High prices in Sweden
– a result of poor competition?

Swedish Competition Authority Report, July 2003

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1 Does poor competition inflate Swedish prices?

For the last few years, the Swedish consumer price level has been vigorously debated. Most seem to agree, although with exceptions, that the price level in Sweden is comparatively high. In addition to high taxes and moderate wage levels by European standards, many have been upset by the apparent hardship felt by Swedish households to make ends meet. Whether this is due to poor competition, macroeconomic factors, geography, or a combination of these factors and others, has been the subject of intense discussion. The debate has been stimulated by a series of Government commissioned reports presented by the Swedish Competition Authority in recent years. These reports have highlighted a number of competition issues that are likely to affect prices.

This volume is the offspring of a commission by the government that was received in February 2002 and delivered on December 13, 2002.[1] The project involved a number of separate studies conducted by researchers at institutes and universities in Sweden. These studies are published in full in this volume and consider a number of aspects of the price differences between Sweden and its neighbours, such as measurement techniques, the role of borders, different mark-ups, the role of transport costs, and the potential for parallel imports to level out price differences.

The next subsection of this introductory chapter summarises what we know about price level differences between Sweden and other countries. Section 1.2 deals with the causes for high Swedish prices. Our main interest, the role of competition, is analysed in Section 1.3 which summarises the latest reports by the Authority on the subject. The contributions in this volume are described in Section 1.4. Section 1.5 concludes and outlines the policy proposals by the Authority.

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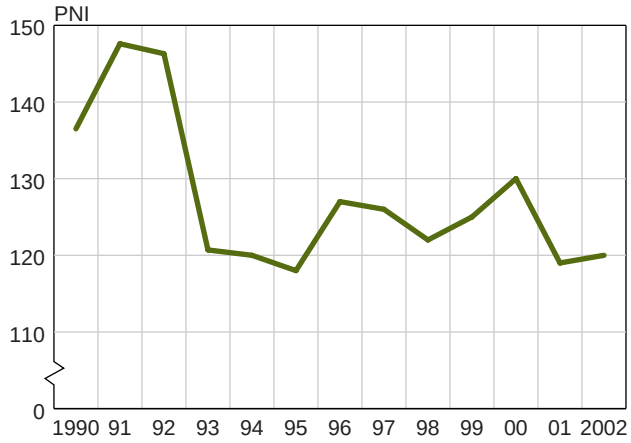
[1] ”Swedish prices can be squeezed!”, (”De svenska priserna kan pressas!”), Konkurrensverkets rapportserie 2002:5

1.1 The Swedish price level

Over the years, several studies have been published on the price level differences between Sweden and other countries. All these studies conclude that Swedish prices are high in a European perspective. For this project, Statistics Sweden was asked to conduct projections for the period 2000 - 2002 on the Eurostat comparative consumer price levels of 1999.[2] The projections for the subsequent years are based on official exchange and inflation rates. The price levels represent private consumption of goods and services and is constructed to be representative for an ordinary consumer within the Union. This means that each index is as relevant for a Swedish consumer as for a consumer from any other country within the Union.

Figure 1.1 illustrates the development for the last years. After the fixed exchange rate regime was abandoned in 1992, Swedish prices have oscillated between 20 to 30 percent above the EU average.

Figure 1.1 General price level for private consumption in Sweden compared to EU15, 1990-2002 (EU15=100)



Source: Statistics Sweden

[2] For 2002, the index refers to the period January to October.

Table 1.1 displays the national differences for the last years. For 2001, the price levels are also derived net of VAT. These figures show that Sweden has a high price level from a European, but not from a Scandinavian, perspective. For instance, Sweden is significantly more expensive than Germany, Netherlands and France. The results suggest that Sweden is 20 percent more expensive than the EU average in 2002 (for January – October). For 2001, the corresponding figure is 19 percent, which represents a significant reduction compared to 2000. Exclusive of VAT, the difference is smaller at 17 percent given the higher taxes in Sweden.

Table 1.1 General price level for private consumption, 2000-2002

Country	Country code	2000	2001	2001 (VAT excl)	2002 (Jan – Oct)
Belgium	**BE**	103	103	103	102
Denmark	**DK**	122	122	116	123
Finland	**FI**	121	121	119	121
France	**FR**	105	105	105	105
Greece	**GR**	79	80	81	82
Ireland	**IR**	107	108	108	111
Italy	**IT**	87	87	85	87
Luxemburg	**LU**	99	99	102	99
Netherlands	**NL**	97	100	101	102
Portugal	**PO**	73	75	76	76
Spain	**ES**	84	84	85	85
UK	**UK**	119	115	115	113
Sweden	**SE**	**130**	**119**	**117**	**120**
Germany	**DE**	104	104	105	104
Austria	**AT**	101	101	99	101
Norway	**NO**	131	133	130	140
USA	**US**	123	127	138	121

Source: Statistics Sweden

The statistics also reveal price level differences for separate sectors. In some of these, the indices are subject to some degree of uncertainty due to different measurement techniques and consumption patterns across the Union, such as housing and health care. Food, on the other hand, is considered to be measured with better accuracy. Swedish food prices were 11 percent higher than the EU average in 2001. Excluding VAT, the difference is 6

percent. It cannot, however, be taken for granted that full harmonisation of VAT rates within the Union would be fully reflected in prices.

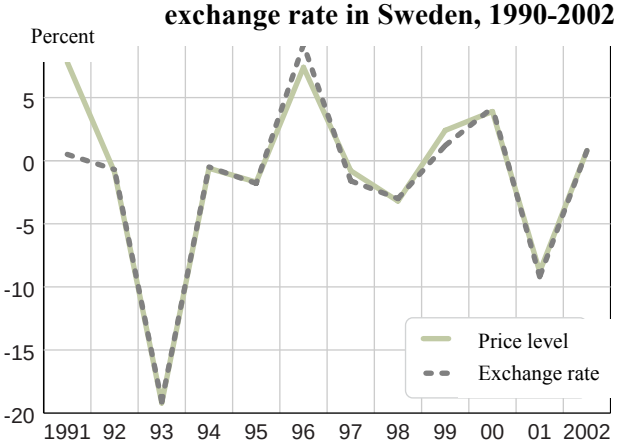
Other studies conducted by papers, research and financial institutes, and the Commission, confirm this picture. Although they sometimes differ in percentage terms, they all point in the same direction qualitatively, namely that Sweden is relatively expensive in an EU perspective.

1.2 Causes for high prices in Sweden

There are many factors behind international price differences. Important factors include exchange rate changes, gross domestic product and labour costs.

The price of the Swedish currency naturally affects the relative price level for Swedish private consumption. The reason is that national prices fluctuate much more slowly than exchange rates. This is illustrated in Figure 1.2 below which depicts the nominal exchange rate and the relative general price level for the last decade. It is obvious that the short-term variation is almost fully explained by exchange rate fluctuations. The long-term structural price level difference in Figure 1.1, however, hinges upon other factors.

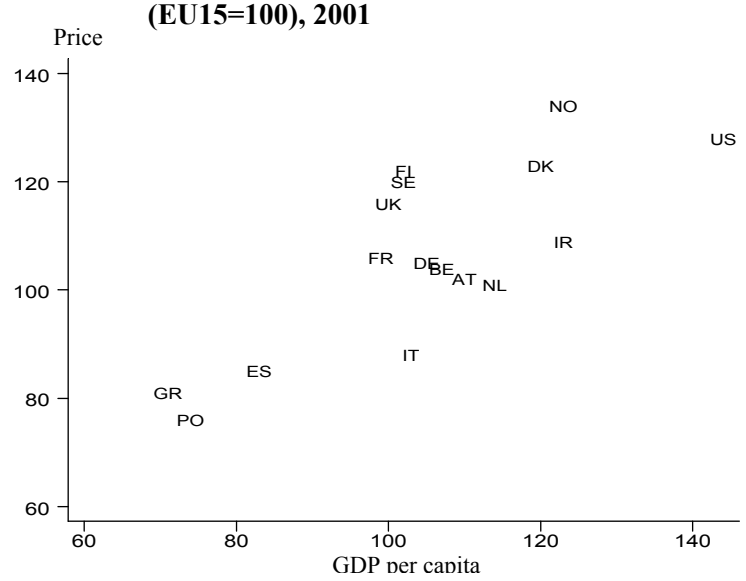
Figure 1.2 Changes in price levels and the nominal exchange rate in Sweden, 1990-2002



Source: Statistics Sweden

Richer countries usually have higher prices. This relationship is consistent with economic theory and is displayed in Figure 1.3. As is evident in the figure, Sweden has a GDP per capita close to the EU average, but a price level similar to that of high income countries. A number of countries have a higher GDP per capita and lower prices than Sweden, including Germany, Netherlands, Austria, Ireland, Italy and Belgium. No country within the EU exhibits higher prices and lower GDP per capita than Sweden.

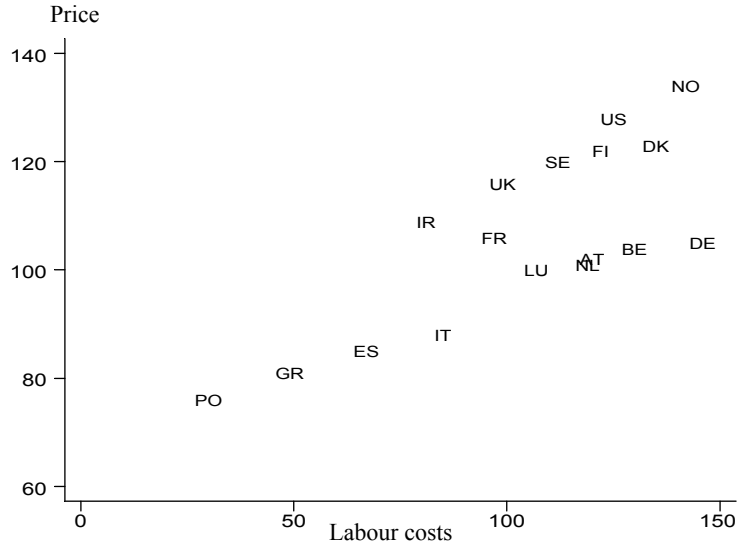
Figure 1.3 Price level and real GDP per capita (EU15=100), 2001



Source: Statistics Sweden and OECD (2002a) table 2.

High labour costs lead to higher prices as is illustrated in Figure 1.4 below. Sweden has comparatively high labour costs, but there are countries with still higher costs and with lower prices, namely Germany, Netherlands, Austria and Belgium. Again, there are no countries in the EU with higher labour costs and lower prices.

Figure 1.4 General price level and labour costs



Source: Statistics Sweden and U.S. Department of Labor (2002), table 1.

In sum, these data suggest that the Swedish price level is comparably high even when labour costs and gross domestic product are considered. Most important, Sweden would by no means be abnormal had it a price level similar to the EU average given its levels of labour costs and gross domestic product per capita.

Hence, are high Swedish prices due to poor competition? This is the key issue that the Swedish Competition Authority has tried to answer in a series of reports. The next section summarises these studies.

1.3 The role of competition

Several publications by the Swedish Competition Authority have touched upon the price level issue recently. These are summarised in table 1.2.

The report, "Why are Swedish prices so high?"[3], was published in the autumn of 2000 and sought to explain the role of competition in

Table 1.2 Recent reports on prices by the Swedish Competition Authority

Report (publication year)	*Content*
Why are Swedish prices so high? (2000)	Panel regression analysis of the role of competition in international price level differences in the OECD during the 1990s
Sweden – a part of the Internal Market. Why do price differences persist? (2000)	Price level comparisons and 4 case studies of products which exhibit large price differences between Sweden and the EU
Can Municipalities put pressure on local food prices? (2001)	Analysis of planning permission as an entry barrier for food retailers
Why are wooden planks expensive in Skåne and food cheap in West Sweden? (2002)	An analysis of the role of competition in explaining national price variation in retail markets for food, building materials, and transport fuel.
Swedish prices can be squeezed! (2002)	Price level comparisons between Sweden and the EU and examination of possible factors behind differences

explaining price differences between Sweden and other countries in the EU and the OECD. Price variation among countries naturally depends on a number of macroeconomic and other factors such as gross domestic product, tax levels, labour costs, geography and must not be interpreted solely as a result of market imperfections. However, the debate on prices often becomes confusing since a judgement must be made as to whether such factors explain the full price difference between Sweden and its neighbours or just a part of it. In other words, do we "deserve" the prices we have given the specific economic conditions we live under?

The report attempts to address this question by analysing the relative consumer price levels of OECD members during the 1990s using panel regression techniques. The price indices were modelled in terms of variables chosen with inspiration from the literature on

[3] "Varför är de svenska priserna så höga?", Konkurrensverkets rapportserie 2000:2

purchasing power parities, including gross domestic product, the level of taxes, labour costs, changes in private consumption and exchange rates and also population density (to capture variations in transportation costs). The results indicate that about half of the Swedish price difference, which amounts to approximately 20 percent as an average for the 1990s, can be explained by these variables. The remaining half constitutes a "fixed effect" and is *not* due to these factors. The open question is to what extent does lack of competition in Swedish markets explain the residual.

