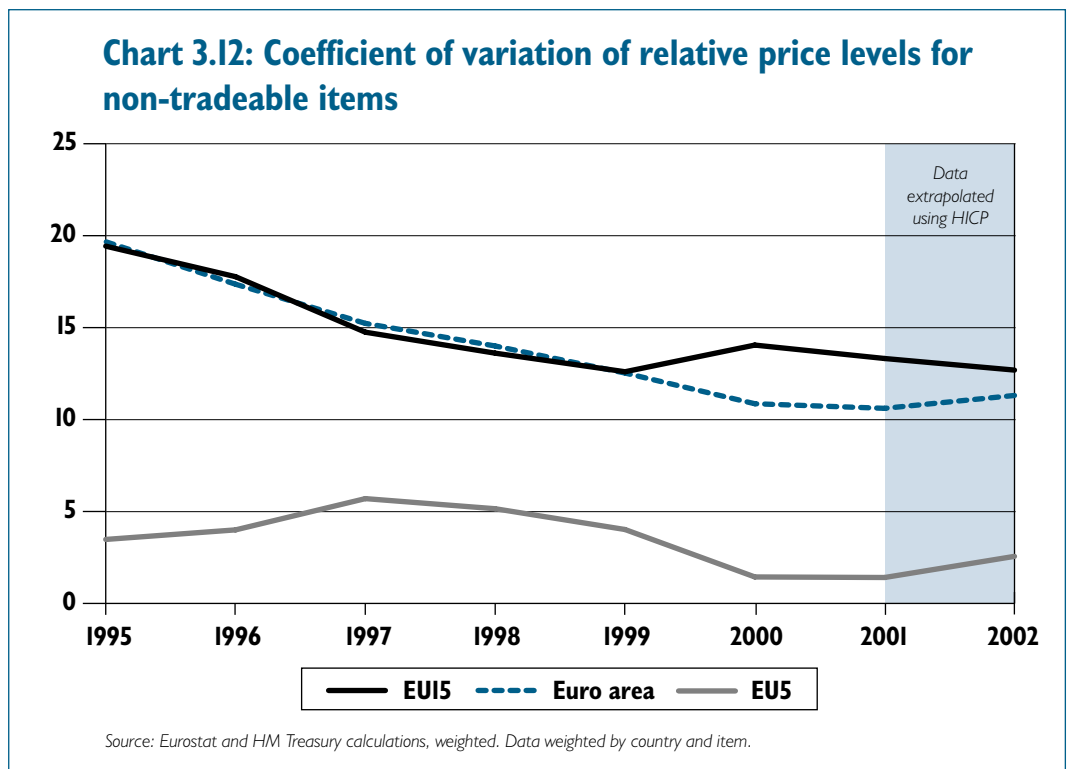
3.29 The coefficient of variation for the EU as a whole is shown in Chart 3.10, and is identical to the data used by the European Commission in its list of structural indicators. As the chart shows, while there was a significant increase in price convergence from 1995 to 1997, this only represents a return to levels achieved in 1992. However, from 1997 the level of convergence in the euro area increased relative to the EU as a whole. The data for the geographical core of the euro area (France, Germany, Belgium, Luxembourg and the Netherlands, marked here as EU5) show both a consistently higher level of price convergence and a more marked increase in convergence in recent years.



Tradeables and non-tradeables 3.30 The all items data described above include products that would generally be viewed as non-tradeable. Since price convergence may occur at different rates if goods and services are more or less amenable to trade, it is important to analyse relative prices for tradeable and non-tradeable items separately. Tradeables account for around two-thirds of retail products by sales weight (see Annex B for a complete breakdown of these weights by sector).



3.31 Chart 3.11 shows that price convergence for tradeables is in fact higher than for all items, although there is a more notable downward trend in divergence for non-tradeables (Chart 3.12). In both cases, price convergence is higher for the 'core' euro area (EU5) countries than either for the euro area as a whole, or for the EU15.



Prices for similar goods vary widely between countries in the EU – to the extent that some supermarket goods can be found at half their maximum EU retail price in other Member States. However, there is no country which is uniformly expensive or uniformly cheap, although UK prices tend to be at the high end for a number of products. Clearly individual market effects and barriers are very important in driving the extent of price convergence. It is difficult to say which UK sectors might be most affected by EMU. Price convergence now seems to be higher where there are more large firms and more trade. However, the main impact of EMU on price convergence would come through reduced exchange rate costs, and these may be a more significant barrier to trade for small firms and consumers. This suggests that competition and price convergence could be boosted most by EMU in the retail sector or in areas with high numbers of smaller firms.

Price dispersion is lower in the US than in the EU, suggesting that price convergence within the EU could go further. However, it is hard to say how far this reflects the US's longstanding and mature currency union, and how far it reflects the US's lack of significant internal political boundaries and more competitive general trading environment.

What evidence there is also suggests that price convergence takes many years. The contribution that EMU might make to such convergence depends critically on the significance of currency related costs to arbitrage costs as a whole. While it is difficult to draw any definitive conclusions, the widely differing picture across different sectors, countries and products highlights the importance of non-exchange rate factors in driving existing price differentials.

4.1 This section surveys more detailed evidence about how prices vary across Europe in different industrial sectors, and on individual items that are sold in many countries. The evidence dates from different survey periods and covers different markets and products. As such, while it complements the whole economy analysis of Section 3 and amplifies it in places, it cannot necessarily be mapped across directly.

Comparing prices between countries across different products and services

Studies looking at baskets of goods

4.2 Most studies show that there is substantial variation in the relative 'cheapness' or 'expensiveness' of individual countries according to the product in question (with the exception of the US, which tends to be the cheapest for the vast majority of products). UK prices are not consistently above or below those of other European countries. For example, recent work by the European Central Bank (ECB) (2001) on utilities prices showed that the UK was generally close to or lower than the EU average for gas prices and long distance telephone calls but somewhat higher for household electricity prices and international calls. A similar European Commission (2001) survey on food and electronic products showed that UK was below average on food prices and close to the average on electronic goods prices.

4.3 In the UK the Economist Intelligence Unit (EIU) was commissioned by the Department of Trade and Industry (DTI) to conduct a pricing survey of 133 branded items, results of which were presented in November 2000.¹ Cities in the UK, Germany, France, Sweden and the US were surveyed. Spain was dropped due to lack of available price points. For most product categories the study concluded there were no overarching trends in price differences or it was difficult to make meaningful comparisons. Notwithstanding, the following conclusions were reached:

- prices in the US were significantly cheaper than Europe for many internationally traded global brands;
- within Europe, Germany and France were cheaper for most of the brands surveyed compared with Sweden and the UK; and
- the UK was the most expensive country for items such as compact discs and cosmetics.

4.4 An earlier DTI commissioned survey by AC Nielsen in 1999 found that UK prices were not significantly different from the US, Germany and France for 45 out of 56 products compared. The definition of 'not significantly different' was that there had to be some overlap between the price *range* in the UK and at least one other country. Obviously average prices might still differ considerably between countries. The UK was systematically more expensive for eight items surveyed and least expensive on three items.² CDs again featured in the most expensive items.

4.5 A study by de Serres, Hoeller, and de la Maisonneuve (2001) for the OECD examined the border effect – the impact of a border on prices between two areas. They found that price dispersion in the UK for comparable highly tradeable goods is about 20 to 25 per cent higher across borders than within countries. They used evidence from 39 cities in eleven countries (ten EU countries and Switzerland) to compare price divergence between cities in the same country and across borders. This is shown in a simplified form in Table 4.1, which shows that for most products and countries the price dispersion within the country is less than that for all 39 cities.

¹ Originally 176 items were surveyed but some were omitted for reasons of lack of comparability.

² The study again stressed the difficulties in making genuine like-for-like price comparisons. Indeed, the study started out with 120,000 price points, of which 8,262 were not used due to genuine non-comparability across countries or other factors complicating comparisons.

Table 4.1: Intra- and inter-country price divergence for some EU countries (coefficients of variation)

	Bel	Fra	Ita	Nld	Por	Spa	All 39 cities
Video recorders	5	6	4	2	7	8	7
Printers	7	6	7	3	6	3	10
CDs	5	4	2	4	9	6	10
Perfumes	6	5	8	12	8	8	10
Tennis racquets	5	3	15	3	16	5	11
Personal stereos	12	6	10	9	8	22	12
Irons	5	3	11	2	7	2	12
Car radios	4	6	14	5	28	10	13
Sport shoes	4	6	7	5	13	8	13
Hi-fi systems	5	9	12	4	8	5	14
Radio-cassettes	12	3	20	18	19	15	15
Clothes	7	5	21	8	12	7	15
Electric razors	6	4	9	8	6	7	17
Video cameras	10	15	8	11	10	4	22
Video tapes	3	8	9	3	8	8	24
Toys	6	16	29	7	45	14	24
Headphones	20	22	39	15	42	28	27
Food mixers/processors	4	8	31	9	18	10	27
Calculators/organisers	18	9	44	8	17	40	27
Watches	10	25	27	24	38	24	38
Average	8	8	16	8	16	12	17

Note: Total includes evidence from 39 cities in Austria, Belgium, France, Germany, Italy, Luxembourg, the Netherlands, Portugal, Spain, the UK and Switzerland.

Source: de Serres et al., 2001.

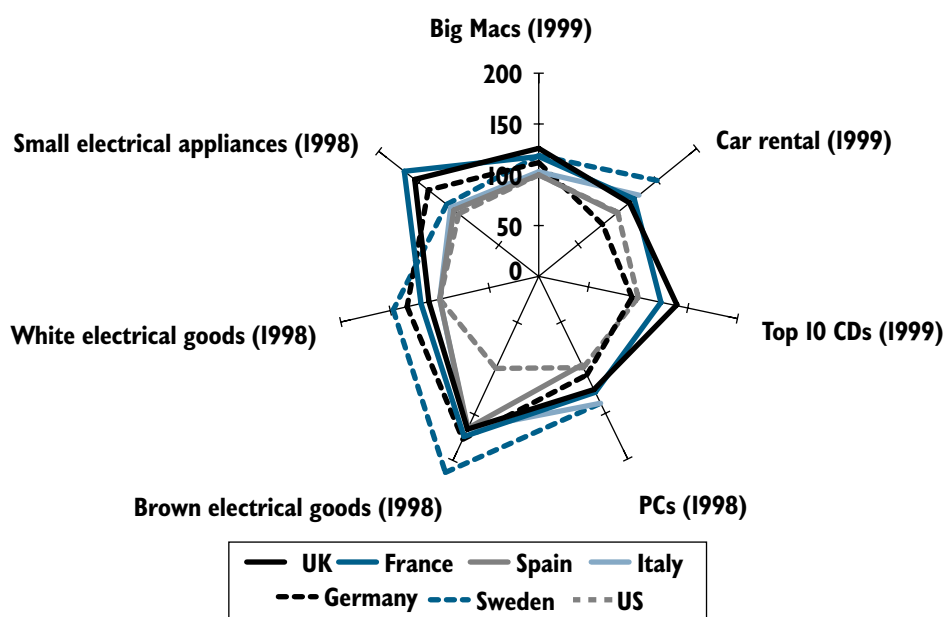
4.6 The European Commission's recent paper on price differences for supermarket goods³ concluded that the EU remains divided into 15 separate markets for supermarket goods, and that even in neighbouring countries prices are not strongly related. Some grocery products are clearly subject to local taste and some brands are sourced from particular locations, making them subject to variations in distribution costs. However, the analysis of branded grocery items undertaken as part of the study included several which are produced under licence in many Member States (the full table is in Annex C).