Unfortunately, no variable describing the efficiency of competition was available for inclusion in the model, as this would have enabled us to test this factor directly. However, a somewhat rudimentary variable of industry concentration was derived for a number of sectors in the EU for a few years in the 1990s, which shows that Sweden exhibits comparably high levels of concentration in most cases. The variable was included in the analysis of a restricted sample and the results indicate that it is strongly significant as a determinant for price levels in Europe.

These findings, together with general experiences gained during the last ten years, led the Authority to conclude that weak competition in Sweden represents up to half the price difference between Sweden and the EU.

Another report, "Sweden – a part of the Internal Market. Why do price differences persist?"[4], conducted in conjunction with two other government agencies, was also published in the autumn of 2000, and provided explanations of some of the institutional and regulatory factors making Sweden more expensive than other countries within the EU. A number of case studies were carried out on items where measured price level differences were remarkably high. These items included pasta and rice, non-alcoholic beverages, chemo-technical household products and building materials. The results show that the markets for these products are characterised by high concentration and in some cases strong brand names or little competition from imports. Non-tariff barriers of various types were identified and were fairly common.

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4 "Sverige – en del av EU:s inre marknad. Varför kvarstår prisskillnader?", Konkurrensverkets rapportserie 2000:3

The Authority has also conducted studies on specific competition problems in various sectors of the Swedish economy. These studies confirm the view that severe restrictions on competition do remain in many markets.

The report "Can municipalities put pressure on local food prices?"[5] presented in the autumn of 2001, focused on the conditions under which food retailers can receive permission from municipal planners to open new food supermarkets. Concerns are often raised that municipal planning is too restrictive, thus creating a legal barrier to entry for new food shops which tends to raise prices and limit supply in local markets.

To evaluate the validity of these claims, close to 16,000 planning decisions were examined to verify whether there was a correlation between how "restrictive" municipalities were and local market structure.[6] The results suggested that in areas with restrictive planning shop space per inhabitant also tended to be smaller. This is an important result because some argue that planning in itself only affects the decision on where to locate the shops and not the number or their size. Shop structure, in turn, has a visible effect on local food price levels. The market share of discount retailers is particularly influential on prices. In response to the question posed in the title of the report, the Authority therefore concludes that municipalities indeed can put pressure on food prices by using planning as an instrument to encourage new entry and thus competition.

Why then, are not municipalities doing this already? A survey and a series of interviews conducted as a part of the study show that some do, but others do not. Planning for food retailing often involves consulting experts about the likely effects of a new establishment. The focus of these enquiries is, almost exclusively, on negative consequences, including reduced turnover and the possible closure of existing shops, increased traffic, possible drain of consumers from the city centre, and so on. The positive aspects of new entrants to the local food market, such as lower prices, greater variety and

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5 "Kan kommunerna pressa matpriserna?", Konkurrensverkets rapportserie 2001:4

6 "Restrictiveness" is of course a subjective concept. Two definitions are used in the report: 1) the share of decisions which permits any kind of retail trade within its boundaries to the total number of decisions, and 2) the share of decisions that forbids food retail to the number of decisions that allow any kind of trade.

better service are rarely, if at all, considered. One can thus conclude that taking an informed decision, based on material that almost exclusively deals with the disadvantages but not with the advantages, is a challenging task for municipal decision makers at the very least. As a result, planning is often overly restrictive, thereby curbing efficient competition.

In addition to being restrictive, planning is also slow, costly and uncertain. Entrepreneurs often have to share the costs of consultancy studies. The planning process, once it has commenced, may very well lead to a rejection of a proposed new location for a supermarket. From a competition point of view, this is particularly disturbing because it favours the three large players on the Swedish food retail market since they have strong financial resources and can bide their time during a lengthy process. They have long experience and often personal connections to the planning staff. All this lessens the prospects for small entrepreneurs to successfully challenge the dominant players to the detriment of the performance of the market and ultimately the consumer.

The Authority proposed these problems be addressed by: (i) improving knowledge among city planners of the role of competition in creating welfare, (ii) developing new analytical tools for evaluating the positive effects of new entry to food retailing and (iii) a clearer emphasis in the 1987 Planning and Building Act on competition as a general factor to be considered in planning.

A second report on the national level involves original price measurements and analysis of regional differences. The study, "Why are wooden planks expensive in Skåne and food cheap in West Sweden?",[7] was presented in January, 2002. As mentioned above, international price level differences are to a significant extent driven by differences in the economic and regulatory environment. However , regional price differences in a country like Sweden are hardly a function of such factors, given the fairly uniform economic geography of the country. Competition can thus be expected to play a comparatively greater role in regional as opposed to international price differences.

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[7] "Varför är byggvaror dyra i Skåne och maten billig i Västsverige?", Konkurrensverkets rapportserie 2002:1

The analysis proceeds in two steps. The first involves price measurement and the derivation of price indices relevant for a representative consumer. The markets for food retailing, building materials and transport fuel were studied. The second step contains an analysis of regional price variation using so-called price-concentration models, in which price is modelled in terms of explanatory variables measuring costs, demand structure and the competitive situation. The methodology enables us to study the relationship between competition and prices, allowing us to take account of these other factors.

The results reveal substantial regional price differences for two of the three sectors studied. A basket of food items costs 7 percent less in West Sweden compared to the county of Stockholm - a difference that is statistically significant. The estimates are based on scanner price data for close to 1,000 products registered in a sample of 269 supermarkets. Building materials exhibit large regional variations too. Prices are 8 percent higher in Skåne in the south, compared to East Sweden (except Stockholm). For transport fuel, on the contrary, Skåne is one percent cheaper than the rest of Sweden.

The second step of the analysis, involving price-concentration models for each of the sectors, produces some answers but also poses additional questions. An overall result is that competition has an effect on price formation. In food retailing, physical distance has an influence - prices become lower the smaller the distance to the nearest competitor. Another effect is that the market share of discount outlets has an overall depressing effect on prices. As a consequence, a consumer can continue to shop wherever he or she usually shops and still benefit from the establishment of a new discount store since the “old” shop will reduce its prices as a result of increased competition. If the market share for discount outlets increases from zero to 20 percent, i.e. if one out of five equally sized stores were to become the first discount outlet in a local market, the overall price level would decrease by one percent. Moreover, discount shops are of course cheaper – the difference being on average six percent compared to other shops.

However, the model cannot explain all regional price variation. West Sweden is still cheaper, even when cost, demand and market structure differences are accounted for, and the difference is statistically significant. This calls for a more thorough examination

of the demand side and putting the role of the consumer on the agenda for future research. In the markets for building materials and transport fuel, estimated results are not as clear regarding the role of competition. Nevertheless, the discount alternatives in these markets are significantly cheaper, thereby putting competitive pressure on other actors.

1.4 Contributions

Each of the chapters 2 to 6 in this volume are the full expert reports commissioned by the Authority as the background material for the report “Swedish prices can be squeezed!”. The studies were written by researchers at universities and institutes who are presented under the “Contributors” section above. The views are those of the authors and do not necessarily represent the opinion of the Swedish Competition Authority.

In chapter 2, Hans Bolin and Martin Svedin estimate transport costs for a number of items in Sweden, Denmark, Finland, Netherlands and Germany. Transport costs have been advocated as a determinant of price differences among nations, particularly for Sweden, given its location at the northern edge of Europe. The study estimates the costs for transporting a sample of goods from the factory or farm gate to the point of sale to the consumer. The sample includes tomatoes, hard cheese, French fries, granulated sugar and portable phones which are traced throughout the whole logistic chain.

The results reveal that Sweden has relatively high transport costs, driven mainly by greater distances. However, these are not of a magnitude that would represent any significant part of the price level difference between Sweden and other countries in the EU. The highest transport costs are estimated for tomatoes at 0.158 Euro per kilo in Sweden, to be compared with, for instance, 0.127 Euro for Germany. In Sweden, transport costs thus represent about four percent of the sales price. Had transport costs in Sweden been at the same level as in Germany, the price for tomatoes could in principle be reduced by roughly one percent maintaining the same absolute margins for the retailer. Similar figures can be derived for granulated sugar and French fries. Even less differences are estimated for hard cheese and portable phones. In conclusion, transport costs do not appear to represent any substantial part of the

price difference for Sweden, which can be attributed to the highly efficient transportation system in use today.

The distribution costs, i.e. the costs associated with holding inventories and organising distribution centres, are, unfortunately, not captured by the study. Nevertheless, it is reasonable to expect that these costs exhibit less international variations compared to transport costs. The conclusion that distribution and transport costs only explain a minor part of the price level differences between countries is therefore plausible.

In chapter 3, Anders Norberg and Angelica Arellano present price comparisons of washing machines in five countries in Europe using different statistical methodologies. The paper attempts to deal with the various methodological problems that emerge in a novel way, including the consideration of different shop structures, product characteristics, consumer tastes and brands. The results indicate that washing machines are on average 8 percent more expensive in Denmark and in France compared to Sweden. In Germany, on the other hand, prices are 10 percent lower, and in Holland 5 percent lower, than in Sweden.

In chapter 4, Christian Jörgensen analyses the effects of borders in determining price differences between countries within the EU. As described above, such differences persist in spite of the implementation of the Single Market Programme in 1992, which established free movement of goods, capital and labour. The study analyses the relative price differences of 56 food products and beverages in order to study market segmentation across national borders for the time period, 1990 - 2002.

National borders are found to cause price differences within the Union for most products. Barriers to entry and trade are likely to drive these results. In addition, different cost structures and local preferences may play a role. The border effect varies depending on the product studied. Dairy items and some branded food products exhibit comparably high border premiums. For homogenous products such as meat, fruit and vegetables, the border effect is relatively small or statistically insignificant. There is no clear indication that the border effect is decreasing over time. For some products, price dispersion between countries has even increased. As Sweden, Austria and Finland became members in the Union in

1995, the price differences between cities in these countries and the rest of the EU have decreased.

In chapter 5, Dick Durevall conducts an investigation on the variation in roasted coffee prices across the EU. A key interest is whether the disparities are a function of competition in these markets, which is motivated by the high concentration in several regional coffee markets in the Union. A typical case is where a few companies dominate the market with a small fringe of independent producers operating on a small scale.

The effect of competition on prices was analysed using time series econometrics. Surprisingly, clear evidence of the exercise of market power on the price variable was not found. Prices were not set in excess of marginal costs in any of the five countries studied (Sweden, Denmark, Finland, Spain and Austria). However, pricing behaviour does exhibit some interesting differences between the countries. With the exception of Austria, there exists a long-term relationship between import prices and consumer prices. For Finland, the long-term coefficient equals 1.18, which means that an increase in the price of beans by, for instance, 1 euro, raises the consumer price by 1.18 euro in Finland. Strikingly, the corresponding change in consumer prices in Sweden would be 1.70 euro, and for Netherlands and Spain more than 2 euro. These differences can indicate potential competition problems in the coffee markets in the latter countries.

These estimates are averages for positive and negative changes in the world price of beans. In some countries, however, one might suspect that companies may act differently depending on whether prices are falling or climbing. In other words, are the players in the market quicker in passing on world market price increases to consumers than they are in passing price decreases? Such asymmetry would suggest that market power is exercised. The estimates indeed reveal tendencies of such behaviour in all the countries except Spain. The effect is statistically significant in Finland and Austria. These results suggest some imperfections in the markets studied for coffee at the retail or manufacturing levels.

In chapter 6, Mattias Ganslandt and Keith Maskus study the benefits and costs of parallel imports using data on 53 categories of products including sweets, toiletries, clothes, electronic devices and other goods. Parallel imports are defined as goods traded without

the authorization of an owner of associated intellectual property rights. The policy issues of the subject are sensitive since different consumer groups are affected differently, and there are no simple conclusions on the total welfare effects of parallel trade.

The empirical analysis shows that an important reason for parallel imports are international retail price differences which gives rise to arbitrage possibilities for traders. Parallel imports can also affect the relationships between manufacturers and distributors and lead to changes in wholesale pricing strategies. This may improve retail-market competition and market integration, but the welfare effects are nevertheless uncertain because manufacturers will act in order to restrict this trade. Evidence from Denmark and England indicate that manufacturers increase export prices with the objective of deterring parallel imports.

Several arguments have been raised in favour of restraining parallel imports. One view is that parallel trade allows distributors to free ride on costly promotion activities of the original distributors. It may also reduce the potential for manufacturers to recoup development costs, which would reduce the incentives to innovate, especially in industries with high R&D costs, such as pharmaceuticals, biotechnology and some copyright sectors. There are also arguments that an increase in parallel trade has the potential of raising welfare. The authors point out that this line of reasoning may hold true for a group of countries with similar income levels and legal protection principles for intellectual property, such as the EU, but not for the world as a whole. However, the gains are highly dependent on an overall reduction in trade costs. Thus, there is a strong need to coordinate a policy for parallel imports with that of other trade policies.

Parallel trade within EU is legal since the intellectual property rights are exhausted upon the first sale of the product. However, given the imperfections of the internal market, producers may nevertheless have an opportunity to gain from charging different prices in different countries. This is certainly not in violation of the competition rules. Nor is it illegal to prevent parallel imports through levelling out price differences between countries, which means that prices will be increased in some countries and reduced in others. What is more questionable and in potential violation of the rules are export bans imposed on sales agents in different countries within the union. Given that the internal market is

developed and the border effects are eroded, the incentives for producers to act in order to prevent parallel imports between member countries will grow. For this reason, these markets need careful monitoring by competition authorities, especially at the Community level.