4.7 Haskel and Wolf (2000) reviewed a range of price studies. They found that no European country consistently had the highest or lowest price across all products, while the US uniformly has the lowest or one of the lowest prices. Similar results were found in the above mentioned EIU survey of branded goods which concluded that prices in the US were significantly cheaper for many internationally traded global brands.

4.8 Chart 4.1 shows some of their results for seven types of goods, indexed to US=100, for the UK, Spain, France, Italy, Germany and Sweden. The date of the survey for each type of good is shown in brackets.

³ European Commission, DG Internal Market (2002a). See also the Commission's Internal Market Scoreboard for May 2002, European Commission, DG Internal Market (2002b).

Chart 4.I: Prices of comparable goods: UK, France, Spain, Italy, Germany, Sweden and US (US=100)



Source: derived from Haskel and Wolf, 2000. Survey dates in brackets.

4.9 These studies all support the conclusion that variation in national price levels is not consistent but rather varies between markets. This may be due to particular characteristics of the products or the markets in question.

Market structure and propensity to export

4.10 Some light can be cast on the relationship between the structure of particular markets, arbitrage, and relative prices by evidence linking firm size and involvement in international trade. Recent work on small and medium sized enterprises (SMEs) in Europe⁴ has indicated that in most sectors SMEs have a lower propensity to export than larger sized firms operating in the same sector. This study found that on average, an enterprise in Europe sells 17 per cent of its turnover abroad but this varies significantly with the size of the enterprise, from 21 per cent among the largest firms to 7 per cent among the smallest. These data support the model of Sutton (1991) that the size of a firm will dictate the extent to which they are able to gain and maintain market share and to enter into arbitrage. Sunk costs such as advertising, R&D and branding can be significant barriers to market entry, which is the key to export success. Indeed, this non-price competition may determine market structure in some advertising-intensive sectors. Traill (1996) observed just such a pattern in the EU food industry.⁵

4.11 The conclusion of the work on propensity to export is also important if particular sectors are dominated by a particular size of firm. **If arbitrage is the basis by which prices are expected to converge, and some firms are more likely, purely as a result of their size, to enter into export markets, then it might be expected that those sectors which are dominated by large firms will show less price divergence.**

⁴ European Commission (2002d).

⁵ These data do of course relate to propensity to export rather than import. However, to the extent that a significant proportion of these exports are intra-EU, and to the extent that patterns of exports are similar outside the EU, these data may cast some light on import patterns also.

Characteristics of particular markets

4.12 This section looks in more detail at surveys of how prices compare in certain sectors:

- electronic goods;
- food prices;
- supermarket goods;
- comparable household goods (different sorts of mirrors sold by IKEA); and
- cars.

4.13 Recent European Commission surveys (2001) of **prices for food and electronic goods** showed that price variation of electronic goods differed between Member States by up to 40 per cent, and some food prices were three times higher in some countries than in others. Indeed, on average EU consumers could save around 12 per cent on an average basket of electronic goods, were the lowest prices to prevail throughout the union.

4.14 Haskel and Wolf (2001) studied price differences for **IKEA mirrors**, presented in Table 4.2 below. The study is particularly interesting as the products were identical and all sold under similar conditions, being part of the IKEA umbrella. The results showed considerable divergence between the EU15 with prices close to three times higher in one country than another. The differentials between countries were not systematic – i.e. one country was not consistently higher or lower priced, which Haskel and Wolf suggest could be attributed to varying mark-ups for products within different markets.

Table 4.2: Prices of IKEA mirrors across Europe, US dollars

	Mirror type 1	Mirror type 2	Mirror type 3
Netherlands	20	20	101
Spain	32	34	112
UK	25	30	115
Belgium	22	28	111
Finland	15	21	107
Switzerland	19	27	67
France	21	33	100
Sweden	15	24	94
Italy	23	44	79
Austria	24	48	113
Norway	12	27	82
Germany	22	51	97
Denmark	13	34	119
Coefficient of variation	25	30	15

Note: **■** denotes the maximum price.

■ denotes the minimum price.

Source: Haskel and Wolf, 2001.

4.15 Using data until May 2001 the European Commission concluded that **car prices** in the UK remained much higher than in the euro area. Degryse and Verboven (2000) similarly found that UK car prices were systematically higher than the EU average during the 1990s under a variety of different assumptions including a fixed exchange rate.⁶ They found that factors including taxes, exchange rates, margins and the UK's right hand drive could only account for around half of the variation in car prices. There is no easy explanation for why UK car prices are higher although substantial variation across Europe is in part linked to the 'block exemption' from some competition rules for the sale of cars which is currently in the process of being reformed. However, Goldberg and Verboven (2001) do find evidence of some price convergence in the European car market with an implied half-life to shocks of 5-8 years.

UK relative price levels for particular markets

4.16 A further implication of variation in country-relative prices between different products is that to the extent that entry into EMU would increase pressures for price convergence, this could result in pressures upwards or downwards and of varying degrees of magnitude – depending on the relative price of particular products in the UK compared with the rest of the EU.

4.17 As Table 4.3 shows, (using Eurostat data as in Table 3.1) there is significant variation in UK price levels relative to both the euro area and to other large Member States. To the extent that EMU reduced price divergence, such variation in relative price levels does indeed suggest that the impact on UK prices – whether this would be manifest as upward or downward pressure – would vary between products and markets.

Table 4.3: UK relative price levels for a range of goods and services

Description	Euro area	EU5 'core' euro area
Food and non-alcoholics	=	=
Alcohol and tobacco	+	+
Clothing and footwear	-	-
Furnishings and equipment	=	=
Transport goods	+	+
Recreation and cultural goods	=	=
Health	=	=
Communications	+	+
Recreation and cultural services	+	+
Rent and maintenance	=	=
Fuel and power	-	-
Transport services	+	+
Restaurants and hotels	+	+
Miscellaneous goods and services	=	=

+ UK RPL significantly higher than average indexed at 100 (+20 or more); - UK RPL significantly lower (-20 or less); = equivalent (± 20).

Source: Eurostat; HM Treasury.

Possible effects from joining EMU

4.18 However, it is difficult to specify how, in practice, the effects of any increased price pressures would be felt in terms of particular UK products. The Eurostat categories used above, for instance, are too general and aggregated to represent individual markets accurately. It would also depend on the nominal exchange rate at which the UK entered EMU and the degree of price stickiness in different sectors.

⁶ Degryse and Verboven (2000) analysed the different effects of exchange rates at the average of the 1993-2000 rate, and of exchange rates constant from 1 January 1999 onwards. The key impact of using fixed exchange rates was to smooth the changes in prices – i.e. volatility was removed.

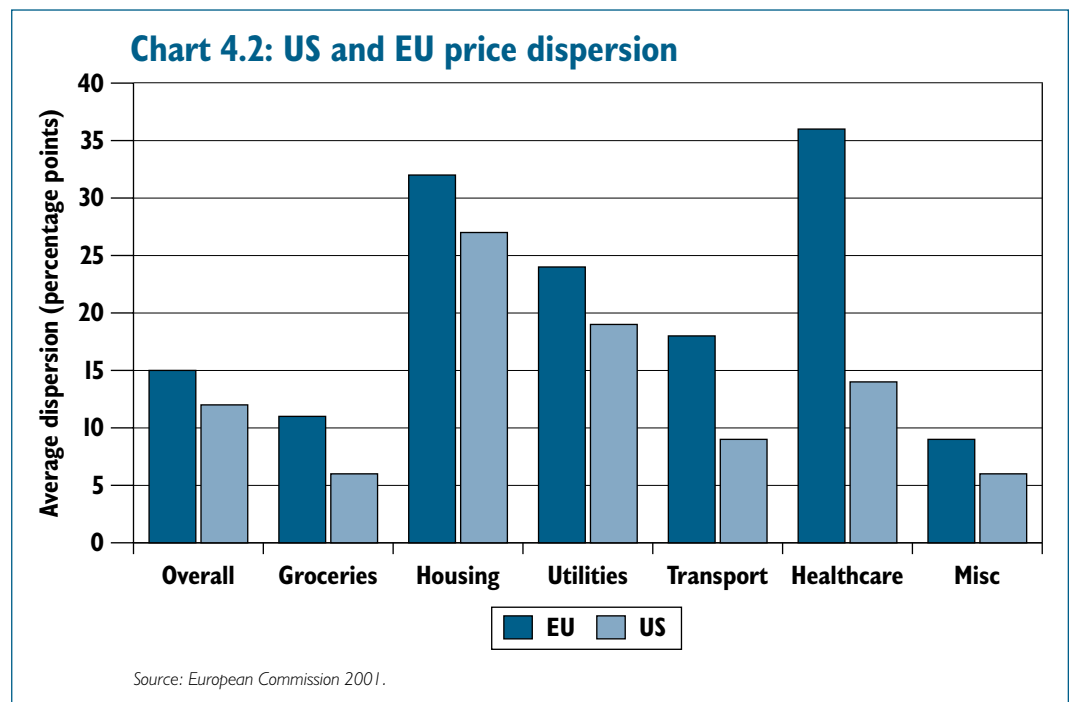
4.19 Furthermore, variations in relative price levels prior to EMU would not necessarily be directly reflected in price changes as a result of any increased pressures for convergence. The reduction in transaction costs that could be expected to result from entrance into EMU might have a more significant impact in some markets – most obviously those for products that are highly tradable – than in others. For instance, the barriers to trade in a service such as a haircut might be little affected by a reduction in arbitrage costs – so we would not expect to see much price convergence from EMU even if that service was relatively very expensive or cheap in the UK.

4.20 As Section 2 discussed, the particular impact of EMU in reducing the costs of exchange rate risk and search may mean it has a greater impact on price convergence in sectors where there are more small firms, or in the retail sector. This is because small firms and consumers are more likely to find exchange rate-related costs either insurmountable or high as a proportion of their trade activity – i.e. the existence of different currencies is a more important barrier to trade in these sectors.