1.5 Conclusions and policy proposals

Why are Swedish prices so high? The studies and reports summarised above suggest the following conclusions can be drawn:

- **Exchange rate:** The nominal exchange rate has a direct impact on price relations between countries because prices generally changes much more seldom than exchange rates. This is especially evident during the years 2000 and 2001, when the Swedish krona fell considerably, which led to a reduction in the Swedish price level from 30 to 19 percent above the EU average.

- **Gross Domestic Product:** Richer countries generally have higher prices. Sweden has a GDP per capita close to the EU average, but a price level similar to that of high income countries. A number of countries, including Germany, the Netherlands and Austria, have a higher GDP per capita and lower prices than Sweden.

- **Labour costs:** High labour costs lead to higher prices. Sweden has comparatively high labour costs, but there are countries with still higher costs and with lower prices, such as Germany, the Netherlands and Austria.

- **Transport costs:** Sweden has higher transport costs than most other countries within the EU, primarily as a result of greater distances and a sparsely distributed population. Transport systems today, however, are so efficient that this probably does not explain more than a minor part of the price differences.

- **Parallel imports:** Since Sweden has a relatively high price level, parallel imports in most cases have a downward effect on prices. There is empirical evidence for this as regards pharmaceutical products. However, the effects would seem to be limited as a consequence of limited import volumes.

- **Competition:** The Authority has previously concluded that weak competition in Sweden represents a major factor behind the price difference between Sweden and the EU. Given the other competition problems identified in current and earlier reports, and also that competition problems have indirect effects on prices for various inputs, the Swedish Competition Authority concludes that approximately half the price differences can be explained by weak competition in Sweden.

The answer to the questions put in the titles of this chapter and of the entire volume is therefore positive. The Swedish price level can indeed be reduced by an improved and intensified competition. To achieve this goal, the Swedish Competition Authority proposes reforms in the following three main areas: competition policy, the internal market and consumer policy. More research into the underlying relationships is also needed.

A more effective competition policy

– **Fighting cartels more effectively:** Cartels are a type of economic organised crime costing consumers and society large amounts each year. The work of detecting and fighting illegal cartels has the highest priority at the Swedish Competition Authority. In recent years the regulatory framework has been made more effective i.a. through the possibility of negotiating concessions and reductions in fines for companies co-operating with the Swedish Competition Authority, as well as providing a higher level of confidentiality, greater opportunities for the exchange of information and coordination with authorities in other countries. Additional resources would mean that a larger number of cartels can be identified and legal action taken.
The Swedish Competition Authority proposes that the Government allocate increased resources to the Authority.

– **Better functioning of deregulated markets:** Over the last 10 years a number of sectors have been opened up to competition in Sweden, e.g. taxis, domestic aviation, and also the postal and telecommunication markets. However, changes in deregulated markets need to be followed closely in order to identify and solve at an early stage potential

competition problems. Statistics available today are inadequate for achieving this purpose.
The Swedish Competition Authority proposes that Statistics Sweden be commissioned to develop and regularly provide price indices measuring the development on these markets.
In addition, comparisons between deregulated markets are valuable when making qualitative evaluations.
The Swedish Competition Authority proposes that the Authority be commissioned to carry out such studies.[8]

- **Increasing the part of the economy opened up to competition:** In the Bill "Competition policy for innovation and diversity" (1999/2000:140), the Government stated that the part of the economy opened up to competition should be enlarged. The aim is to increase efficiency in the economy thereby creating better market performance and lower prices. The Swedish Competition Authority considers that there are good opportunities for realising this goal.
The Swedish Competition Authority proposes that monopolies be phased out (e.g. the monopoly on pharmaceutical products) and also that changes in legislation be implemented in such areas as public procurement and state aid.
It is important that long-term competition programmes be developed for those parts of State administration not involving the exercise of public authority. The municipal sector should also have similar programmes. The provision of services in health and medical care should not be exposed to competition until the requisite competence for purchasing such services has been developed.
The Swedish Competition Authority proposes that such competition programmes be drawn up. [9]

- **Establishment of more companies by reducing barriers to entry:** The number of company start-ups in Sweden is lower than in many other OECD countries.[10] This

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8 "Konkurrensen i Sverige 2002", Konkurrensverkets rapportserie 2002:4

9 "Vårda och skapa konkurrens", Konkurrensverkets rapportserie 2002:2

10 "Benchmarking av näringspolitiken 2002", Näringsdepartementet, Ds 2002:20

undermines competition since one of the most important prerequisites for effective market performance is that new companies are established at the same time as inefficient companies disappear. A crucial obstacle to the establishment of new companies are barriers to entry of different kinds. This may involve access to necessary infrastructure, physical planning of land use, and also national rules or certification and permits.
The Swedish Competition Authority proposes that the Government appoint a commission to analyse the effects of barriers to entry on the establishment of new companies in Sweden.

A better functioning internal market

- **Reducing barriers to trade:** Ten years after the launch of the internal market, price differences which are considered to arise as a result of barriers to trade continue to exist within the EU.[11] These barriers are mainly in areas in which standards have not yet been harmonised and where national demands continue to dominate. Another problem is the occurrence of voluntary and non-state systems for identifying and monitoring such barriers. Chapter 4 illustrates the significant role of border which indicates that the internal market is far from perfect.
  The Swedish Competition Authority proposes that Sweden intensifies its efforts to accelerate harmonization within the EU, as well as the application of the principle of mutual recognition of national rules in order to reduce barriers to trade in the internal market.

- **Introduction of a common currency – the Euro:** The introduction of a common currency, the Euro, will simplify trade within the Union for the benefit of consumers, as well as eliminate exchange risks. In addition, a single currency will lead to greater price transparency thus enabling cross-border price comparisons to be made. Customers and consumer will thus have better opportunities to make informed choices, which is positive for competition and

[11] The European Commission (2002)

may exert a downward pressure on prices.
The Swedish Competition Authority considers that membership of the EMU would be favourable to competition and lead to somewhat lower prices. However, the Swedish Competition Authority also considers that the removal of barriers to trade is more important than a common currency in order to reduce price level differences.

A more effective competition policy

- **A consumer policy with a competition perspective:** A prerequisite for competition is that consumers are in a position to make choices and do in fact take advantage of this. If consumers make active choices, the result will be lower prices, higher quality and better service. There is a natural link between consumer and competition issues which needs to be emphasised in consumer policy.
  The Swedish Competition Authority proposes greater prominence be given in consumer policy to the consumer benefits resulting from competition.

Further research

- **In-depth studies of causal relationships:** There are different methodological problems involved in analysing the relationship between prices and competition. The problem exists not only because of the complexity of the interrelationships and analytical models, but also because relevant statistics are not available. Further analysis of prices and competition conditions is needed, and in the future should also involve researchers from university colleges and universities from both Sweden and abroad. Chapter 3 is an example of the need for further research in the area of international price level measurement.
  The Swedish Competition Authority proposes that the Authority be commissioned to carry out regular analyses in conjunction with researchers and other authorities.

2 Transport prices and transport costs in the European Union

Hans Bolin and Martin Svedin

2.1 Introduction

All presentations have to have a starting point and we will try to make this chapter a proper take off for the reader of this report. We are starting with short explanations of the background and aim for this study. This is followed by a brief description of the project work and the limitations of the study.

2.1.1 Background

This study, ordered by the Swedish Competition Authority, forms a part of an investigation that the Authority undertakes on some of the underlying factors behind price level differences between Sweden and some other countries following a government instruction issued on February 28, 2002.

The transport costs are one of the factors that affect the price when a private consumer buys an article in a public store. Transport costs are added along the supply chain all the way from producers to the public stores. The discussions about different price levels in different countries will indeed be more adequate if we can isolate the part referring to transport costs.

In this work, we have analysed a snapshot of the transport markets within the European Union. The analysis contains pricing and cost data for some standardized products that could be found in all countries in the European Union.

2.1.2 Aim

Our aim has been to describe how the transport prices vary in some selected countries within the European Union. In addition to that, we wanted to describe the underlying transport costs for those prices. The differences between prices and costs will be the operating margin for the logistics companies involved in the supply chain.

2.1.3 Project work

The project work has focused on finding a comparable set of data regarding transport prices and the underlying transport costs for freight transport of five standardized products in six countries. The products and countries were chosen in co-operation with the Swedish Competition Authority. The selection of products was made with an ambition to have typically products from dry, chilled and frozen transport chains. It was also important to select standardized articles that were easy to find in any European country.

We have studied the following products:

Tomatoes

Common vegetable demanding a chilled transport chain

Hard cheese

Common dairy product demanding a chilled transport chain

French fries

Common potato product demanding a frozen transport chain

Granulated sugar

Common sweetening product demanding a non-tempered transport chain

Portable telephone

Common home electronics product[12] demanding a high-quality transport chain

We have studied supply chains for end consumers in the following countries:

Sweden

Nordic country with approximately 9 million inhabitants.

Finland

Nordic country with approximately 5 million inhabitants.

Denmark

Nordic country with approximately 5 million inhabitants.

The Netherlands

Western European country with approximately 16 million inhabitants.

Germany

Western European country with approximately 83 million inhabitants.

Our aim was also to collect data from the Spanish market, but unfortunately we have not been able to fulfil this ambition. We have had problems to find the right companies and when we did find them, many of them neglected to participate in the study.

All together the collected data represent 25 (5 times 5) supply chain relations of products transported from producers to end-consumers in the European Union. The total number of figures is however much greater according to multiple transports carried out along the supply chains and our aim to find more than one comparable transport chain per product and country.

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[12] Fast Moving Consumer Goods (FMCG)

2.1.4 Limitations

This report contains qualitative estimations of costs and prices and has no statistical ambitions. The results are confirmed by TFK's previous experience of work and by our network of actors within the transport market.

2.2 Methodology

The intention of this chapter is to provide the ideas of how TFK has carried out this study. Have in mind that this is an industry study made for price comparison reasons.

2.2.1 New data collection

We have identified a set of logistics actors with supply chain relations for the chosen products in the selected countries. All of these actors have been contacted by phone, followed by an e-mail or fax describing our task and the aim of this study. The mail has been attached with a comfort letter[13] from the Swedish Competition Authority and a questionnaire for the respondents to consider. The data collection period was October – December 2002.

2.2.2 Empirical data

TFK has more than 50 years experience of the European transport market. We have used our own empirical data to fill in the missing parts and to verify the received figures in each supply chain. The data is typically derived from our extensive interchange with transport market actors like logistics companies, transport companies and shippers.

One way of using our empirical data has been to make qualitative estimations of price figures derived in the study. We have used our knowledge of differences in transport prices between countries to compare the data we have gathered. E.g. we know that tomatoes are shipped from Southern Europe to the Nordic countries and we

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[13] Appendix 1: Comfort Letter from the Swedish Competition Authority

know how much you will be paying for a chilled transport. By this reasoning we can re-use figures for tomato transports to Sweden on tomato transports to Finland.

2.2.3 Systems simplification

Transport prices are heavily dependent on a large variety of parameters. A study like this one could easily enclose more than 1000 parameters in order to get the correct value for each product and country. We have harmonized our approach to all respondents and asked for typical (most common or average) transport relations. Depending on the structure of the market and the transport conditions it will give us the most reliable figures on transport prices for our study.

2.3 The transport system

This chapter gives a brief description of what a transport supply chain can look like. The main idea is to describe common supply chain structures and point out how complex even the smallest of these systems can be.

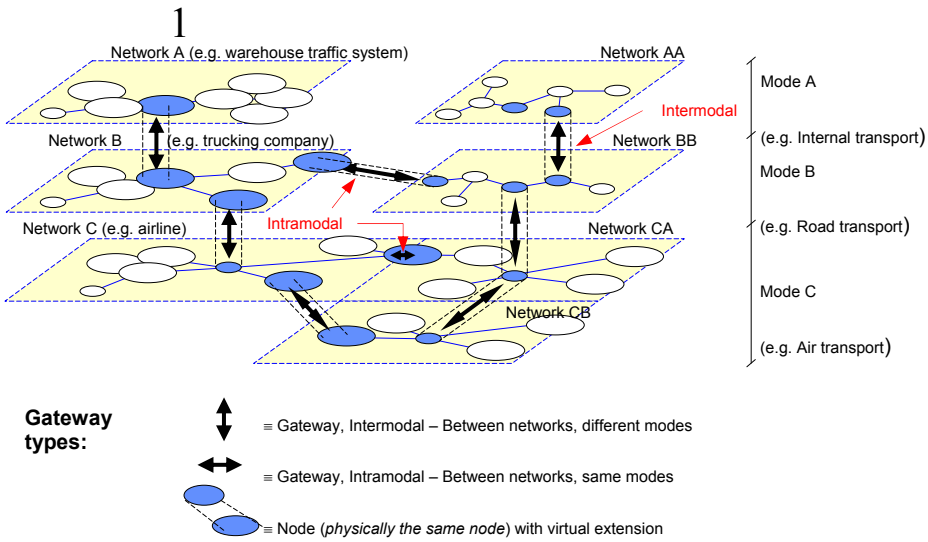
2.3.1 Transport networks

A transport is a service that gives the buyer increased value in time and space (Lumsden, 1997). The movement can concern passengers as well as goods. In goods transport systems, the system will include a set of producers and a set of consumers or at least one of each other. When the goods are moved from one place to another it might not be moving in a straight direction to the end-customer. It will though for some purpose increase value for the transport service buyer to have the goods in the specific place and time, e.g. an assembly line, a global distribution centre or a local inventory.

The globalized markets of recent years have indeed created remarkable networks of combined transport services. A usual way of describing the physical interfaces between the different sub-networks or sub-systems is to call them gateways. Common examples of gateways are ports, airports, terminals, distribution centres and cross-docking facilities. Gateways are divided in

intermodal and intramodal ones. An intermodal gateway connects different types of networks or systems, e.g. a port where shippers and carriers exchange goods. An intramodal gateway connects networks of the same type, e.g. a terminal where carriers exchange goods with other carriers.

Figure 2.1 Logistics network – a complex view



Source: Lumsden, 1999 (Adopted from Roos, 1997)

All of these nodes and gateways are parts in a door-to-door shipment from the producer of raw material to the end consumer or the recycling station. In some cases, there is a direct distribution with truck from production plant to public store and in others, there are several different forwarders involved. The most convenient solution for the shipment will be selected with regard to environmental issues, transport lead times etc.

In this study all of the transports are carried out by road, i.e. by mode B in figure 1. The gateways in these transport systems are for that reason all intramodel.

2.3.2 Complexity in transport systems

Transport systems have as many configurations as there are supply chains to serve. Every transport system can have numerous sub-systems and is an excellent example of what we call a complex system or a system with large variety. In order to give a quick view over a few variables that may affect the transport system we are presenting a short list over some properties:

Product properties

– producers	(possible producers of the goods or services)
– cycle-time or perishability	(the period in which a product is usable)
– value density	(the value of products per m^3)
– packaging density	(the number of colli per volume unit)
– stackability	(the ability to stack goods)
– unit loads	(standard of packaging)

Transport properties

– marketplaces	(where do they sell this product)
– customers	(requirements on transport services)
– transport management	(who is managing the transport / supply chain)
– cycle-times	(transport routes, resources etc.)
– traffic situation	(circumstances for transporting)
– delivery time	(according to transport system/situations)
– shipment size	(full or half truck load)

Overall supply chain properties

– supply chain actors	(who are involved in the supply chain)
– relationship	(for how long will they corporate)
– information sharing	(what information is available)
– profit/risk sharing	(contract issues)

The set of variables will be different in every unique supply chain. These variables will also vary in the number of possible states (the values of the variables) from supply chain to supply chain. If you are attempting to manage a transport system of this kind, you will have to face all of these system states.

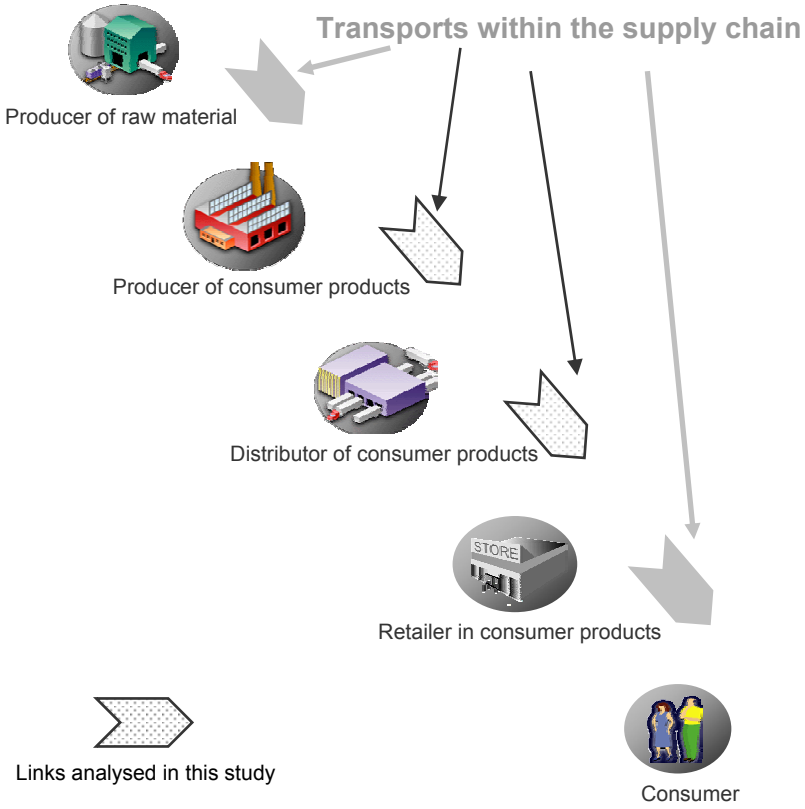
2.3.3 Transport systems in this study

The products we have studied are shipped in quite common supply chain structures. There are producers, some wholesalers, perhaps a distribution company and then a retailer selling the products to the end consumers. All of the links between the actors (nodes) are set up by vehicle transport by road. Road transports are dominating both the European market and all of the domestic markets in this study.

Goods transports by road are carried out by external logistics companies or with company vehicles. The trend is towards fewer trucks within production, distribution and retailing companies. More and more producers are focusing on their core business and fleet operation of vehicles is rarely a strategic competence in these companies.

As we already have stated, the transport system can contain many different actors depending on market situation and product specifications. There are cases where the producer, distributor and seller are working together within the same company, but even then there have to be links between the different departments in the organisation.

Figure 2.2 Transports in a schematic supply chain



In this study we have excluded the first and the last actor in the supply chain: the producer of raw material and the consumer. Our figures are describing the total price for transports from producer of the finished goods to the retailer. The first and the last part of the supply chain obviously also contains transports, but we assume that country specific differences within the other parts will be representative for this case.

2.4 Market descriptions

2.4.1 European market structure for the selected products

In this section of the report each product will be described individually in order to give an understanding of how the market structure looks like for the specific product category. The description will include both market structures for raw material and for the finished product as well as supply chains from production plant to the purchase/shopping place of the end consumer.

Tomatoes

The largest growers of tomatoes can be found in Italy, Spain, Portugal and Greece. Most of the production is then sold thru wholesalers in the Netherlands who never handle the goods in any way. When you look at the supply chain of tomatoes in northern Europe all tomatoes seems to be coming from the Netherlands even though it is a rather small producer of tomatoes.

The logistics chain for tomatoes often consists of between 3 and 5 links from producer to consumer. The chain starts with the harvest of tomatoes in the south of Europe. From there the tomatoes sometimes go to a facility where it is packaged and chilled to appropriate temperature. After that it is ready to be sold to, in most cases, a food retailer on local markets that distribute the tomatoes together with other food and vegetables. A food retailer can have from one to three links from import warehouse to the store for end consumers.

Since tomatoes are a product with a short shelf life it usually pass thru the whole supply chain in less than two days. This sets high demands on the logistic companies that handle the product. When the tomatoes are sold thru a dealer in northern Europe the transport usually origin from the grower in the south of Europe. The shipment then goes thru a food wholesaler that delivers to a public store for end consumers. In some cases the shipment stops for a few hours at a wholesaler that delivers to a terminal that is supplier to large food store chains.

Tomatoes need to be transported in a chilled environment. This is an additional service that some transport companies can deliver.

The equipment required to provide a chilled environment on a truck is very expensive and thus results in a higher transport price. Traditionally this is something that a transport company has to be very good at since the cost of a lost shipment can be high.

Because of the short shelf life of the product it is very seldom warehoused for a long time within the logistics chain. In most cases a pallet of tomatoes is never stored for more than a couple of days. The average lead time from grower to consumer is between 1.5 weeks to 2 weeks.

The average price paid by end consumers in Sweden for a kilo of tomatoes is 2.37 Euro.[14]

Hard cheese

In the case of all dairy products you have to consider the short shelf life of the product. This is the case both for the input goods and the finished product. This is the main reason for having at least one or a few dairy companies in every country. The second reason for that market structure is that the investment in production plants for dairy product is much larger than in most other cases.

In this study we found that the supply chain for dairy products most often consists of two or in some cases three links. From the dairy plant the products can be divided into a few categories of products, and hard cheese is one of them. The hard cheese may be shipped directly to distributors or stored for ripening. As the hard cheese has longer shelf life than most other dairy products it is more suitable to join a consolidated shipment from wholesaler to public store.

Hard cheese need to be transported in a chilled environment. These transports have the same characteristics as the transports of tomatoes.

Because of the short shelf life of the product it is very seldom warehoused for any longer time within the logistics chain. For a producer of cheese the demand of a best before date on the package sets the demands on fast logistics chains. This ensures that the store has as many days as possible to sell the product before it gets too

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[14] Jordbruksstatistik årsbok 2002: Priser på livsmedel 2001

old to sell to a consumer. The average lead time from producer to consumer is between one week and three months depending on the sort of hard cheese.

The average price paid by end consumers in Sweden for a kilo of hard cheese is 6.78 Euro.[15]

Frozen French fries

On the European market there are three major dealers in frozen French fries. They have a number of production plants located at different places in the middle of Europe. There are also some minor companies working on local markets e.g. in Sweden. An important element in the French fries market is the large industrial use by fast food chains.

The input goods for making French fries are mainly potatoes and the largest producers of potatoes are Germany, the Netherlands and France. The potatoes are then transported to a few production plants within Europe that produce most of the sold French fries. The French fries are then mostly sold to food wholesalers on the European market. Wholesalers distribute the frozen French fries to stores for end consumers.

A specific feature for this product is that it is in most cases produced in batches and then warehoused until it is sold. The time between harvest and production can be up to 6 months and after that the product can be warehoused for an additional 12 months. This makes the average lead time from producer to consumer very fluctuating.

French fries need to be stored and transported in a frozen environment. The number of pallets that can be stored in a frozen environment in each country is bound by the investments in freezer storage facilities. When a batch of French fries is produced it is often produced in large quantities due to production costs. When one storage facility is full you go to next one and start to fill it up with the next batch. This sometimes result in transports between storage facilities to free space in the storage facility which is best geographic positioned.

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[15] Jordbruksstatistik årsbok 2002: Priser på livsmedel 2001

The number of links in the logistic chains can vary from direct distribution from the producer's warehouse to serial transports between cold stores to a food wholesaler's cold store and from there to a distribution centre where the product is picked together with other frozen products. The food retailer then distributes the consolidated shipment to the store for end consumers. The most common number of links in a logistic chain is between 3 and 5 from producer to store for end consumers.

The average price paid by end consumers in Sweden for a kilo of French fries is 2.04 Euro.[16]

Granulated sugar

On the European market there are few companies that produce granulated sugar. In most cases there are one or a few sugar companies in each country that handle the domestic market and have some export on the industrial side. Since we have chosen to study the consumer market for granulated sugar the industrial side of the market will not be subject of discussion.

Granulated sugar is a high volume product for every sugar company. This provides the companies with the opportunity to produce this product on every market with the effect that there are no imports or export of granulated sugar within Europe. Not even in Scandinavia where there has been a consolidation of sugar companies in recent years. On these markets there is only one producer of sugar products that has production plants in every country.

The sugar companies mostly sell their product to food retailers with a chain of stores or other large customers. This part of the supply chain handles their own distribution of consolidated pallets of goods.

The input goods for making granulated sugar are mainly sugar beets and the major growers of sugar beets are France, Germany and the Netherlands. The sugar beets are transported to large production plants where they are refined into granulated sugar. After the refining of the sugar beets into granulated sugar it is warehoused

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16 Jordbruksstatistik årsbok 2002: Priser på livsmedel 2001

until a wholesaler orders the product. Since sugar don't have any specific demands on the transport it is fairly easy to transport and warehouse. The number of links in the logistic chain can be between two and four depending on where it is warehoused. Since sugar has an unlimited shelf life the average lead time from producer to consumer varies a lot.

The average price paid by end consumers in Sweden for a kilo of granulated sugar is 1.06 Euro.[17]

Portable phones

In this study we choose to study the supply chain for a certain brand and model of portable phone that was available in every European country. By doing this we were able to have an overview of the transport costs for exactly the same unit of goods thru all of Europe.

A typical supply chain for this product is a shipment from the production plant to a warehouse where the portable phone is consolidated with other products. The consolidated shipment is then transported to a store for end consumers. For this kind of product a time limit for getting the product out to the stores is motivated by the life cycle for electronic product in today's fast moving product flow.

The difference between this product and the other products selected for this study is that it does not have an expiration date that you have to take into consideration in the logistic chain. As long as the demand for the particular product will continue it can be stored in a warehouse waiting for an order by the retailers. This makes the distribution of the product fairly easy in comparison to for example the frozen French fries.

Some electronic products are so expensive that you need to arrange a transport that can handle special high value goods. In this case the price of the product is not high enough to justify a more expensive distribution with higher security as a result. The number of links in the logistic chain is depending on the structure on each individual market. If the sales company in the individual countries has its own warehouse the chain starts with the production plant and from there

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[17] Jordbruksstatistik årsbok 2002: Priser på livsmedel 2001

the finished product goes to a distribution centre that holds the product for all of the European countries. From that distribution centre the product will be ordered to a warehouse in any individual country for further distribution to a store for end consumers. This makes the total number of links in the logistic chain to three.