Lessons from the United States

4.21 As a mature currency union, the United States provides a counterfactual case study. To the extent that a significantly greater degree of price convergence is exhibited within the United States than the EU, it might be implied that further European convergence is possible. (Further detail on the economic implications of monetary union in the US can be found in the EMU study by HM Treasury *The United States as a monetary union*.)

4.22 Evidence produced by the European Commission (2001b) suggests that price dispersion in the EU is clearly higher in all categories, particularly in healthcare, than in the United States, although US dispersion in housing and utilities is also notable. According to these data, the average extent of price dispersion in the United States is one fifth less than that in the EU (Chart 4.2).



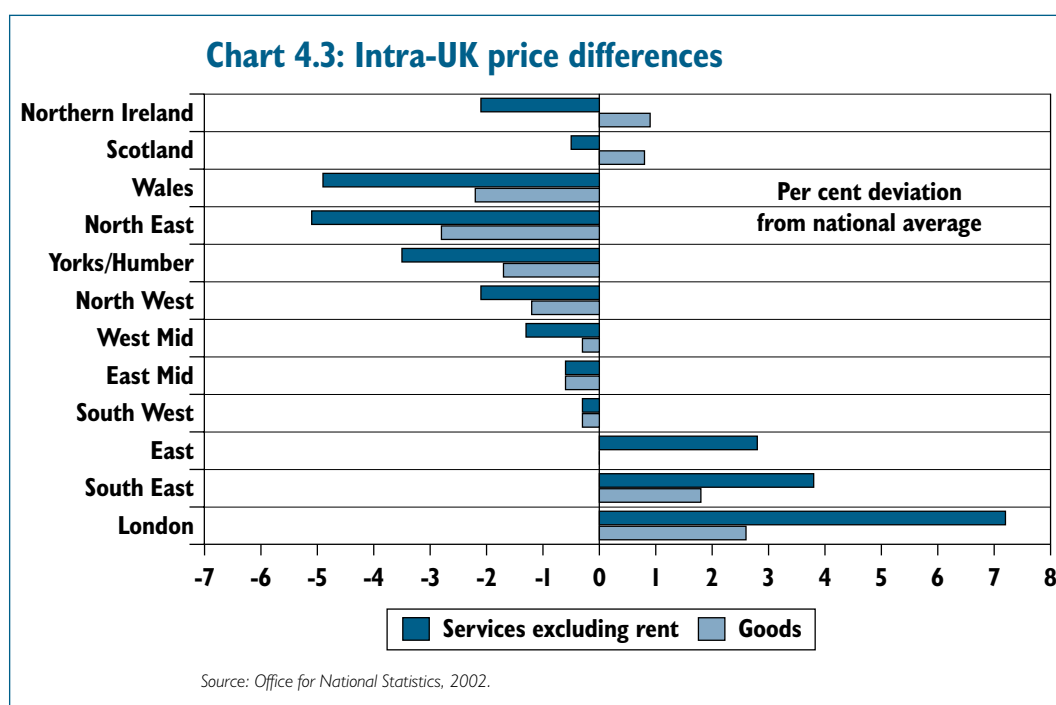
4.23 A number of caveats should be applied to these figures. Many of the sectors for which data are available in this chart are not characterised by extensive levels of trade, and even in the US, transport, housing and healthcare are not subject to the same levels of trade as groceries. Also, these data are from 1998, and thus would exclude any effect of improved transparency and reduced arbitrage costs entailed in the adoption of the euro (although the evidence described in Section 3, suggests that such effects are not large, at least at present).

4.24 The picture is clearly not simple: Rogers (2001) concluded that some measures of traded goods price dispersion across the euro area are now close to those for the US; and wide variation in US housing costs complicates aggregate comparisons. **However there appear to be a large number of areas in which US price dispersion is lower than that in the EU, and few (if any) where the reverse is true.**

Likely impact of EMU as against other factors

4.25 It is very difficult to say how far greater price convergence in the United States reflects the existence of a mature monetary union, and how far it reflects other factors such as the lack of significant internal political borders, a more generally competitive trading environment and relatively low transport costs.

4.26 Empirical evidence certainly does suggest that price differences exist *within* EU states, as well as between them. For instance, a recent ONS study⁷ of price differentials in the UK (Chart 4.3) showed that London and the South East are clearly more expensive than anywhere else in the UK in terms of both goods and services. This reflects higher costs in these two regions for non-traded inputs such as floor space and labour costs, the importance of which have been discussed in Section 2. (Housing rents are excluded from the data since they are essentially non-tradable and distort the results for the traded goods and services that are of particular relevance to this analysis.) It is interesting, and consistent with price theory, that price divergence is much greater for services than for goods.



⁷Baran and O'Donoghue (2002).

4.27 However, this intra-country dispersion appears to be much less significant than inter-country differences. Research by the European Commission looked at both within and between country price dispersion for ten grocery products (Table 4.4). The intra-country price differentials for these goods are markedly lower than those which exist for the same goods across the EU. For four of the ten items the inter-country price dispersion is an order of magnitude greater than the intra-country price dispersion. This applies to seemingly identical products such as Mars Bars. Once again differences in local distribution costs and differences in the markup provide two alternative explanations of the finding.

Table 4.4: Relative differences in intra- and inter-country price dispersion for selected products (excluding VAT)

	per cent		Relative difference
	Inter-country dispersion	Average intra-country dispersion	
Evian mineral water	42.7	3.6	11.8
Rexona deodorant	21.4	1.8	11.7
Sensodyne toothpaste	21.0	2.0	10.7
Mars Bars (single)	21.0	2.1	10.1
Mars Bars (multipack)	22.0	2.9	7.6
Coca Cola	20.8	3.8	5.5
Pedigree Pal dog food	9.7	2.2	4.3
Plenitude face care	20.6	4.9	4.2
Colgate toothpaste	14.0	3.6	3.9
Bonne Maman marmalade	18.7	5.6	3.3

Source: European Commission, 2002a.

4.28 These border effects are consistent with other research on the EU. The OECD⁸ studied price dispersion in the Single Market and found that dispersion remained on average around 20 to 25 per cent higher across borders than within OECD countries, while Engel and Rogers (2000) found large border effects in their study of fifty-five cities across eleven European countries.

4.29 Placing this evidence within the framework provided by the theory of arbitrage suggests that these differences are consistent both with higher costs for trading between than within countries, and with specifically international restrictions on trade.⁹

Implications for the impact of EMU

4.30 The balance between these factors will in turn affect the relative impact of any reduction in arbitrage costs as a result of entry into EMU. Although reliable estimates of the relative impact of the two elements are not available, it is fairly clear that barriers to trade do continue to exist within the EU, despite the Single Market; and even in instances where countries have essentially fixed bilateral rates, such as between Germany, Belgium and the Netherlands, border effects still exist. The HM Treasury publication *Meeting the Challenge: Economic Reform in Europe* (2003b) assesses progress in improving the functioning of European markets and in removing barriers to a true Single Market.

4.31 Therefore it seems that, while it is not clear how much a reduction in arbitrage costs as a result of EMU entry would impact on price dispersion, other factors also impede effective arbitrage and so the potential for price convergence. **To this extent, measures additional to EMU (most obviously along Single Market lines, reducing barriers to trade) would be necessary to ensure that arbitrage works as effectively as possible. Those measures would also be likely to have an impact even in the absence of EMU.**

⁸ Schreyer and Koechlin (2001).

⁹ There are of course questions of heterogeneity of taste, cultural barriers and so on, which Professor Wolf picks out in his paper (e.g. whether a British Christmas pudding can be considered the same good in the UK and Germany, given the different demand in the different markets). However, while it is true that it can be difficult to establish true comparability for goods across different countries, the methodological issues have been recognised and tackled by researchers who have still established price differentials.

The speed of price convergence in EMU **4.32** It seems likely that any impact from EMU on price convergence would take time to feed through. The research literature supports this view:

- price differences seem remarkably persistent. Cecchetti, Mark and Sonora (2000) studied price level convergence within regions in the United States and concluded that price level divergences across US cities had a half-life of nearly nine years (i.e. it took almost nine years to reduce price level divergences by a half). They also found that there was no change in the rate at which differentials were eroded throughout the 78 year span of their data run. Goldberg and Verboven (2001) found a slightly shorter half-life for UK car markets, at closer to five to eight years; and
- rates of convergence appear to be affected negatively by distance and by the presence of a border between two locations.¹⁰ To the extent that the rate, as well as the level, of price convergence is affected by arbitrage costs this suggests that entry into EMU might impact on the rate as well as the level of price movement.

¹⁰ For example see Cecchetti *et al.* (2000).

5.1 This study has looked at the theory and evidence on prices in the EU, at how EMU could increase price convergence within the euro area and at how it might affect UK prices were the UK to join EMU.

5.2 Economic theory suggests that the decision to join EMU could affect prices in a number of ways:

- it is likely that there would be some **transitional effects** associated with the move to a single currency. Experience in the euro area suggests that these effects are not large, although they can be concentrated in particular markets. Small price rises may be associated with the costs of changeover itself (e.g. replacing equipment) and there may be some ‘clustering’ of planned price rises to coincide with the new currency; and
- more enduringly, and occurring **over a longer time period**, savings in the costs of trade between the UK and the euro area – through the removal of currency conversion costs and exchange rate risk, and because greater price transparency makes searching for cheaper deals easier – could boost trade activity and competition. Businesses would find it easier to take advantage of differences in prices between the UK and other countries, and to purchase from the cheapest locations and sell in more expensive ones. This activity – known as ‘arbitrage’ – should have the effect of gradually eroding price differentials within the single currency area.

5.3 This study has examined the empirical evidence on prices across the EU at both the aggregate level, and for particular sectors of the economy. As new research for this study has shown, in the short term the nominal exchange rate has quite a large effect on relative prices in all the major European economies. Prices are quite ‘sticky’ – importers and exporters dampen the effect of the exchange rate and take a hit on their margins rather than passing currency volatility onto their customers. This effect can last several years, and makes it quite difficult to compare underlying relative prices across sectors at any point.