The average price paid by end consumers in Sweden for this portable telephone is 112 Euro.[18]

2.4.2 The European transport market

When comparing transport markets you have to consider some key factors that have a strong influence on the market. In this part of the report we will try to describe the transport market for the European region, which is in focus in this study. On the 1st of July 1998 the European transport market was deregulated with the effect that a haulier in any country within the European Union are free to do business in any other country within the Union.[19] This fact has put the transport market in focus in many countries because of the effect is has on the environment and safety related to the roads.

The transport market was deregulated in order to create a European market accessible from any country and to increase the competition. When you look at the market in 2002 you can easily see that the competition has increased with lower transport prices as a result. In this study we have found that the distance of the transport is no longer the driving factor when we discuss the cost for the total transport from manufacturing plant to a store for end consumers. We have found that the main cost drivers are market competition and the possibility of finding freight to ship on the carrier with the return transport. Hauliers that are part of a large logistic network have a great advantage in this matter.

Within the European community there are as many market structures as there are countries. There are differences in the correlation between hauliers and forwarding agents, but also special situations that may only exist in one country. On some markets the hauliers frequently go directly to the transport buyer instead of

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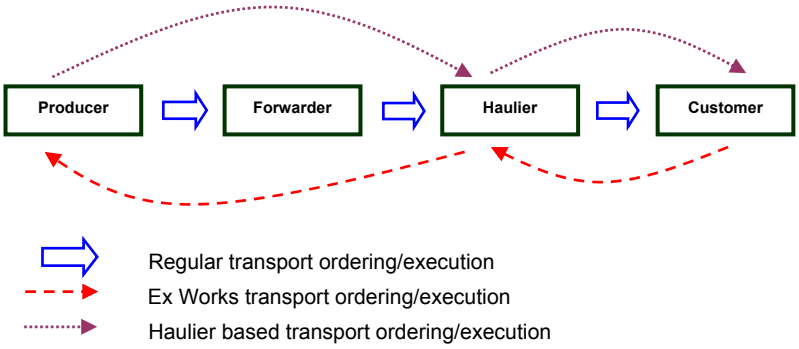
[18] http://se.pricerunner.com

[19] Enarsson (1998)

using a forwarding agent. This will lower the cost for the transport buyer since the percentage that the forwarding agent put on the price no longer exists. This behaviour lowers the transport buyer's perception of a reasonable price and he will have no tolerance for the cost that can be associated with consolidation of transported goods. This is the forwarders main business and a condition for a market that wants to minimize the environmental influence.

Figure 2.3 Different kinds of transport ordering and execution



The accruals of low budget hauliers that use drivers from countries outside the European Union has further decreased the transport prices and lowered the profit margin. The profit margin is typically between 0 and 10 percent for a haulier or a forwarding company. The fierce competition sets the price level for the whole market and even causes negative results at the end of the year for many of the largest hauliers and forwarders.

The geographic and demographic structures of Northern Europe are unfavourable from a logistics perspective. But a lot has been made to compensate for these two problem areas. The effects of the long distances are compensated with longer vehicles and higher axle weights on the road network. In a report published this year by TFK the measured effect on usage of longer vehicles are an increase of transported volume with almost 40 percent. The clustered population with a high percentage of the inhabitants living in a few urban areas have been managed with efficient distribution centres and terminals. By using these facilitates a high degree of consolidation and usability can be reached.

In this study we have focused on the distribution of groceries and portable phnoes to stores for end consumers and the link from producer of the goods out to the facilities of retailers. This is a network system that can be very complex for a large distributor that services many stores from a few distribution centres within Europe.

The food retailing market consists of a few large chains that have a high percentage of the total European market. Beside the large chains there are a large number of independent stores. We have focused on the larger chains since they have the major part of the market. The logistic chain for a large distributor is very much dependent on a high volume and a low margin. To be competitive with a low margin they constantly have to work on how to be more efficient and reducing cost in transport, warehousing and handling of the goods.

2.5 Results

This chapter presents the figures gathered in the study. The figures are aggregated per product and country and hold no references to the participating respondents. TFK will not be able to share more specific information due to our commitment to the respondents.

2.5.1 Transport prices

The transport figures are transport prices paid for shipping the goods from one location to another. Obviously there is a difference between the total cost for transporting and the price paid by the transport buyer.

These figures are compounded of information from at least one source per market, product and supply chain role. The prices per kilo or unit are representing the total supply chain price from producer to public store for the end consumer. In some cases the production and consumption is made in the same country, but in others the products are imported.

Table 2.1 Transport prices for tomatoes

Product	Country	Transport price
Tomatoes	Sweden	€ 0.158 / kg
	Finland	€ 0.195 / kg
	Denmark	€ 0.123 / kg
	The Netherlands	€ 0.087 / kg
	Germany	€ 0.127 / kg

The tomatoes are expensive to transport. A pallet of tomatoes contains approximately 200-250 kg of goods and has to be transported in a chilled environment.

Table 2.2 Transport prices for hard cheese

Product	Country	Transport price
Hard cheese	Sweden	€ 0,092 / kg
	Finland	€ 0,081 / kg
	Denmark	€ 0,070 / kg
	The Netherlands	€ 0.070/ kg
	Germany	€ 0.079 / kg

Hard cheese is quite inexpensive to transport. A pallet of hard cheese contains approximately 500 kg of goods and has to be transported in a chilled environment.

Table 2.3 Transport prices for French fries

Product	Country	Transport price
French fries	Sweden	€ 0.132 / kg
	Finland	€ 0.192 / kg
	Denmark	€ 0.115/ kg
	The Netherlands	€ 0.057 / kg
	Germany	€ 0.107 / kg

Frozen French fries is quite expensive to transport. A pallet of frozen French fries contains approximately 250-700 kg of goods and has to be transported in a frozen environment. The large interval in shipment size is due to different pallet systems.

Table 2.4 Transport prices for granulated sugar

Product	Country	Transport price
Granulated sugar	Sweden	€ 0,040 / kg
	Finland	€ 0,035 / kg
	Denmark	€ 0,030 / kg
	The Netherlands	€ 0.027 / kg
	Germany	€ 0.041 / kg

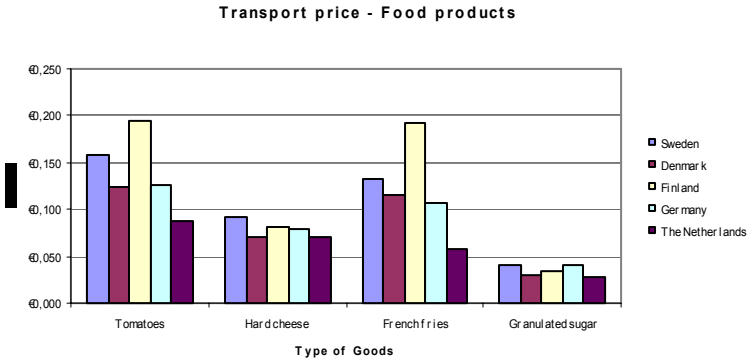
Granulated sugar is inexpensive to transport. A pallet of granulated sugar contains approximately 800-1000 kg of goods and can be transported in any reasonable temperature.

Table 2.5 Transport prices for portable telephones

Product	Country	Transport price
Portable telephone	Sweden	€ 0,402 / unit
	Finland	€ 0,464 / unit
	Denmark	€ 0,452 / unit
	The Netherlands	€ 0,206 / unit
	Germany	€ 0,267 / unit

Portable telephones are expensive to transport. A pallet of portable telephones contains approximately 180 units and can be transported in any reasonable temperature.

Figure 2.4 Transport prices for the food products in the study



2.5.2 Transport costs and operational margins

In the previous chapter we have presented transport prices in supply chains for the five products analysed in this study. The total transport price for shipping a product from producer to end consumer will of course be affected by the margins of each transport agreement. Every actor in the supply chain (forwarder, shipper, haulier, etc) has an ambition to do great business. But the intense competition on the market is limiting the ability to increase the financial margins for transport operations. In fact, many road hauliers and forwarders have profitability problems due to the extensive market competition.

Figure 2.5 Profitability of Dutch international road hauliers

Source: NEI, 2001

As you can see in the analysis of the Dutch market in figure 5, there has been a dramatic decrease in the average profitability from the 1980's to the 1990's. We will say that these figures are representative for most Western European countries.

The most common way to handle profitability problems is to cut internal costs. The question is where to cut? In a traditional production orientated company you are looking for possible ways to decrease the costs with little or no negative effect on the productivity. This reasoning is quite hard to transfer to the market of hauliers.

Table 2.5 Cost structure for large hauliers

Costs per 10 km (SEK)	Sweden	Denmark	Germany	Netherlands
Fixed costs	19	15	9	16
Variable costs	30	21	23	19
Costs of personnel	39	36	28	38
Administrative costs	13	9	12	7
Total	*101*	*81*	*72*	*80*

Source: PWC, 1999
Explanations: Fixed costs = Vehicle taxes, Depreciation, Interest, Insurance
Variable Costs = Tyres, Fuel, Maintainance,
Costs of personell = Wages, Social fees,
Administrative costs = Costs for administration and profit margin

The administrative costs in table 5 include the profit margin set by the hauliers. For the Swedish and German market the profit is set to approximately 7 percent and the other markets has a lower value: 3 to 4 percent.[20] The cost structure is also indicating a major problem for the hauliers: the costs of personnel are the largest part of the total costs. Personnel costs are mainly related to the truck drivers and therefore a hard nut to crack.

[20] PWC, 1999

2.6 Conclusions and discussion

2.6.1 The transport system

Transport and logistics systems are without hesitation illustrative examples of complex systems. For an uninitiated person the question of logistics might seem to be an easy one: satisfy your customer with the right product or service at the right time! The factors behind different supply chains tell us it might be a hard nut to crack depending on a variety of reasons.

When the consumers are visiting their local stores they are expecting to find products matching their demands. The managers of the stores are trying to satisfy this demand by holding a number of products in stock. But holding a large stock is expensive and enhances the risk for obsolescence. The keys to success are just-in-time deliveries and supply chain excellence.

This reasoning can be made for all actors along the supply chains. The producers, wholesalers, distribution companies and retailers all must have products matching the demands of their customers. Ingoing and outgoing transports are enablers of this complex world, where no one wants to be out of stock and no one wants to have high inventory costs.

As the transport forms such a vital part of the supply chain the costs or prices paid for the transports are an interesting area for investigation. In this study we have compared the total price paid for transports along a supply chain for common products, which could be found in any country within the European Union.

2.6.2 The results

When we compare the specific products analysed in this study we could say that tomatoes, French fries and portable telephones are produced in a few countries in Europe. The other products (hard cheese and granulated sugar) are locally produced in every country. Therefore the first three products are more sensitive to pan-European transport prices. The domestic transport prices are indeed influenced by pan-European prices, but the total supply chain

transport price is typically lower when the total distance is shorter. This reasoning holds for our quite simplified view when we are not comparing internal differences within a specific country.

The Nordic market

The Nordic market is geographically disadvantaged when the products are produced on the main markets of Europe. Internal transports within the Nordic markets are well correlated between the countries and many retailing companies are present on every Nordic market.

The Danish market has the lowest transport prices per kilo delivered goods compared to Sweden and Finland. Sweden and Finland have similar demographic and the internal transport prices are by that reason comparable.

The European market

The European market is characterized by a large competition between European and global logistics companies as well as relatively small distribution areas. In contrast to the Nordic market the population of Central Europe is quite evenly distributed. This fact enables easier planning, forecasting, etc for the logistics companies. Since a lot of the products for the European market are produced in this area the conditions for wholesalers and retailing companies are better. They can purchase more inexpensive transport and have more frequent replenishments.

The different products

A brief analysis of the total transport prices for the different products country by country shows some similarities. The transport price for tomatoes is about four times higher per kilogram than for the granulated sugar in all of these countries. The main reason is the fact that packaging and loading of the goods are made in two separate ways. Granulated sugar can be packed with high density (typically 800-1000 kg per pallet) and tomatoes are packed with less density (typically 200-250 kg per pallet).

The transport price for frozen French fries is somewhat higher than for hard cheese. The French fries is transported in a frozen transport chain which is more expensive than the chilled transport chain used

for hard cheese. The difference is mainly caused by the reason of quality inspections. You can easily check if the tempered transport chain for frozen goods has been carried out correctly. The shippers generally pay for insurances in order to have a straight forward relation with the customers. Quality inspections of chilled transport chains are more difficult to do. A logging equipment has to be attached to the goods in order to see if the temperature has been correct during the transport chain. There is no chance to identify bad handled goods by an ocular inspection.

The Finnish market has significant higher prices for transport of frozen French fries and tomatoes. Both of these products are imported from Middle and South European countries. The transport prices for shipping goods from the Continent to Finland are higher than to all of the other countries in this study.

Extending the conclusions

The products analysed in this study are quite representative examples of dry, chilled and frozen food products. The price figures can easily be compared to other similar products with the same characteristics. Most important is how the packing of the goods is made on a pallet or another load carrier. A dry food product can be compared to granulated sugar, but you have to keep in mind that sugar is loaded with 800-1000 kg per pallet. The price paid for dry food transport is usually specified by pallet and therefore it is necessary to know how much goods you normally transport per pallet.

Transport costs and logistics costs

When we are comparing prices for transport of products in different countries it is important to know that transport costs is not equal to logistics costs. If a national distribution company has many small distribution centres (DC:s) the transport costs of outgoing goods to the local stores is relatively low. The transport costs of incoming goods to the terminal are relatively high, but the total sum of transport costs may not be equal to that of a distribution company with a few large DC:s. If you extend this calculations and put in additional logistics costs as capital tied up in inventory, inventory handling costs, etc the large DC:s are more cost effective than the smaller ones. We know that the logistics market is heading towards distribution networks with fewer and larger DC:s. In this study we

are only comparing transport prices and transport costs and companies with large logistics facilities may be disadvantaged by this fact.

TFK has an extensive experience in logistics, distribution and transport costs in food distribution. Our assessment is that the transport costs represent approximately 40-50 percent of total logistics costs. This figure will be lower if you consider markets with longer lead times and logistics solutions which are not based on just-in-time deliveries.

Operating margin and logistics profit

The European transport market is a low margin business. The fierce competition between hauliers, shippers and forwarders from different countries has resulted in a situation where many companies have profitability problems. A well-performing organisation may be able to reach 10 percent profitability, but most of the actors are pleased with just a few percent. The more specialised your fleet operations are, the better are the chances to reach a good profitability. Cost cutting in the organisation is difficult though the costs for personnel are high and related to the truck drivers. Larger trucks will be the most suitable solution for a company that is interested in reducing costs for personnel. The solution with larger trucks has shown other advantages too; increased transport volume, decreased emissions, etc.

The accuracy of our results

The reader should bear in mind that the figures used for comparison in this study are not statistically confirmed and we are not attempting to draw any conclusions without confirmation. Our object has been to show some examples of how transport prices for a few products vary in the European Union. We assume that the causes of the variation could be found in different conditions on the transport market and different market structure for the supply of the products to the end-consumer. Depending on the actual situation (place of origin, place of destination, product properties, etc) the total transport price may differ a lot, but the figures given in this report should be representative for an average transport chain to consumers in each country.

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Appendix 1 Comfort Letter

Comfort Letter for TFK – Transport Research Institute

This is to certify that the Swedish Competition Authority has commissioned TFK - Transport Research Institute to conduct a study on transport costs for a sample of products that are imported to Sweden.

The objective of the Authority is to promote effective competition in the private and the public sector for the benefit of consumers. The main task is to apply the Competition legislation (homepage www.kkv.se).

The study is part of an investigation the Authority undertakes on some of the underlying factors behind price level differences between Sweden and some other countries following a government instruction issued on February 28, 2002. The results of the investigation will be presented to the government in a public report during the early spring of 2003.

The study by TFK, which is expected to be a 30-80-page document, is the only material that will be delivered to the Authority. This document will be made public. All the working material that TFK uses for its research will not, and cannot, be requested by the Authority.

Should any questions on the purpose and method of this project arise, you are welcome to contact Karl Lundvall (karl.lundvall@kkv.se, +46 8 700 16 33)

Yours sincerely, Karl Lundvall (project manager)

3 Cross-country comparison of prices for durable consumer goods: Pilot study - washing machines

Angélica Arellano and Anders Norberg

3.1 Introduction and summary

During the last years, the Swedish consumer price level has been intensively debated. It has been put forward that the Swedish price level is relatively high. Whether this is due to poor competition, macroeconomic factors, geography, or a mixture of these factors and others, has been subject for intense discussion. The debate has been stimulated by a series of reports presented by the Swedish Competition Authority. These reports have highlighted a number of competition issues that are likely to affect prices.

The Authority is convinced that these kinds of price comparisons are valuable input in surveys on which European countries and which industries there may be lack of competition. For that reason is it valuable that the PPP-studies made by Eurostat are of a high quality and that the methodology continues to improve.

The Swedish Competition Authority has commissioned Statistics Sweden, SCB, to conduct a study on price comparisons of washing machines in Sweden relative some other European countries. The aim was to compute price level indices for five European countries using data collected by the market research company GfK[21].

In the form of a workshop SCB and GfK have made price comparisons for a forty different assumptions. We have also tested a hedonic approach. The results are summarized in table 3.1. SCB and GfK have judged which alternatives are most reasonable before we looked at the numeric results of the price levels. The proposed

[21] GfK is a part of an international network as a subsidiary to GfK AG in Nürnberg, a research company with activities in nearly 50 countries

estimates in the first column of the table below, therefore is not in the centre of the intervals in the second column.

Table 3.1 General price levels for washing machines in Germany, Netherlands, Sweden, France and Denmark. October 2001-September 2001. All five = 100.

Country	Index (point estimate of this study)	Results based on 42 different methods* (price index range)	Price level according to PPP[22] for white goods
Germany (D)	90	88 - 99	83,3
Netherlands (NL)	95	91 - 98	104,0[23]
Sweden (SE)	100	97-104	105,2
France (FR)	108	98-110	99,8
Denmark (DK)	108	100-111	107,6

*Refers to the effect of shop-types, the degree of details used in the product definition and the different criteria for equi-representativity. All results are presented in the appendix.

In our calculations shop-type is controlled for, in such a way that "ordinary shops" and hypermarkets including multiple chains are separated in the first stage of the index computation. In the second stage the indices for the shop types are averaged with the same weights for all countries. In the PPP surveys each country must deliver an average price for each item, these averages being computed to reflect the retail trade structure of the country itself. When we, as a test, computed indices on GfK-data in the PPP-way the index for France was 106 instead of 108, which can be taken as an indication that France has a higher market share for hypermarkets and big chains than other countries when these shops types have a lower price level.

When we used wide specifications of the items to be compared, not including brand as a criteria, the price level index for Denmark, The

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[22] Purchasing Power Parities, international purchasing parity comparisons by Eurostat. Latest estimate May 13, 2002. Recalculated to show average of these five countries = 100.

[23] Estimate for the Netherlands based on model calculation

Netherlands and France was relatively lower in comparison with Sweden, while Germany's index was higher. This finding can probably be explained as there being differences between countries in market shares for "low-price" and "exclusive" brands.

3.2 Coverage, Comparability and Equi-representativity

There are three criteria that decide the quality of a price comparison between markets (countries):

- Coverage of the markets (item, area, shop-type, time)
- Comparability between specified items (and shop-types) to be compared
- Equi-representativity in the markets for the basket of specified items (and shop-types).

By "item" we mean a group of products precisely defined for use in the survey. An item can be a specific product, identified by brand and model (possibly an EAN-number). The item can have, on the other hand, a generic definition, for example "frontloaded washing machine, 4,5-5 kg capacity, energy-class A and spin speed 1000-1199 turns per minute", i.e. without even brand in the specification.

High *coverage* means that the items in the comparison between two countries should cover at least 50 percent of the markets in the two countries, but not necessarily 99 percent. Wide specifications automatically give high coverage (See table 3.3).

Comparability means that the items must be homogenous enough to be comparable, the consumers must not clearly prefer one or the other. We have specified the items using the variables brand, front/top, capacity, (kg), energy-class (A, B/C and D/E/F), spin speed (classes of 100 turns).

The samples of items must be *equi-representative* for each pair of countries. It is thus sufficient that the whole sample is equi-representative. It is not necessary that each and every item is equi-representative. Therefore we have initially excluded items in the bilateral comparison *only* if the market share in one country is more than 100 times higher than in the other country.

These three criteria (see above) are negatively correlated. Designing a survey to compare prices is to balance these factors so that all three demands are fulfilled to a reasonable extent. We can control the comparability and equi-representativity and get coverage as a result of the first two.

3.3 Data

The GfK data are collected for retail trade companies, which together have a market share of 80-90 percent in the five countries, studied. There is no sampling variance to be computed. How the remaining 10-20 percent of the markets possibly could have influenced the results cannot be estimated.

The GfK data was made available during a workshop with SCB. The data covers the sales of washing machines during the period October 2001 – September 2002 and was collected from retail companies that together account for 77-86 percent of the market in each of the five countries. The data is split into two retail categories[24] for all countries except the Netherlands for which only the total market is available; 1 = "Buying group" and 2 = "Multiples/Hypermarkets". For each country/retail category combination the data covers several hundred different models and brands.

[24] The definition of the GfK retail categories is not the same as the definition of the PPP shop types

Hence, identification variables are as follows:

- Country (5 countries)
- Retail category (2 categories)
- Brand (at least 17 brands)
- Model (this variable is not uniformly coded across the five countries, hence comparisons are not completely possible on individual product level)

The price in Euro is an average price, weighted by the quantities during the twelve months.

The washing machines are described in terms of the following characteristic variables:

- Front-loaded vs top-loaded
- Laundry weight (3,0 – 7,0 kg)
- Volume (water utilization in liters, mainly 30-100 liters)
- Energy class (A, B, C, D, E, F and “missing value”)
- Spin-speed (mainly 600 – 1800 cycles per minute, 1000 and 1200 are the most common)
- Width
- Depth (high proportion of missing values)
- Height
- Quantity = number sold units

3.4 Analysis of important variables and groupings

Because the effect of each of the individual characteristics above, all other characteristics kept unchanged, is assumed to be proportional or multiplicatory with respect to the price, we have performed regression analyses with *log*(P), the logarithm of the price, as the dependent variable. E.g. the effect of increasing the spin-speed from 1000 to 1200 cycles per minute is assumed to cause the same percentage increase in price for all machines, not the same price increase in absolute terms.

All qualitative variables have been transformed into so called dummy-variables. Continuous qualitative variables can also be transformed into dummy-variables if there is reason to believe that the relationship between the variable and the price is gradual rather than linear. The 15 largest brands are represented by 15 dummy variables and a sixteenth represent all other brands (compare with item definition V3 below). The two shop-types are discriminated by one dummy variable.

The regression analyses, with and without weighting with respect to market share, indicate that important physical characteristics include:

- Spin-speed
- Capacity
- Front-loaded vs. top-loaded
- Energy class (definition differs between the countries)
- Water utilization in relation to capacity
- External dimensions (small machines are more expensive than large ones with similar performance)

A valuable outcome of this hedonic (regression) analysis is that the coefficients of regression for the countries can be interpreted as relative price levels.

Table 3.2 Price level indices for countries estimated by hedonic regression

Country	Index
Germany (D)	90
Netherlands (NL)	93
Sweden (SE)	102
France (FR)	106
Denmark (DK)	110

The standard error of these estimated coefficients are 1,0 – 1,2 percentage units.

3.5 Alternative definitions of items

For same-model products available across all of Europe, we tried to

- Calculate the relative price levels based on data for individual models (product approach).

  These results were then compared with

- Average prices calculated for groups of models, of one or several brands, so called generic items. The country comparison is based on these average prices.

The result of the regression analyses is useful for the definition of generic items as described above. Performing both of the calculations was of relevance to the Swedish Competition Authority and SCB, since products and generic items occur in Eurostat's PPP-investigations in different proportions, based solely on experience and judgment. By calculating price levels based on both alternatives we were able to compare the two methods in a "laboratory environment".

The four following alternatives of item definitions were used:

V1. The item is defined by brand, front-loader/top-loader, capacity (kg), energy class (A, B, C, D, E, F, missing), spin-speed small/(normal and large)

V2. The item is defined by brand, front-loader/top-loader, capacity (kg), energy class (A, B/C, D/E/F, missing), spin-speed (in multiples of 200 cycles per minute)

V3. The item is defined by the 15 largest brands plus "other brands", front-loader/top-loader, capacity (kg), energy class (A, B/C, D/E/F, missing), spin-speed (in multiples of 200 cycles per minute)

V4. The item is defined by front-loader/top-loader, capacity (integer kg), energy class (A, B/C, D/E/F, missing), spin-speed (in multiples of 200 cycles per minute)

SCB and GfK prefer alternative **V2**. V1 is well in accord with the product approach since a large number of characteristics must match to be able to perform a price comparison. V4 means loose item descriptions, but still there are 133 different items.

3.6 Bilateral price comparison

Independent of the number of countries one wishes to compare, the price comparison must first be performed for each pair of countries.

The PPP-estimates provide an arithmetic mean of the price for each item. The benefits of this can be discussed. Harmonious averages and geometric averages provide better estimates for the average market price if one desires to take quantities into account, even if the quantities are unknown. In our case, both the quantities and the average prices, weighted by quantity, are available per item. It is difficult to imagine better prerequisites at the lowest (basic) level.

Each national statistical institute is required to indicate whether items are representative in the PPP-estimates. Items are dichotomously coded, i.e. as either representative or not. Representative items carry greater relative importance for the comparison than do non-representative items. An item that is non-

representative in both countries for which a comparison is made receives no weight at all, i.e. is ignored, in the price calculation. In this study, where quantities are known, we have assign weights to the items based on their market shares. We also simulate the PPP-method to classify items as representative or non-representative (method D. and E. below).

The PPP-method achieves full symmetry between two countries by calculating the relative prices according to the Laspeyre and Paasche method and then calculating a geometric mean according to Fischer. We follow this approach but obtain instead a Törnkvist index, since we use geometric means at all stages of the calculation.

Let v represent an item (product or generic item). Let Q and P represent quantity and price. We assume prices are expressed in the same currency. Let x and y represent the two countries. Let b and m represent the two retail categories.