5.4 Nonetheless, the evidence surveyed in this paper suggests the following key points:

- **there is considerable scope for further price convergence** both in the EU in general, and between the UK and other European economies in particular. Prices of similar goods and services are much more variable than in the US – a mature currency union. However, there is a good deal of price dispersion within EU countries, including between the regions of the UK, highlighting the fact that currency costs are not the only relevant factor behind price divergence;
- **the effect of EMU on price convergence will be greatest in areas where currency transaction costs and exchange rate risk are a significant proportion of trading costs**, or effectively prevent trade at present. For example, small firms may be more affected than larger firms that already have sophisticated ways of adjusting to currency costs, and for whom these costs are a relatively small proportion of total costs;

- **although EMU should reduce the extent of price divergence, it will not eliminate it.** Price differences also reflect the costs of trading between different locations. Costs such as those of transport or translation, and local differences in taxes or wages, will not necessarily be affected by EMU and will continue to affect price differentials;
- **remaining price differences are likely to vary across sectors.** Even now, detailed sectoral analysis shows that there is no European country which is uniformly cheap or uniformly expensive, although UK prices tend to be at the high end for a number of products;
- **in some markets, barriers to trade will remain, and may be the most important factor in preserving price differentials.** These might include the simple psychological effect of the political boundaries within the euro area; and
- **the process of price convergence is likely to take time,** occurring over many years.

5.5 These conclusions, in turn, suggest some implications for the relationship between EMU and competition. A single currency has the potential to intensify competition, particularly by increasing the likelihood of cross-border entry into markets. It would only be possible to gain these benefits in full, however, by working in parallel to tackle other barriers to competition in Europe – addressing other impediments to effective competition and well-functioning markets.

5.6 The Government has pursued reforms to improve competition both in the UK and in the EU. The Enterprise Act has given the UK competition authorities full independence and more effective powers with which to work proactively to promote competition. In Europe, the Government has strongly supported economic reform and has pressed for structural improvements to product, capital and labour markets to make them work better. Earlier this year, the Government reported on progress in *Meeting the Challenge: Economic Reform in Europe* (HM Treasury, 2003b).

5.7 This study is an input into the assessment of the flexibility test – the second of the Government’s five economic tests for EMU entry – and the growth, stability and jobs test – the fifth of the five tests.

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RELATIVE PRICE LEVELS

A1 The relative price level, scaled to equal 100 when price levels are equal, is defined as:

$$\text{RPL} = 100 \cdot P / (P_f \cdot e) \quad [1]$$

where P is the UK price level, P_f is the foreign price level and e is the exchange rate, defined as £ per unit of foreign currency.

A2 The relative price level may also be written in terms of a relationship between the current exchange rate and the purchasing power parity (PPP) rate.

A3 Note that, by definition, the PPP exchange rate is the exchange rate that sets the RPL to equal 100. So in the above equation, the PPP rate (PPP) must satisfy the following condition:

$$100 = 100 \cdot P / (P_f \cdot \text{PPP}) \quad [2]$$

A4 Equation 1 may be written as:

$$\text{RPL} \cdot e = 100 \cdot P / P_f \quad [3]$$

A5 And equation 2 may be written as:

$$100 \cdot \text{PPP} = 100 \cdot P / P_f \quad [4]$$

A6 Combining equations 3 and 4 gives:

$$\text{RPL} \cdot e = 100 \cdot \text{PPP} \quad [5]$$

A7 Which can then be rewritten as:

$$\text{RPL} = 100 \cdot \text{PPP} / e \quad [6]$$

WEIGHTED COEFFICIENT OF PRICE VARIATION

A8 For a set of n countries the coefficient of price variation, v , of price level is given as the standard deviation, σ , divided by the mean (\bar{r}):

$$v = \frac{\sigma}{\bar{r}} \cdot 100 = \frac{\sqrt{\frac{1}{n} \sum_{i=1}^n (r_i - \bar{r})^2}}{\bar{r}} \cdot 100$$

A9 However, it may be informative to use a weighted coefficient so that the larger Member States have a more significant impact upon the coefficient than smaller Member States. While this is advantageous in that a given price level represents a proportionate share of transactions within the EU, it still disguises price variations within each Member State – but the unweighted does so also.

A10 One way to consider weighting is that it is as if each observation is repeated for a number of times equal to the weight, w , and the number of observations, n , becomes equal to the sums of the weights, W . The weighted mean (\tilde{r}) will be given as:

$$\tilde{r} = \frac{1}{W} \sum_{j=1}^n r_j w_j$$

A11 So the weighted coefficient of variation, \tilde{v} becomes:

$$\tilde{v} = \frac{\sqrt{\frac{1}{W} \sum_{i=1}^n w_i (r_i - \tilde{r})^2}}{\tilde{r}}$$

USING HICP TO EXTRAPOLATE RPL

A12 Section 3 presents data for UK relative price levels (see, for example, chart 3.1). Eurostat data for relative price levels (RPLs) are only available with a relatively long lag, and therefore in order to provide a more timely picture of movements in RPLs, the Eurostat data have been extrapolated using the more timely HICP series.

A13 RPL data measure the relative cost of a basket of similar goods in two countries. HICP data, similarly, measure the cost of a basket of goods in a single country over time. On the assumption that HICP and RPL baskets are comparable, it is possible to estimate the change in the relative price of the basket in the two countries – the change in the RPL – from the change in the price of the baskets in each country presented in HICP.

A14 In other words, the RPL in one year can be approximated by scaling up the RPL from the previous year by the ratio of the changes in the HICP for each country.

A15 To minimise the risk that differences in composition or weighting of the baskets have an effect, the data for 2001 and 2002 have been based on RPL data from 2000.

DATA SETS

A16 The data used in this study were taken from Eurostat's New Cronos database. These are variations in the classifications, and some re-grouping was needed to make the data sets fit. These are set out in Table A1.

Table AI: Classifications of products and groupings used for the retail price level data

Description	HICP	SNA79	SNA95	Type
Food and non-alcoholic beverages	cp01	010101, 01010201	0101	Good
Alcohol and tobacco	cp02	01010202, 010103	0102	Good
Clothing and footwear	cp03	0102	0103	Good
Rent and maintenance	cp041,043	010301	010401, 010402	Non-tradeable
Fuel and power	cp045	010302	010403	Non-tradeable
Furnishings and equipment	cp05	0104	0105	Good
Health	cp06	0105	0106	Service
Transport goods	cp071–72	010601, 010602	010701, 010702	Good
Transport services	cp073	010603	010703	Non-tradeable
Communications	cp08	010604	0108	Service
Recreational and cultural goods	cp091–093, cp095	010701, 010703	010901, 010903	Goods
Recreational and cultural services	cp094, 096, cp10	010702, 010704	010902, 0110	Service
Restaurants and hotels	cp11	010801	0111	Non-tradeable
Miscellaneous goods and services	cp12	010899	0112	Non-tradeable

Source: Eurostat.

B

ANNEX B: DISAGGREGATION OF PPP AND HICP DATA

Table B1: Disaggregation of Eurostat PPP and HICP data used in this study

Description	Type	Weighting
1 Food and non-alcoholic beverages	Tradeable	151
2 Alcohol and tobacco	Tradeable	41
3 Clothing and footwear	Tradeable	74
4 Rent and maintenance	Non-tradeable	79
5 Fuel and Power	Non-tradeable	44
6 Furnishings and equipment	Tradeable	78
7 Health	Tradeable	36
8 Transport goods	Tradeable	126
9 Transport services	Non-tradeable	23
10 Communications	Tradeable	27
11 Recreation and cult goods	Tradeable	65
12 Recreation and cult services	Tradeable	55
13 Restaurants and hotels	Non-tradeable	98
14 Miscellaneous goods and services	Non-tradeable	80

Source: Eurostat and HM Treasury calculations. Weighted by country and item.

C

ANNEX C: PRICE DIFFERENCES IN SUPERMARKET PRODUCTS

Table C1: Price differences in the EU for selected supermarket products – including VAT (EUI4=100)

Product	Spa	Nld	Ger	Bel	Fra	Gre	Por	Ita	Aut	UK	Ire	Fin	Den	Swe
Butter	89	87	–	89	120	–	100	–	106	77	114	96	113	110
<i>Nescafe</i>	87	86	88	93	93	77	117	133	103	94	100	108	113	107
<i>Colgate toothpaste</i>	76	101	102	94	88	108	76	101	101	126	109	95	–	124
<i>Elvital shampoo</i>	76	125	82	88	100	–	91	83	98	111	126	112	107	–
Drinking chocolate	121	84	87	98	99	–	98	124	102	102	77	79	127	–
Flour	79	63	114	119	110	82	102	86	118	89	–	116	–	122
<i>Coca cola – big bottle</i>	93	116	73	99	78	91	82	88	90	113	92	112	139	135
<i>Barilla spaghetti</i>	92	–	109	112	89	–	102	59	–	94	99	106	–	138
Frozen pizza	96	78	71	100	99	83	152	89	103	110	–	107	103	108
Ground coffee & coffee beans	82	88	97	90	103	–	80	123	–	–	–	139	–	99
<i>Kellogg's corn flakes</i>	82	93	100	91	94	152	85	115	123	71	–	112	88	93
<i>Fanta – big bottle</i>	88	77	81	90	85	–	81	82	95	95	115	120	145	146
<i>Single Mars bar</i>	–	80	85	73	–	–	106	98	98	78	–	95	143	142
Granulated sugar	78	64	75	65	121	–	84	126	113	133	–	137	–	106
Marmalade	87	63	116	–	118	–	75	144	117	126	–	72	114	66
Milk (uht) full fat	79	65	100	80	–	–	142	88	119	75	81	119	154	97
Milk (uht) half fat	76	–	56	–	76	–	97	147	78	104	–	91	118	157
Mineral water	51	89	94	126	108	81	58	69	118	–	113	166	–	127
Olive oil	54	69	80	82	107	129	98	75	–	145	178	87	87	108
<i>Evian still – big bottle</i>	–	95	85	63	44	76	–	58	116	99	98	189	–	176
Washing up liquids	39	68	109	79	57	73	–	49	60	129	145	153	139	199

Note: EU excluding Luxembourg. Pan-European brands are defined as brands available in a minimum of seven EU countries.

Branded items are in italics, others are generic.

Source: European Commission, 2002a.

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INTRODUCTION

D1 Differences in common-currency retail prices across locations have frequently generated public protest at ‘price gouging’, typically interpreted as differences in mark-ups. This note discusses the evidence on international relative prices and the inferences that can, and cannot, be drawn based on the available evidence.

D2 Firstly, it discusses the methodological and empirical pitfalls that arise in interpreting international relative prices. The framework illustrates that a host of other factors, including exogenous factors such as location and endogenous factors such as differences in local costs and taxes, can also lead to price divergences; consequently price divergences by themselves do not permit inferences about pricing behavior.

D3 Secondly, it surveys evidence on international relative prices. While findings differ across studies, a number of features have been confirmed by multiple studies, the section focuses in particular on these ‘stylized facts’.

D4 Finally, it concludes with the main findings and open questions.