Market shares:

$$M_{xb} = \sum_{v} Q_{xbv} \cdot P_{xbv} \ , \quad M_{xm} = \sum_{v} Q_{xmv} \cdot P_{xmv}$$

$$M_{yb} = \sum_{v} Q_{ybv} \cdot P_{ybv} \ , \quad M_{ym} = \sum_{v} Q_{ymv} \cdot P_{ymv}$$

Market shares are the market sizes normalized to 1.0 for each country and retail category:

$$A_{xbv} = Q_{xbv} \cdot P_{xbv} / \sum_{v} Q_{xbv} \cdot P_{xbv} \text{ , etc.}$$

Let us assume V different items (products) exist. The task is to calculate the overall price ratio between the two countries, with regards to equi-representativity. The PPP Laspeyre-index (from the perspective of country 1) is calculated as an unweighted average of the price ratios for the products that exist in country 1. Thereafter a Paasche index is calculated as an unweighted average of price ratios for products in country 2. We propose to calculate a Laspeyre-index and a Paasche-index in a similar fashion, with the difference that we use geometric averages, weighted in terms of the market share of each country, rather than in terms of 1 = representative or 0 = non-representative. We, thus, obtain a Törnkvist-index, which is comparable to a Fischer-index calculated on an additive basis.

The Laspeyre-index (for retail category b) is thus

$$K_b^L = \prod_v (P_{xbv} / P_{ybv})^{A_{xbv} / \sum_v A_{xbv}}$$

The Paasche-index is

$$K_b^P = \prod_v (P_{xbv} / P_{ybv})^{A_{ybv} / \sum_v A_{ybv}}$$

The Törnkvist-index is thus simply

$$K_b^T = \prod_v (P_{xbv} / P_{ybv})^{\left(A_{xbv} / \sum_v A_{xbv} + A_{ybv} / \sum_v A_{ybv} \right) / 2}$$

But $\sum_v A_{xbv} = \sum_v A_{ybv} = 1$, further simplifying the expression above.

It is sufficient that the whole sample is equi-representative for the two countries in the price comparison. It is not necessary that each and every item is equi-representative. We use the market shares for this purpose. Nevertheless, excluding products/items with significantly different market shares in the two countries is a further way to obtain equi-representativity of the basket.

For this purpose we introduce a parameter k to settle the degree to which the market share of an item in one country can exceed the corresponding market share in the other country before the item is excluded from the comparison. We propose to make comparisons with

A. k=1000
B. k=100
C. k=10.

Thus the weights are defined as arithmetic means of the market shares or alternatively as 0.

Let

$$V_{bv} = \begin{cases} (A_{xbv} + A_{ybv})/2 \; if \; A_{xbv} < k \cdot A_{ybv} \; and \; A_{ybv} < k \cdot A_{xbv} \\ 0 \quad otherwise \end{cases}$$

$$V_{mv} = \begin{cases} (A_{xmv} + A_{ymv})/2 \; if \; A_{xmv} < k \cdot A_{ymv} \; and \; A_{ymv} < k \cdot A_{xmv} \\ 0 \quad otherwise \end{cases}$$

Introducing a step-like approach to prevent the distortion that arises when a product with a large market share in one country and small market share in the other country is excluded from the comparison could further enhance the sophistication. In such a case the market shares for the remaining products/items should be re-normalized (not illustrated below).

We introduce two alternatives D. and E. to simulate the implementation of asterisks[25] (symbol for representative items) in the national statistical institutes. This means that we use weights based on a dichotomization of market shares set to either 0 or 1. The two alternative are:

D. The weight is assigned a value of 1 if the market share (for all retail categories) of the item is at least 10%.

E. The weight is assigned a value of 1 if the market share (for all retail categories) of the item exceeds the median.

For **D**. and **E.** let

$$V_{bv} = (A_{xbv} + A_{ybv})/2$$

$$V_{mv} = (A_{xmv} + A_{ymv})/2$$

SCB and GfK prefer alternative B., since this alternative only excludes products with sales of very few units in one of the countries. Alternative E. seems to be better than D. as a model/simulation of the process of applying asterisks in the national

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[25] This practice of assigning asterisk to the representative items is implemented in European Ccomparison Program at Eurostat.

statistical institutes. The weighted regression method, results in table 3.2, also appeal to SCB.

Weight the logarithmized price ratios by retail category, compute the artimetic mean and de-logarithmize:

$$K_b = \exp\left[\sum_v V_{bv} \cdot^e \log(P_{xbv} / P_{ybv}) / \sum_v V_{bv} \right]$$

$$K_m = \exp\left[\sum_v V_{mv} \cdot^e \log(P_{xmv} / P_{ymv}) / \sum_v V_{mv} \right]$$

These price level ratios are interesting as is, but they are also weighted by the respective market share for each retail category in the two countries, across all items.

$$K = \frac{K_b \cdot (M_{xb} /(M_{xb} + M_{xm}) + M_{yb} /(M_{yb} + M_{ym}))}{2} +$$

$$+ \frac{K_m \cdot (M_{xm} /(M_{xb} + M_{xm}) + M_{ym} /(M_{yb} + M_{ym}))}{2}$$

The price level index between country x and y is also calculated without regard to retail category, i.e. as average prices weighted in terms of item quantity independent of retail category. In our evaluation of PPP it is of particular interest to observe the effect of different retail structures.

3.7 Price level indices for all countries

Thus follows 10 pairs of price comparisons for the 5 countries. The bilateral relationships are not transitive[26] since different items are used in each pair. We achieve transitivity by using the EKS-method, illustrated below for Denmark with the Swedish index set to 1.0:

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[26] Transitivity means that a direct comparison between any two countries yields the same result as an indirect comparison via any other country

$$I_{DK} = \left(K_{\frac{DK}{SE}} \cdot K_{\frac{SE}{SE}} \cdot K_{\frac{DK}{DK}} \cdot K_{\frac{DK}{SE}} \cdot K_{\frac{DK}{NL}} \cdot K_{\frac{NL}{SE}} \cdot K_{\frac{DK}{FR}} \cdot K_{\frac{FR}{SE}} \cdot K_{\frac{DK}{D}} \cdot K_{\frac{D}{SE}} \right)^{1/5}$$

We use a regression procedure to compute the price level index for each country in practice. This procedure minimizes the sum of the squares

$$S = \sum_{all 10\ pairs} \left(\log(priceratio) - \beta_2 \cdot X_2 - \beta_3 \cdot X_3 - \beta_4 \cdot X_4 - \beta_5 \cdot X_5 \right)^2$$

With

$$X_i = \begin{cases} 1 & \textbf{if country i is in the numerator} \\ -1 & \textbf{if country i is in the denominator} \\ 0 & \textbf{otherwise} \end{cases}$$

We assign Sweden to country 1, to which each of the other 4 countries are compared. The coefficients β_2, β_3, β_4 *and* β_5 are thus the price levels of the other four countries.

3.8 Results

From a producer's point of view, it is interesting to calculate the coverage of the items used in each bilateral comparison.

The most significant finding in Table 3.3 is the rise in coverage when going from item definition type V1, which in practice is the same as product specification (brand and model), to type V4. The fourth item definition has the following criteria:

- 2 values on front-loader/top-loader,
- values on capacity (3, 4, 5, 6 and 7 kg),
- values on energy class (A, B/C, D/E/F, missing27),
- 8 values on spin-speed (in multiples of 200 cycles per minute from 400 to 1800).

Table 3.3 Average coverage of markets in the bilateral price comparison. Percent.

	Item definition			
Method	V1	V2	V3	V4
All outlets, without breakdown into shop types				
A.	30,1	56,6	68,3	88,1
B.	27,1	50,6	62,0	85,5
C.	16,6	35,3	44,9	71,4
D.	21,5	43,9	53,3	84,4
E.	31,0	57,2	68,0	89,4
Breakdown into two shop types				
A.	27,4	52,5	63,3	87,3
B.	24,0	47,3	57,5	83,2
C.	15,2	33,1	40,7	67,8

Theoretically the total will be $2 \cdot 5 \cdot 4 \cdot 8 = 320$ classes. In our data there are observations for 133 items (see table 3.4).

[27] Missing values on energy class ought not to be a problem in a PPP-survey as this information is indispensable for the retail trade.

Table 3.4 Number of items for definitions of varying detail

	Item definition			
	V1	V2	V3	V4
Number of items in data for the five countries	1 919	1 249	547	133

At this stage, the workshop decided that the alternative

- Breakdown into two shop types
- Item definition V2
- Equi-representativity method B.

is the "point-estimate" to be produced for the Swedish Competition Authority. For this combination an average of 47.3 percent of the sales were covered in the five countries. Brand is part of the item specification. Only if the market share of one item is less than one hundredth of the market share of another country, the item is deleted from the bilateral comparison.

In Table 3.5 the impact of the different methods used on price levels is indicated by averages on all alternatives, but in comparison to each other.

The largest variations in results are found for the choice of item definitions (V1 – V4).

Table 3.5 Average price level indices for different methods. (Arithmetic average for all five=100)

	Country				
Method	D	NL	SE	FR	DK
All outlets, without breakdown into shop types	92,0	94,7	100,0	105,7	107,5
Outlets broken down into two shop types	91,3	94,8	99,5	107,3	107,1
A.	91,3	94,5	100,1	106,3	107,8
B.	91,2	94,5	100,3	106,5	107,5
C.	91,9	93,4	100,4	105,9	108,5
D.	90,8	95,6	99,4	106,2	108,0
E.	93,2	95,9	98,6	107,5	104,9
V1	90,7	95,2	98,6	106,8	108,7
V2	90,4	94,4	98,8	108,7	107,6
V3	89,0	94,5	100,7	107,2	108,5
V4	96,5	94,9	100,8	103,3	104,4

Note: The price level index for Germany is 91,3 for method A and it is calculated for all combinations as 2*4=8 for outlets both broken down and not broken down, and for all V1-V4.

3.9 Conclusion

Equi-representativity, comparability and coverage are negatively correlated. This fact raises the issue of trade-offs between these principles. Our results will be used to illustrate the potential impact of the different methods we have implemented in the calculation of the price level indices.

The degree of comparability can be decided by using tight or wide item definitions. Equi-representativity depends on how we can utilise information on market overage shares – if available at all. We can use the market shares as they are (A. – C.) or dichotomised (D. and E.). Coverage of market is a function of these two.

3.9.1 Coverage vs. Comparability

The coverage table (see table 3.3) shows that the item definitions are of great importance depending on how tight we define the items. A wide definition as V4 gives a higher average coverage of markets in the bilateral comparison than a tighter one as V1. This clearly shows the inverse relationship between coverage and comparability.

We can also establish the fact that we get lower coverage when we have calculated the average coverage with two separate shop types than without the differentiation. Those items which do not have enough market coverage (in accordance with the definitions) disappear from the sample when we calculate the coverage with breakdown of shop type.

3.9.2 Equi-representativity vs. Coverage

We obtain a different degree of average coverage of markets depending on whether we have a weighted or dichotomised market share (methods A-C and D-E).

The results show higher average market coverage for the method E for all item definitions (see table 3.3). The distribution of the market shares is very skewed. The sum of market shares for items with markets shares exceeding the median will therefore be high. But the market shares are dichotomised and E fails to give an accurate coverage of markets for the bilateral comparison.

3.9.3 Price levels

We do not see any considerable differences in price level indices for the equi-representativity methods A-D or for the comparability methods V1-V3. On the other hand we can see differences in the indices for the method E and V4 (see Table 3.5). These two methods result in less dispersion between countries. Only France shows a higher price level index when we calculate price level for two different shop types. It would mean that France has a larger share of hypermarkets/multiple chains.

For the combination V4 and E and without breakdown of shop types, the differences between the lowest and highest price level indices is only 4 percent. This fact gives rise to the questions: Do the consumers in the five countries spend the same amount of money to buy a washing machine, and do they get different products? These results can be compared with the combination V1 and A and with breakdown of shop types which get a price level difference of 19 percent.

We observe that price level indices calculated with V4 for Germany, and to a minor degree Sweden, are higher when compared with the price level index with V1. France and Denmark have lower price level indices when making the same comparison. If the market share for expensive washing machine is larger in Germany than in Denmark, the price level should accordingly be higher, consistent with the findings.

The weighted hedonic technique uses all available data, and coverage is 100 percent, implying that results are reliable. The conditions for our hedonic indices are most similar to A, V3 and broken down shop types. The result for this alternative turns out to be quite similar to the results of the hedonic method.

3.9.4 Final comments

- Our results give a hint as to how the item specification can be a serious measurement problem in PPPs.

- The lack of information about market shares and dichotomisation of any available information could lead to a distortion depending on the distribution of the brand or non-brand definition of items.

- This study needs to be further extended to include other products and other countries.

Appendix.