D5 Before proceeding, it is useful to ask whether the answer ‘matters’: if significant price divergences indeed exist, are they of serious concern? While the literature on this question is still in its infancy, a number of recent careful studies (Bradford and Lawrence (2002); Hufbauer, Wada and Warren, 2002) pursuing different avenues have come to the conclusion that reductions in price divergences (interpreted as reductions in barriers) may yield significant GDP gains.¹

International Relative Prices: Methodological Background

D6 The law of one price (LOOP) provides a useful organizing framework for discussing the determinants of international relative prices.² In its basic form, the law of one price simply states that the price of an identical tradable³ good, expressed in a common currency, is identical across all locations.

D7 Functionally, the law rests on the assumption that, were it to fail, arbitrageurs would profit by buying in the cheap and selling in the expensive location, in the process bringing about price convergence by raising supply in the expensive and reducing supply in the cheap location. Turning the argument around, a failure of the law of one price implies a failure of effective arbitrage.

¹ These studies interpret price divergences as measures of barriers to market integration. Strictly speaking, their results thus pertain to reductions of such barriers as measured by reduced price divergences.

² The size of the literature on the law of one price and its aggregate cousin, purchasing power parity, rules out both a comprehensive review and adequate citations. Rogoff (1996) provides an excellent survey.

³ The distinction between ‘tradables’ and ‘non-tradables’, fundamental to much of international economics, is far from trivial for many products. In practice, the common practice has been to use thresholds on actual tradedness (trade shares in output) to separate products.

D8 Such a failure may reflect a number of reasons:

- first, the apparent arbitrage opportunity may not in fact exist. The retail price of a product reflects not only its production costs but also local costs. As such costs would apply to any arbitrageur as well, the price differential reflecting such costs cannot be arbitrated away, and is consistent with identical mark-ups across locations⁴; and
- second, the failure may reflect barriers to arbitrage which may arise both from actions by market incumbents and from policy actions. In this case, market segmentation may lead to mark-ups differing across locations.

D9 A simple decomposition of the final retail price of a product sold in location j into its various components is useful in separating these causes of price divergences. For this purpose, it is useful to distinguish between three prices:

- the price charged at the factory gate to the wholesaler serving location j ;
- the price charged by the whole-seller serving location j to the retailer; and
- the price charged by the retailer in location j .

D10 These prices can differ substantially. For the United States in 1993, estimates suggest that goods producers on average received sixty per cent of the final retail price.

D11 Using this framework, the retail price may differ across retailers because of:

- differences in the tax rates facing wholesalers in different locations;
- differences in the tax rates facing retailers in different locations;
- differences in the transportation cost from factory to wholesalers in different locations;
- differences in the transportation cost from wholesalers to retailers in different locations;
- differences in costs across wholesalers;
- differences in the costs across retailers;
- differences in mark-ups charged by producers to different wholesalers;
- differences in mark-ups charged by wholesalers to different retailers; and
- differences in mark-ups charged by retailers to different purchasers.

D12 Only the last three of these factors signify differences in mark-ups. Consequently, the mere presence of price divergences is insufficient to infer price discrimination. A researcher wishing to ascertain the importance of differences in mark-ups in explaining price differences across locations must thus devise effective controls for the first six determinants. All six of these controls pose significant empirical difficulties, examined in the next section.

D13 It is worth noting that even if differences in mark-ups existed, these do not by themselves imply higher risk adjusted profits in some locations, as the mark-up may compensate for risk factors. This caveat applies in particular to comparisons of prices charged by a given firm across multiple markets.

⁴The resulting differences are however not fully exogenous. In particular, they depend on the cost structure of the distribution network. To the extent that arbitrageurs can reduce these costs relative to incumbents, scope for price convergence exists.

DI4 None of the above discussion comparing prices in two locations depends in any way on these locations being separated by a national boundary. The law of one price applies to two locations within a country, or indeed within a city block, as much as it does to different countries. While much of the recent literature has emphasized the inter-national perspective, the intra-national dispersion of prices is also quite relevant, and indeed provides a very useful benchmark.

Local factors DI5 The most direct approach to assessing the presence of differences in mark-ups entails the decomposition of prices into their constituent parts as discussed above. In practice, researchers following this line face daunting data problems. The datasets typically used for studies contain detailed information about the product and the final seller, but rarely specify the location of production or resellers, curtailing the ability to measure transportation costs. Furthermore, product specific retailing costs are rarely available. The data problems can partly be overcome through reformulations of the hypothesis tested. In general, such modifications however rely on ancillary assumptions and are thus weaker than outright tests of the law of one price.

Transport costs DI6 The cost to a seller in a particular location depends on the transport cost from the production location. In consequence, prices covering transportation costs differ across location even with constant mark-ups.

DI7 As direct measures of transportation costs from factory to reseller and from reseller to final retailer are generally not available, it is difficult to adequately control for transportation costs in studies focusing on the actual retail price of products across locations.⁵

DI8 A weaker hypothesis can however be tested. In cross-section, effective arbitrage implies that, *ceteris paribus*, the price differential between any two locations A and B should not exceed the transportation cost between A and B. With the adjunct hypothesis that transportation costs are proportional to distance, one might then expect that absolute price differences should, *ceteris paribus*, be smaller for city pairs located nearby compared. The tests, and others along similar lines, rely on a number of inexact (if generally reasonable) additional assumptions, the results obtained are thus conditional on the validity of the assumptions.⁶

DI9 It deserves mention that while transportation costs are almost exogenous for the individual retailer, they (and hence the price divergences reflecting transportation costs) are endogenous in the aggregate, depending on the efficiency and competitiveness of the distribution system, which in turn partly reflects the regulatory framework.

Retailing costs D20 Retail prices contain a non-traded component reflecting the costs associated with the retail outlet, notably rent and wages. Differences in retailing costs can thus find a reflection in price divergences even with identical mark-ups.

⁵ One exception, reviewed below, is the car market (Lutz, 2002).

⁶ Without going into detail, one obvious problem is that transportation costs depend on the mode of transportation which may differ across location pairs; and are generally not linear in distance.

Table D1: Labour costs (gross income of saleswomen, Zurich = 100)

Berlin	69.6
Brussels	65.0
Dublin	64.9
Luxembourg	62.2
Vienna	58.4
Paris	56.6
Amsterdam	53.1
Helsinki	51.9
Milan	48.2
Madrid	32.9
Athens	26.2
Lisbon	23.7
Copenhagen	89.8
Stockholm	74.1
London	61.8
Tokyo	114.7
New York	103.7
Zurich	100.0
Oslo	82.3
Warsaw	10.3
Budapest	6.2
Moscow	3.6

Source: UBS, Prices and Earnings Around the World, 2000.

D21 The datasets commonly used to evaluate pricing do not contain information about product-specific retailing costs. Various alternatives have been pursued to address the data problem.

D22 In studies exploring actual retail prices, controls for average citywide costs, such as the average wage level can be included. Such proxies introduce additional measurement error. As inferences on different mark-ups are often based on the residual price divergences after cost controls have been included, such measurement error is a serious concern.

D23 With this caveat in mind, such cost data tend to follow some broad patterns:

- rents tend to increase with population density, tending to increase costs in urban relative to rural areas, and in large relative to small cities. These may be offset by volume differences allowing shops in locations with higher turnover to spread rents costs across more units; and
- wages on the retail level reflect overall wages, influenced both by local costs of living (which again tend to increase in population density) and relative labour productivity.

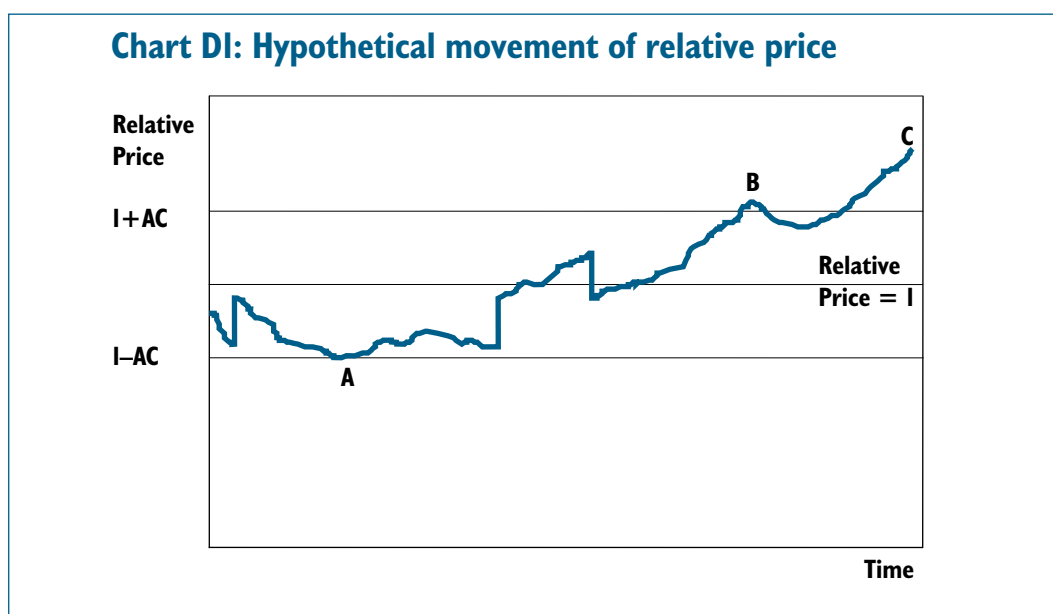
D24 Under the assumption that retail costs are ‘similar’ for ‘similar’ products, in a given location they can be effectively controlled for by shifting the focus from actual prices to double relative prices. Specifically, if products A and B are ‘similar’ and have the same proportional retail costs, then such costs effectively cancel out if the relative price of A to B is considered. The same argument applies in the comparison location. Thus if prices for products A and B across the two locations differ only because of differences in local retail

costs, then the ratio of A to B should be the same in the two locations, and the ratio of the ratio should be one. Again, however, serious caveats apply. In particular, distribution channels may differ.⁷

Sales taxes **D25** Finally, divergent retail prices may reflect divergent taxes.

D26 In summary, each of these three factors – transportation costs, local wages and rents, and taxes – can bring about a divergence in common-currency prices on the retail level. Such divergences would not by themselves permit an inference regarding mark-ups, the latter requires careful controls for the cost factors, an empirically challenging task.

A graphical exposition **D27** It may be instructive to summarize the above discussion in a simple diagram (Chart D1). The figure plots a hypothetical time path of the relative price of an identical tradable in two locations. For simplicity, it is assumed that sales taxes are zero in both locations.



D28 Under the simple law of one price without local cost differences the relative common-currency price is constant at one. Any finding that common-currency prices differ would thus, assuming no measurement error, provide strong evidence of different mark-ups.

D29 In contrast, in the presence of local costs, price differences do not by themselves allow inferences about mark-ups; to draw such inferences requires controlling for the differences in costs.

D30 Within a country, if mark-ups do not differ, the relative prices, even if different from unity, would however vary over time only to the extent that costs vary. The time pattern of cost changes would thus be mapped into relative prices. To the extent that costs change discretely at intervals, the expected relative price path would thus resemble a step ladder.

⁷ Consider, for example, a comparison of the relative price of Christmas pudding and Stollen, two fundamentally 'similar' seasonal products, between the United Kingdom and Germany. Christmas pudding in the United Kingdom is likely to be a large-volume consumption item sold in supermarkets with low retailing costs, but a niche product sold in specialty stores with high retailing costs in Germany. The reverse case applies to Stollen, suggesting that although the double relative price will be far from unity, it is unclear whether strong inferences on differences in markups can be drawn.

D31 Across countries linked by variable exchange rates, a further complication arises. Absent costs of changing prices, any movement in the exchange rate that affects costs would be immediately mirrored in prices ('be passed through'), the time path would thus again solely reflect changing relative costs. In practice, firms do not alter their selling prices continuously, but rather do so only periodically. Consequently, within some range, small (cumulative) movements in the nominal exchange rate tend to map one for one into movements of relative prices, with occasional step adjustments once nominal prices are changed. The smooth time path interspersed with the occasional step adjustment in Chart D1 aims to represent this case.

D32 Within this range, realized profit mark-ups thus co-move with the nominal exchange rate. In general, an importer with a fixed domestic currency price will enjoy a higher profit markup if the domestic currency appreciates.⁸ This variation however does not reflect deliberate price setting, but rather a random fluctuation due to the combination of exchange rate movements and costly price adjustment, with occasional re-setting of nominal prices once the costs of price adjustment are justified by the divergence of relative prices from the optimum.

D33 Within this framework, arbitrageurs facing transportation costs from the low to the high price location and local selling costs will only become active once the price difference between two locations exceeds the cost of arbitrage.⁹

D34 Arbitrage is thus subject to *threshold effects*: the ordinary arbitrage costs (AC) define a band around the common currency price ratio of unity (or, more generally, the ratio of costs if local costs are allowed for), given by $[1-AC, 1+AC]$ for which arbitrage is unprofitable. Ordinary arbitrage costs refers to costs that must be incurred by an arbitrageur who faces no particular product-specific and deliberately-imposed obstacles in either buying the product in the low price or in selling the product in the high price location.

D35 Profitable arbitrage opportunities arise once the relative price reaches the band.

D36 In Chart D1:

- at point A, the relative price reaches the barrier but bounces off it, consistent with arbitrage becoming immediately effective once price differences exceed the ordinary arbitrage cost;
- at point B the relative price breaches the band but soon returns to it, consistent with arbitrage becoming effective with a lag; and
- at point C the relative price breaches the band and displays no tendency to return, inconsistent with effective arbitrage.

D37 A, B and C all violate the strict law of one price, but do so to different degrees. A and B are consistent with a 'dynamic law of one price' in the sense of arbitrage pressures placing limits on the maximum relative price divergences (both are examples of mean reversion of relative prices, reviewed below). C constitutes a clear-cut violation of both strong and weak versions of the law of one price.

⁸ Some complications arise with regard to the invoicing currency and the degree to which imports themselves contain traded inputs, these are ignored here.

⁹ Coleman (1995), Dumas (1992), Obstfeld and Taylor (1997), O'Connell and Wei (1997) and Williams and Wright (1991).

D38 Observing a price pattern such as C suggests that arbitrage that (based on ordinary arbitrage costs) would appear to be profitable was in fact not undertaken. One potential explanation for the absence of arbitrage is the presence of extra-ordinary arbitrage costs, defined as additional costs arising from actions of other market participants that differentially impact costs faced by potential arbitrageurs relative to market incumbents, or their ability to sell equivalent products. Examples of the latter include restrictions on re-selling, restrictions on servicing (such as policies requiring appliances to be serviced in the original destination market, or limiting service to products bought through authorized dealers).

D39 It should be noted that public policy can similarly create additional arbitrage costs and barriers, in most cases unintended consequences of policies with other objectives. Examples include limits on price and other competition in markets for cultural goods and consumer-protection legislation requiring labels on electrical products to be in the local language.

Summary D40 In the public debate, the presence of price differences across locations is at times used to infer the presence of deliberate price discrimination in the sense of different mark-ups.

D41 The above discussion illustrated the potential pitfalls involved in this inference. In particular, price differences may simply reflect cost differences. Controlling for costs is hence necessary before inferences on pricing can be drawn.

D42 The available data present serious obstacles to precisely controlling for costs in studies examining actual price distributions. While these obstacles can be addressed, doing so generally requires either additional assumptions, or involves weaker tests.

D43 Before turning to a review of results, it is hence worth noting that a finding that price differences remain even if costs factors are controlled for provides neither a sufficient nor even a necessary condition for concluding that sellers (at whatever level) enjoy local pricing power. Given the data problems, a finding of conditional price differences is equally consistent with measurement error, placing a premium on careful empirical work.¹⁰

Evidence

D44 A number of empirical literatures explore the nature of relative prices, including:

- studies focusing directly on the law of one price, with and without controls for other factors;
- studies exploring the static and dynamic properties of price dispersions;
- studies examining whether, even if relative common currency prices differ, such differences are bounded or display a tendency towards mean reversion; and
- studies focusing on the implications of alternative market structures on pricing decisions, notably in response to exchange rate movements.

D45 This literature is too large to comprehensively review. The following sections attempt to draw out some of the sturdy results, placing particular emphasis on the most recent studies.

¹⁰ Trivially, finding no such conditional price differences also does not imply an absence of pricing power, as optimal prices may not differ across markets.

The law of one price **D46** A very sizeable literature explores the law of one price, pursuing different strategies. As a general caveat on this literature, it should be noted that it is often far from trivial to find ‘identical’ products. At times, the differences are evident, as in cars with left versus right hand side drive. More often, the differences are subtler and difficult to realise at first sight. For example, the spin cycles of ‘typical’ washing machines differ across countries depending on climate¹¹; as does the composition of some laundry detergents, reflecting differences in the most common stains.

D47 Cultural products pose yet a different problem. Should the law of one price for books be examined by contrasting the price of the same Italian-language novel across countries (which would imply comparing a niche product sold in specialized, probably high-cost stores with a mass-product sold in chains), by contrasting the price of the novel in Italy with the price of translations of the same novel in other markets, or by comparing the price of a typical Italian bestseller paperback with a typical paperback bestseller in other markets? Are performances of Aida in the Scala and Covent Garden identical products? Without going deeper into these thorny issues, it is useful to keep in mind that the notion of ‘identical’ products presents more a theoretical convenience than a practical reality.

D48 With this caveat, the empirical literature has with few exceptions all but unanimously rejected the validity of the law of one price at a given point in time.¹²

Table D2: Prices and wages in major cities (Zurich = 100)

	Prices excluding rent 1991	Prices excluding rent 1997	Prices excluding rent 2000	Gross wages 1991	Gross wages 1997	Gross wages 2000
Tokyo	115.0	121.7	140.1	63.9	84.5	109.4
Chicago	73.9	81.1	100.0	71.4	72.3	90.3
Stockholm	111.3	101.7	99.3	69.1	62.1	65.3
London	84.2	89.8	94.8	45.5	51.6	64.1
Paris	81.6	89.2	81.6	48.1	54.2	57.0
Dublin	76.0	77.2	72.6	45.5	51.2	58.1
Frankfurt	74.5	83.6	76.2	72.2	75.9	72.0
Milan	82.0	70.9	66.8	56.2	48.0	46.5

Source: UBS, *Prices and Earnings Around the World, 1991, 1997, 2000*.

Table D3: Prices in major cities (Zurich = 100)

	Household appliances 1991	Household appliances 1997	Household appliances 2000	Services 1991	Services 1997	Services 2000
Paris	104.0	104.2	81.8	73.6	72.5	85.5
Milan	109.4	68.1	71.4	76.3	62.3	63.2
Frankfurt	85.1	89.8	86.9	74.7	73.1	78.7
Stockholm	115.1	123.1	115.6	111.6	92.9	110.6
Dublin	97.1	76.9	78.4	66.4	73.8	75.2
Tokyo	109.9	115.2	127.7	103.0	104.3	138.0
Chicago	61.2	73.5	83.9	65.3	79.6	99.3

Source: UBS, *Prices and Earnings Around the World, 1991, 1997, 2000*.

¹¹ See Richard Tomkins, A Shopping Contest for the Euro, *Financial Times*, January 6th, 2002, Page 7.

¹² Rogoff (1996) provides an excellent survey. Appendix Table A.2. in Hufbauer, Wada and Warren (2002) provides a striking illustration.

D49 The law of one price applies to any two locations, whether separated by a border or not. A number of papers¹³ examine whether borders in fact make a difference. The answer is emphatically yes. Price dispersions across borders are significantly larger than price dispersions within borders.¹⁴ The differences might reflect differences in arbitrage costs between intra- and inter-national arbitrage. Alternatively, they might reflect price discrimination by firms across countries. In the latter case, it becomes interesting to ask, particularly in the European context, why companies would choose (and be able to choose) national borders in Europe to segment markets in spite of the Single Market and other integration initiatives, a point further taken up below.

D50 A related approach explores whether violations of the law of one price systematically differ across product types or country pairs, a question typically phrased by exploring the dispersion of relative prices within specified categories and country-pairs. The literature again tends to reject the law of one price for most of the individual products considered. In terms of dispersion, findings suggests that:

- the dispersion measures for a given good across cities tend to decrease in the homogeneity of the product, with the partial exception of branded products;
- the dispersion measures display sizeable border effects. Parsley and Wei (1996, 1999) document intra-national dispersions across cities of 13-14 per cent, while Crucini Telmer and Zachariadis (1998, 2000, 2001) find a substantially higher dispersion across EU capitals of 24;
- the dispersion measures across a given set of goods between sets of locations tend to increase in the bilateral distance between the locations, a finding consistent with, though not proof of, stronger arbitrage pressures over shorter distances¹⁵; and
- the dispersion also appears to increase with exchange rate volatility, although fewer studies have explored this linkage.

D51 Crucini, Telmer and Zachariadis (1998, 2000, 2001) examine final cash prices for a large number of goods and services across European cities for 1975, 1980, 1985 and 1990, finding that:

- the price dispersion is higher for non-tradables than for tradables, consistent with the finding by Rogers (2001). The difference becomes even more marked once a comparison is made between non-tradable products with large input shares of non-tradables and tradables with small input share of non-tradables;
- price dispersion is also higher for services and for heavily taxed goods (alcohol, tobacco);
- price dispersion is substantially less for branded than for non-branded products, a finding hard to reconcile with a more important role for price discrimination for products with higher pricing power;

¹³ The price literature is complemented by an equally active literature on the effect of borders on real magnitudes (Helliwell, 1998). To the extent that prices are significantly determined by actual or potential arbitrage, the two border effects are of course linked.

¹⁴ See for example Rogers and Jenkins (1994), Engel and Rogers (1996, 1997, 1999, 2000) and Parsley and Wei (1995), *inter alia*.

¹⁵ The literature generally uses distance as a proxy for transportation costs. This is at best an approximation as transport costs also depend on modes and the number of changes between modes.

- product heterogeneity is at least as important as geography in explaining relative price dispersion; and
- these results are stable over the four samples covering fifteen years.

D52 While the rejection of the absolute law of one price for most products most of the time is largely uncontested, the interpretation of these findings is, as discussed above, far from evident. Specifically, do these divergences reflect matching divergences of costs, or different mark-ups? A number of studies address this question.

D53 The most direct approach to answering this question involves directly controlling for cost factors in a regression framework. In practice, as discussed above, the cost controls are rarely sufficiently precise to allow much confidence in the results obtained.

D54 One exception is a very careful study by Lutz (2002), who, for the European car market, is able to control for the exact distance between the production and sale location, though other cost factors are less exactly measured. He concludes that arbitrage costs are the most important determinant of price differences.

D55 In an innovative paper, Bradford and Lawrence (2002) utilize input-output tables to exclude distribution margins and indirect taxes to derive a measure of ex-factory prices across the OECD. They find:

- sizeable price differences across five European countries (Germany, Italy, Belgium, Netherlands and the UK);
- modest evidence of convergence over the 1990s; and
- a comparable level of price divergences between the European countries on the one hand and between Canada and the United States on the other hand.

D56 A number of studies has also documented a (not too surprising) positive correlation between retail prices and income/wage levels at a point in time, though the linkage between changes in relative income levels and relative prices over time appears less clear-cut.

D57 In addition to these direct tests, two indirect pieces of evidence on ranking and on double relative prices shed light on the importance of local costs.

Ranking D58 If spatial price differences reflect location specific factors then the prices of all products should be more expensive in the location with the higher cost, that is, the ranking of prices between two locations should be the same for all products.

D59 Crucini, Telmer and Zachariadis (1998, 2000, 2001) examine final cash prices for a large number of goods and services across European cities for 1975, 1980, 1985 and 1990. They find that if prices are expressed relative to a base country (Belgium), most countries exhibit rank reversals, that is, there are both products with prices exceeding the Belgian price and products with prices that fall short of the Belgian price. Haskel and Wolf (2001) report the same feature.

D60 By virtue of these reversals, the average of the deviations (weighted by their share in the CPI basket) is small. Thus, while purchasing power parity does not hold exactly, and while deviations are persistent, the deviations in absolute terms are small. The most recent (and poorest) members of the EU are a partial exception to this rule.

Double relative prices **D61** Under the assumption that local selling cost, transport costs and taxes are comparable across pairs of 'similar' products, the law of one price can be examined 'net' of local costs and taxes by focusing on the relative price of the two products in country A compared to the relative price of the same two products in country B. Pursuing this line of research, Haskel and Wolf (2001) find that the double relative prices often diverge from unity, though the deviations are mostly modest.

Dynamic price dispersion and mean reversion **D62** The study of relative common currency prices at a point in time reviewed in the previous subsection has yielded a number of important insights, including the wide-spread violation of the simple law of one price, and the importance of cost factors in explaining some of the differences.

D63 A related literature shifts the focus from the divergence at a point in time to the evolution of divergences over time and to whether structural factors, including the extent of exposure to competition between locations, influences the evolution.

Dynamic dispersion **D64** Rogers (2001) compares prices in a set of European countries over the 1990-2001 period.¹⁶ He finds that:

- the dispersion of tradables prices has sharply declined over the sample. The decline is more pronounced for the euro area than for the entire sample;
- the dispersion of non-tradables prices displays no marked trend; and
- while there is convergence, the ranking of countries by and large do not change.

D65 Exploring the potential causes for the decline, Rogers (2001) finds:

- a sizeable decline in the standard deviation of VAT taxes for the euro area, but a lesser decline for the full European sample. While providing a possible explanation for the reduced divergence of tradables prices, the reduced dispersion of VAT taxes also applies to non-tradables that display no trend towards lower divergence. The 1993 shift to levying the VAT only at the point of origin however arguably affected tradables more than non-tradables.¹⁷;
- an increase in labor cost dispersion coinciding with the period of reduced price dispersion; and
- a negative association between increased trade flows and price dispersion, consistent with, though not proof of, a negative effect of enhanced exposure to international competition on price dispersion.

D66 Rogers (2001) also compares the findings for European cities with those for US cities, which can be taken as a useful benchmark for a well-established monetary union. He finds that:

- the overall price dispersion of tradables in Europe remained above that in the United States for most of the sample period (consistent with some remaining border effects) although in the last sample years the dispersion among the subset of euro area countries has essentially approached the US level. The dispersion in the United States displays no marked trend, with a small up-tick in the last years; and

¹⁶ In a similar vein, the DRKB pricing survey, exploring a set of 200 European goods across 14 cities, finds that dispersion has decreased over time.

¹⁷ Crucini, Telmer and Zachariadis (2001) and DRKB (2000) document sizeable tax dispersions for alcohol and (for the former authors) tobacco products in the EU.

- in stark contrast, the price dispersion for non-tradables is greater in the United States, a finding Rogers (2001) partly attributes to the greater dispersion of housing costs across US cities compared to European cities.

D67 In addition to Rogers' (2001) work touching on the effect of EMU, a number of other papers directly assess whether EMU reduced price divergence. The literature is partly motivated by the prediction of such an effect in the influential "One Market, One Money" study by the European Commission (1990) and in a background paper to the 1996 *Single Market Review*.¹⁸ A second motivation is provided by the recent work of Rose (2000) suggesting that, *ceteris paribus*, trade is substantially higher between countries sharing a common currency, which, to the extent that greater trade is associated with greater arbitrage pressures, carries implications for price divergences. As yet, no consensus finding has emerged.

D68 The results of Rogers (2001) and Parsley and Wei (2001) point towards a potential negative effect of monetary union on price divergence. In contrast, Lutz (2002), re-examining four standard price sets (Big Mac, the Economist magazine, the UBS Prices and Wages Around the World series and car prices) finds little support for a robust effect.

D69 Bearing on the trade linkage, Parsley and Wei (1995) do not find notable negative effects of customs unions and free trade agreements on price divergence, even though both appear to be associated with higher trade volumes.

Mean reversion D70 A close cousin to the small literature focusing on price dispersion at a time and over time is the larger literature examining the behavior of relative prices over time. The literature on mean reversion inquires whether prices in high-price locations tend to fall over time relative to prices in low-price locations. The null is thus a trend towards a reduced divergence, not a convergence towards a single price.

D71 Econometrically, the simple mean reversion test is given by a regression relating the change of the relative price in a country between the last and the present period to its level in a prior period.

D72 The simple mean reversion equation is appropriate for a situation of no arbitrage cost. As Chart D1 illustrates, with arbitrage cost the simple equation no longer applies, rather, mean reversion only takes place once the relative price has moved outside the band, requiring an additional control capturing whether the relative price is inside or outside the band.

D73 The size of the band (and thus the exact arbitrage costs) is however not known for most datasets. In place of a single regression conditional on a known bandwidth, most empirical studies perform a grid search over a range of potential band sizes, using a goodness of fit criterion to select the preferred bandwidth. The approach introduces additional problems. In particular, it is not evident that the bandwidth is constant over time.

Mean reversion with aggregate price indices D74 Abstracting from composition issues, the aggregate real exchange rate is a weighted average of relative common currency prices for a large number of products, and thus provides a useful indication of overall relative prices. In the limit, if the law of one price held continuously for all products included in the respective national price indices, and if the composition and weighting of these baskets were identical across countries, the real exchange rate would be constant at unity.

¹⁸ See Lutz (2002) for a discussion.

D75 The existence and speed of mean reversion for the real exchange rate is the subject of a large literature. Based on a variety of studies¹⁹ the half-life of deviations of relative prices appears to be in the range of 4-6 years (Rogoff (1996)), with a shorter half-life if threshold effects are allowed for.

D76 The estimation of mean reversion equations for aggregate price indices however carries substantial interpretation risks. Effective arbitrage is a sufficient but not a necessary condition for mean reversion. Alternative explanations for mean reversion include deliberate policy actions designed to maintain real exchange rates within (implicit or explicit) bands and the abandonment of overvalued pegs overwhelmed by financial flows. Mean reversion can thus either reflect competitive pressures directly influencing prices, or macro adjustment of relative prices through exchange rate moves.

D77 Empirically, an argument that the widely observed mean reversion of aggregate relative prices indeed reflects arbitrage would thus be strengthened by direct evidence that arbitrage is in fact taking place. Specifically, if arbitrage is the cause for mean reversion, it should be possible to document a systematic link between trade flows and the deviation of the real exchange rate from trend. Likewise, in the context of threshold mean reversion, the case for arbitrage induced mean reversion would be strengthened if a systematic non-linear change of trade flows as the real exchange rate breaches the thresholds could be established.

D78 While this area of research remains wide open, Campa and Wolf (2002), exploring a sample of monthly bilateral trade flows and real exchange rates between the G7 countries since 1960, fail to detect a quantity response even during periods of clear-cut and dramatic mean reversion. These episodes did, however, frequently coincide with sharp changes in nominal exchange rate behavior associated with changed monetary and fiscal policies.

D79 In sum, the literature documents mean reversion of the real exchange rate, but, so far, these reversals are not tightly linked to arbitrage pressures. Several caveats arise, however:

- *actual versus expected arbitrage.* An incumbent firm knowing the entry costs of potential competitors may strive to keep relative prices (just) below the threshold triggering entry. The mere threat of entry and arbitrage can thus lead the incumbent to alter prices, in particular in response to nominal exchange rate movements, without trade flows (actual arbitrage) being observed; and
- *endogenous exchange rate policy.* Even if trade flows do not take place at the observed points of mean reversion, actual and expected trade flows are likely to play a role in government exchange rate policy.

Mean reversion with individual prices **D80** The use of data for individual products avoids most of these issues. A number of studies (Cumby (1993), Ghosh and Wolf (1994), Haskel and Wolf (1998)) document a tendency towards (slow) longer term mean reversion to the absolute law of one price, though the studies unavoidably focus on a small group of fairly special products, ranging from Big Macs to the Economist magazine.

Pass-through **D81** In addition to the direct tests of the law of one price, a lively literature has examined the effect of a change in the nominal exchange rate on international relative prices.²⁰

¹⁹ For a representative group of papers, see Frankel and Rose (1996), Parsley and Wei (1996), Cecchetti et al. (1998), Taylor (2000a, 2000b).

²⁰ See Menon (1995) and Goldberg and Knetter (1997) for recent surveys.

D82 Under the basic law of one price, international relative prices are constant, hence a nominal exchange rate change is associated with an equi-sized offsetting price movement: the nominal exchange rate change is fully passed through. On the other extreme, if markets are completely segmented, local firms fix their prices in the local currency. A change in the nominal exchange rate has no effect on local prices and is reflected one to one in international relative prices; there is zero pass-through.

D83 Crucini, Telmer and Zachariadis (1998, 2000, 2001) present a powerful aggregate test of the sticky price hypothesis, based on the cross-sectional dimension of their dataset of individual prices across markets (further reviewed below). If prices are fixed in local currencies, an exchange rate change should lift or reduce the relative price for all products by the same percentage, a prediction clearly rejected by the data.

D84 Econometric estimates of the pass-through elasticity have not provided much support for either of the extreme views. Exchange rate movements appear to be substantially but less than completely passed through to foreign currency selling prices. A very rough ‘guidepost’ for the typical short term pass-through is about half of the exchange rate movement. The pass-through elasticity however varies substantially across products and markets, and, at least more recently, also seems to be quite variable over time.

D85 Campa and Goldberg (2001) find that “the un-weighted average of pass-through elasticities across the OECD countries is about 60 per cent over one quarter, and about 75 per cent over the longer run.” The following table presents their estimates of long run pass-through elasticities, illustrating a relatively low degree of pass-through in the United States relative to the EU.

Table D4: Pass-through elasticities

	Short-run Pass-through elasticity	Long-run Pass-through elasticity
France	0.562	1.569
Japan	0.841	1.177
Italy	0.747	1.124
Germany	0.497	0.734
Canada	0.704	0.706
United Kingdom	0.314	0.564
United States	0.184	0.292

Source: Jose Campa and Linda Goldberg, Exchange Rate Pass- Through Into Import Prices, NBER Working Paper No. 8934, 2001.

D86 In addition to the literature on pass-through to prices of tradables, a small literature attempts to assess the effect of exchange rate movements on aggregate CPI levels. The net effect is an amalgam of a variety of channels linking the exchange rate to consumer prices, including the direct effect on imported final consumer products, the indirect effect through imported intermediate products and adjustment effects on both product and factor markets. For the EU, Huefner and Schroeder (2002) find that a ten per cent depreciation of the (nominal effective) exchange rate is associated with a 0.4 per cent increase in the Harmonized Index of Consumer Prices after 12 months, increasing to 0.8 after three years. France and Italy exhibit the highest long term pass-through.

Pricing to market **D87** A related literature examines the link between market structure and relative prices (Goldberg and Knetter (1997)).²¹

D88 The role of pricing to market has been studied for a number of inter-national micro datasets on actual transactions prices²² ranging from industrial products (Knetter (1989,1993)) to Big Macs (Cumby (1993)), commodities (Froot, Kim and Rogoff (1995)), magazines (Ghosh and Wolf (1994)) and furniture (Haskel and Wolf (1998)). In general, these studies have documented sizeable price differences across countries even controlling for cost factors. For example Knetter (1989) examines export unit values at the 7 digit level from a single source location to multiple destinations and documents divergences that are both sizeable and variable over time.²³

D89 One market that has attracted particular interest is the European market for cars, the subject of two recent articles by Goldberg and Verboven (GV) (2001) and by Lutz (2002).²⁴ Cars are differentiated large ticket items sold in markets that are generally viewed as exhibiting a significant degree of segmentation reflecting private actions (servicing restrictions, national distribution networks); national policies (national registration, national standards) and EU wide policies (such as the block exemption from aspects of the competition law). As such, the car market would *prima facie* appear to be highly amenable to and hence suitable for studying price discrimination. Furthermore, some of these restrictions have been partly relaxed over the last decade, creating a natural experiment in reduced border effects.

D90 Both studies find that:

- price differences have been and remain large. GV find an average dispersion of about 30 per cent between the highest and the lowest common currency price. Lutz (2002) calculates that (after controlling for remaining product differences across markets) in 40 per cent of cases, German and French consumers could have saved more than €2000 by buying in the cheapest market rather than in their home market;
- there is evidence of mean reversion, though not to unity, and of a somewhat reduced degree of price divergence over time. The result is important as it implies support for the dynamic law of one price for a sector that has generally been thought to be a prime example of a segmented market with extensive price discrimination; and
- local currency prices do not react fully to exchange rate movements. Lutz finds that a depreciation reduces the mark-up, with a pass-through of 55 per cent. GV partly attribute the local price stability to local marginal costs, estimated at 35 per cent of the total. The incomplete pass-through generates large fluctuations in relative common currency prices in response to nominal exchange rate movements.

²¹ In recent years the literature has been re-invigorated by interest in the effect of EMU on pricing behaviour. The net effect of monetary union on price divergences remains an open question. While the move to a common currency area may lead third country firms to set a common export price to the currency area, thus reducing price dispersion (Devereux, Engel and Tille, (2002), price discriminating firms may react to the exogenously reduced arbitrage costs by endogenously erecting arbitrage barriers Friberg and Martensen (2001). See Lutz (2002) for a discussion.

²² Froot and Rogoff (1995) and Goldberg and Knetter (1997) provide critical surveys of these literatures.

²³ By themselves, these findings are of course simply the mirror image of the rejection of the conditional law of one price, though the focus in the pricing to market literature is on the importance of market structure in explaining cross sectional and time series divergences in relative prices.

²⁴ The car market has also been examined in earlier papers by Gual (1993), Gron and Swenson (1996) and Verboven (1996).

D91 In explaining the price divergences, GV point to:

- *costs*, in particular, higher costs in the UK and in Germany reflecting different equipment, including exhaust equipment;
- *demand elasticities*, in particular, a low price elasticity in Italy (a strong preference for Italian brands); and
- *import quotas* in Italy, France and the UK.

D92 Lutz, distinguishing between price discrimination and arbitrage barriers as explanations, finds that on balance arbitrage costs have greater explanatory power.

Conclusions

D93 Drawing on this broad array of studies exploring the determination of relative prices from different angles, a few fairly robust ‘stylised facts’ emerge, although many issues remain debated.

Stylised fact I D94 The simple law of one price fails. At a point in time, the common currency price of identical products tends to differ significantly across locations. Since local costs and taxes also exhibit divergence across locations, the failure of the simple law of one price however does not by itself imply divergences in mark-ups across locations.

Stylised fact II D95 The violation of the simple law of one price is more pronounced for non-tradables than for tradables.

D96 Price differences between two locations tend to increase in their distance.

Stylised fact III D97 While the law of one price fails both within and across countries, divergences tend to be more pronounced across countries, generating a ‘border effect’.

Stylised fact IV D98 Locations do not tend to be ‘expensive’ or ‘cheap’ for all products, rather, in comparing any two locations, some products tend to be cheaper in the first locations, others in the second location. The divergence across locations of aggregated prices for bundles of products tends to be substantially lower than the divergence of prices for individual products across the same locations.

Stylised fact V D99 Location specific factors cannot provide a full explanation of price divergences but must be complemented by product specific explanations. Empirically, part of the divergences in the common currency prices of tradables can be explained by divergences in (typically location-specific, not product-specific) local cost factors (rents, wages) and taxes, however, a substantial unexplained residual remains.

Stylised fact VI DI00 Between countries linked by variable exchange rates, a 1 per cent change in the nominal exchange rate leads to a less than 1 per cent change in relative local currency prices, and hence to a change in relative common currency prices. A rough estimate of the ‘typical’ pass-through of exchange rates to local prices is about half. The pass-through tends to increase over time as firms periodically adjust prices.

Stylised fact VII DI01 Even though the law of one price fails at a point in time, there is substantial evidence of mean reversion over time: locations with low starting relative prices experience higher inflation compared to countries with high starting relative prices.

DI02 Overall, a significant part of the adjustment of international relative prices bringing about mean reversion reflects adjustments in the nominal exchange rate rather than adjustment in nominal prices. The relative contribution of price and exchange rate adjustments however differs across products.

DI03 The adjustment speed appears to be significantly faster for tradables than for non-tradables.

Stylised fact VIII DI04 During the 1990s, the price dispersion of tradables, but not of non-tradables, has substantially diminished in Europe. The reduction has been strongest for the euro area.

DI05 While much progress has been made in understanding international relative prices, a number of questions remain open:

- why has the decline in price dispersion been more pronounced among the euro area than among the entire EU? What role does exchange rate volatility, coupled with imperfect short term exchange rate pass-through, play?
- what explains the remaining level differences in prices? To date, the scarcity of product specific local cost measures impedes the attribution of price differences to differences in costs and differences in mark-ups for a representative sample of goods, although stylised fact IV is suggestive; and
- to the extent that price differences do reflect differences in mark-ups across locations, can the differences be linked to structural factors? Again, stylised fact IV suggests that the explanation is unlikely to be the same across sectors. Among the avenues worth exploring is the choice of marketing strategy, the importance of national versus multi-national distributional networks etcetera. A simple but suggestive difference between the EU and the United States is the lack of a European equivalent to Wal-Mart: the presence of the ubiquitous Wal-Mart stores (with global sales this fiscal year of about 250bn US\$) with their comparable offerings at comparable and generally low prices arguably by itself provides a formidable price convergence pressure across US states.

Table D5: Competitiveness and prices: a rank comparison

	Competitiveness	Overall prices excluding rent	Prices of household appliances
	Rank (IMD)	Rank (UBS)	Rank (UBS)
	Highest = 1	Highest = 1	Highest = 1
	2000	2000	2000
Netherlands (Amsterdam)	2	9	15
Finland (Helsinki)	3	6	6
Ireland (Dublin)	4	10	14
Luxembourg	5	11	16
Germany (Berlin)	6	12	11
Denmark (Copenhagen)	7	5	4
Sweden (Stockholm)	8	3	2
Austria (Vienna)	9	8	7
UK (London)	10	4	9
Belgium (Brussels)	11	13	9
France (Paris)	12	7	13
Spain (Madrid)	13	17	12
Portugal (Lisbon)	15	16	8
Italy (Milan)	16	14	17
Greece (Athens)	17	15	5
New York	1	2	3
Tokyo	14	1	1

Source: IMD World Competitiveness Scoreboard, April 2002 (data for 2000), UBS Prices and Earnings Around the World, 2000.

Note: Competitiveness data are for the country, price data for the city.

DI06 More abstractly, can price differences be linked to ‘competitive pressures’? Are ‘competitive pressures’ more pronounced within than across countries, and if so, why? Are they stronger between some locations than between others, and if so, why? The answer is unlikely to be simple.

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