Table 3.6 Price level indices for 42 calculation conditions

Shop-types	Item definition.	Equi-repr. Method	D	NL	SE	FR	DK
Collapsed	V1	A.	90	95	99	106	109
Collapsed	V1	B.	90	96	99	107	108
Collapsed	V1	C.	91	94	98	108	109
Collapsed	V1	D.	90	97	98	104	110
Collapsed	V1	E.	92	94	99	108	107
Collapsed	V2	A.	90	95	99	109	108
Collapsed	V2	B.	90	95	99	109	108
Collapsed	V2	C.	91	93	99	108	109
Collapsed	V2	D.	89	94	99	108	109
Collapsed	V2	E.	93	96	97	110	104
Collapsed	V3	A.	89	95	101	107	109
Collapsed	V3	B.	89	95	101	107	109
Collapsed	V3	C.	89	93	102	106	110
Collapsed	V3	D.	88	94	101	106	110
Collapsed	V3	E.	90	96	100	108	106
Collapsed	V4	A.	97	93	102	101	106
Collapsed	V4	B.	97	93	103	101	106
Collapsed	V4	C.	98	93	104	98	107
Collapsed	V4	D.	96	96	100	103	105
Collapsed	V4	E.	99	98	99	102	102
Separated	V1	A.	90	96	99	106	109
Separated	V1	B.	90	95	99	108	108
Separated	V1	C.	90	95	98	109	108
Separated	V1	D.	90	98	98	105	109
Separated	V1	E.	91	94	98	108	108

Table 3.6 Price level indices for 42 calculation conditions (cont.)

Shop-types	Item definition.	Equi-repr. Method	D	NL	SE	FR	DK
Separated	V2	E.	92	96	97	110	105
Separated	**V3**	**A.**	**89**	**95**	**101**	**108**	**108**
Separated	V3	B.	89	95	101	108	108
Separated	V3	C.	89	93	101	107	110
Separated	V3	D.	89	95	100	108	109
Separated	V3	E.	90	96	99	108	107
Separated	V4	A.	96	94	100	106	104
Separated	V4	B.	96	93	100	106	105
Separated	V4	C.	96	93	101	104	105
Separated	V4	D.	94	97	99	107	103
Separated	V4	E.	97	98	99	106	100
Separated	Unweighted regression		94	91	99	106	111
Separated	**Weighted regression**		**90**	**93**	**102**	**106**	**110**

4 How segmented are the EU Food Markets?

Christian Jörgensen

4.1 Background and Aim of Study

Recent surveys indicate that substantial price differences still exist on the EU food markets despite the implementation of the Single Market Program (SMP) (The EU Commission, 2001). National borders exist and still seem to segment the EU food market despite deeper and broader integration. By deeper integration we mean the implementation of the SMP and monetary integration and by broader integration we mean the EU-membership of Austria, Finland and Sweden.

The aim of this study is to analyse segmentation of the EU food markets and to asses the role of the integration process on price disparities. The study covers the period between 1990 and 2002. Price data for individual food products across EU cities over several years are used. The impact of frontiers on price differences over time is analysed, as is how the membership of Sweden, Austria and Finland to the EU has affected price differences between "new" and "old" EU members.

Tariffs and quantitative restrictions on trade had been removed during the earlier stages of European integration, an the SMP aimed to complete the internal market by focusing on the remaining cost increasing barriers to trade and market entry restrictions. Remaining cost increasing barriers to trade consist of for example different national regulations and administrative practices. The SMP, which was to be implemented by the end of 1992, targeted cost-increasing barriers to trade such as delays at custom posts, complying with different national technical regulations and norms in production and distribution. The EU food market had been particularly exposed to cost-increasing barriers to trade before implementation of the SMP. Particularly food markets in Austria, Finland and Sweden were subject to a number of non-tariff barriers such as technical standards and regulations (EFTA, 1992).

Monetary integration should make product markets more effective. Direct transactions costs involved in converting one currency into another are eliminated and switching to one common currency increases price transparency. Also, removal of risks associated with exchange rate fluctuations reduces costs for economic agents and encourages arbitrage activities. The exchange rate regimes that have been applied in the EU and the introduction of the Euro should reduce transaction costs and enhance competition. Monetary integration in the EU is therefore expected to reduce price differences across countries.

4.2 The Economics of Price Differences

4.2.1 The Law of One Price

A natural starting point to examine price differences is the law of one price which states that for any good *i* in period *t*

$$p_{it} = p^{*}_{it} + e_t \qquad (1)$$

where p_{it} is the log of the domestic price, p^{*}_{it} is the log of the foreign price and e_t is the domestic- currency price of foreign exchange rate. Abstracting from tariffs and transportation costs, free movement of goods should ensure that prices are equal across countries. This simple arbitrage argument is the premise underlying the law of one price (Froot and Rogoff, 1995). Deviations from the law of one price is a measure of the degree to which barriers to trade exist, or to what extent cross-border trade arbitrage by economic agents is hindered. In practice, however, the "law" is often violated.

The price of a consumer good consists of different components. Following Engel and Rogers (1996), the price, using a Cobb-Douglas production function, can be expressed as

$$P_{it} = T_{it}^{\alpha} S_{it}^{1-\alpha} MU_{it} VA_{it} \qquad (2)$$

where α and $1-\alpha$ are the shares of the traded intermediate input, $T_{it,}$ and of nontraded service, S_{it}, in the final output, respectively. The mark-up over costs, MU_{it}, is inversely related to the elasticity of demand. Finally, value added taxes, $VA_{it,}$ add to the final price.

There are several causes of price differences. Differing costs for service can be one source of price differences. Poorer countries for example have relatively cheap service, as it is relatively labour intensive and the cost of labour is relatively cheap in these countries (Bhagwati, 1984). Even if countries have the same wage costs on average, wage dispersion can be the origin of varying service costs and explain price differences. Lipsey and Swedenborg (1999) found that wage dispersion partly explains price levels for food products and price differences between countries. Labour markets segmented by national borders can thus be one explanation for price differences between countries. Transaction costs and barriers to market entry also restrict competition and facilitate mark-ups. Different degrees of competition across countries may also allow firms to choose different mark-ups, which can thus be one reason for price differences across countries.

Transport costs widen the band within which prices can differ. Put more formally, the relative price of the tradable intermediate part could fluctuate in a range such that

$$- T \leq L - L^{*} \leq T \qquad (3)$$

where T is the transport cost between two locations, L and L^{*}. This equation does not state that larger transport costs between locations necessarily implies larger price differences, holding everything else equal. Larger transport costs reduce arbitrage possibilities between locations though, and thus prevents prices from equalising across locations. This preventive effect for arbitrage activities between two locations depends upon a different set of factors such as supply of domestic substitutes and location of exporter of the intermediate parts.

Consumers tend to prefer local to foreign products, which prevents trade and thus price equalisation. Preferences for domestic products "hinder" foreign products from being perfect substitutes. Consumers' preference for home products might differ from product to product. Strong national trademarks and food crises, for example BSE, may explain the existence of border effects, even though formal barriers to trade have been abolished.

There are also other reasons why prices differ across products between countries. The share of service, $1-\alpha$ in equation (2), can differ across products between countries creating larger price

differences for service-intensive products. The mark-up over costs can also differ across food products in different countries. Varying consumer preferences across countries can lead to different mark-ups and different prices across countries. Value added taxes could also vary between countries. Some EU countries, for example, tend to have higher VAT rates for beverages compared to food products. Transport costs also differ between products. Especially for bulk products, transport costs are a major element of arbitrage costs.

Of course, the integration of EU markets should reduce transaction costs and improve the validity of the law of one price. Measures taken for the elimination of non-tariff barriers and barriers to market entry are supposed to ease arbitrage activities, and thus allow smaller price differences between countries as well as lower prices of goods and tradable services in general. Prices of nontraded services are, on the other hand, not expected to converge to the same extent. As the service part differs across products, the effect of integration should affect food product prices to a varying extent.

4.2.2 The Empirics of Price Differences

A number of studies have used price indices to study price differences across locations. Engel and Rogers (1996), for example, used monthly price indices in order to analyse how borders and distance affect price differences between cities in the US and Canada. More specifically they focus on the role of exchange rate volatility and wage differences for price volatility. In a more recent paper Engel and Rogers (2000) explore the border effect, or "the width of the border", among European countries. A main conclusion of their analysis is that the border effect is large and that price differences can be explained by sticky prices in local currency and geographical distance. Their results therefore suggest that monetary integration is likely to lower price differences across member countries by abolishing exchange rate volatility.

Parsley and Wei (2001b) constructed price indices of individual tradable goods and studied how instrumental and institutional stabilization of the exchange rate affected the integration of goods markets across 83 cities during the period 1990 to 2000. A main conclusion of their study is also that stabilization of the exchange rate stimulates the integration of the markets for goods and that integration is inversely related to distance.

The Swedish Competition Authority (2000) used OECD price indices for a wide range of categories and analysed price differences between Sweden and other OECD countries. They found that Sweden's relatively high prices partly could be explained by lack of competition.

When using price indices it is not possible to test the law of one price directly. Some studies have used prices of individual items to test the law. Parsely and Wei (2001a), for example, studied price differences of 27 traded goods between Japanese and US cities. Like Engel and Rogers (1996), they studied price volatility, adding shipping unit-costs in the analysis, and found the border effect to be remarkably large.

Jakobsson (2001) also used prices of individual food products to study how integration has affected price dispersion in the northern EU. Yearly prices of milk, coffee, flour, sugar, cocoa, eggs and potatoes in various regions in Sweden, Germany and Finland for the years 1993-1998 were used to study how price differences were affected by the membership of Sweden and Finland in the EU. The study finds that the border effect is significant and also that it has declined over time. The decreasing border effect supports that the EU membership of Finland and Sweden in 1995 has narrowed price differences between these three countries.

4.3 Data and Price Differences over Time

4.3.1 Data Description

The price data used in this study are standardized price comparisons of 56 food products in 23 cities (a total of 253 city-pairs) in the EU for the time period 1990-2002. The cities included are the capital cities in each member country and additionally four cities in Germany (Hamburg, Dusseldorf, Munich and Frankfurt), Milan, Manchester, Barcelona and Lyon. The food products include red meat products, pork, poultry, fish, dairy products, eggs, fresh fruit and vegetables, cooking oils, beverages, colonial products, tinned goods, grain products, sugar and mushrooms.

The Economist Intelligence Unit (EIU) compiles the data and the same methodology is used in collecting prices across cities so the

prices are indeed comparable.[28] Prices are recorded twice a year and averaged to yearly prices. For the year 2002, however, the price data are restricted to the summer price observation. Prices are recorded both in super markets and "high price outlets", but the ones used in our study are limited to those recorded in super markets. These prices are more interesting, since they include a relatively larger tradable component compared to prices of the more service-intensive products from high price outlets. The prices are quoted in Euro to make prices more comparable and all prices are net of value added taxes.[29]

4.3.2 Price differences Across Time for All Products

Relative price differences, $Q_{ij,}$ are defined as the absolute value of the logged price quotient for good *i* between cities *k* and *l*, or put more formally

$$Q_{ij} = abs(ln(p_{ik}/p_{il})) \qquad (4)$$

The mean of the absolute value of the logged price quotient averaged for all products is shown in figure 1 (mean relative price difference and standard deviation are reported for each food and beverage item in the Appendix). As can be seen, relative price differences for all food products between EU members have been declining during the time period. The former EFTA countries, Sweden, Austria and Finland, represented by the small dotted line, had significantly larger price differences than the EU average in the early 1990s. Sweden, Finland and Austria joined the EU in 1995 even though they had started to implement the SMP at a somewhat earlier stage. When they joined the EU, they also adopted the Common Agricultural Policy (CAP), which should also have led to an increased price convergence of primary agricultural products (consumer price of sugar in Sweden, for example, rose in 1995 to an EU level). At the end of the time period, though, the difference is narrowed.

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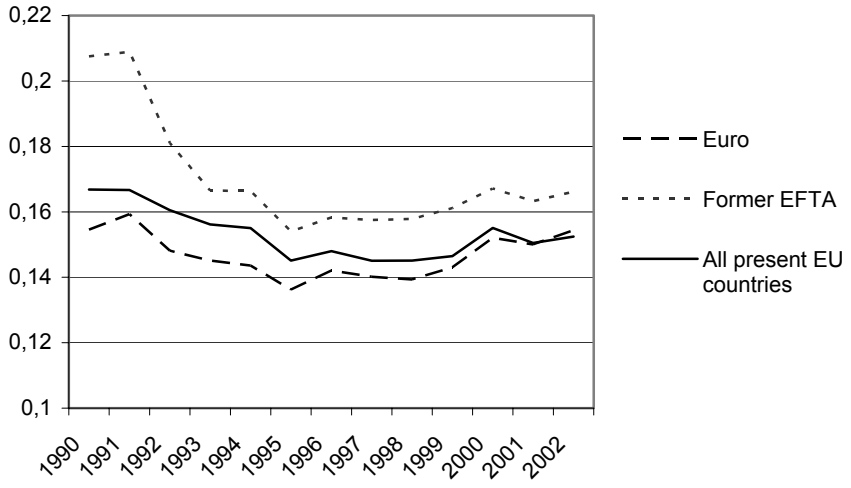
[28] The data from EIU have previously been used in Parsley's and Wei' s study (2001b).

[29] Currency conversion to Euro are done by EIU and carried out using the exchange rates prevailing on the date of the price survey in question.

Figure 4.1 Relative price differences, Q_{ij}, averaged for all products for all countries, former EFTA countries and countries that have introduced Euro.



Notes: Q_{ij} is mean relative price differences ($Q_{ij} = abs(ln(p_{ik}/p_{il}))$) calculated for all 56 products. Products are weighed uniformly. In category All countries Q_{ij} for all city-pairs are included, in category Former EFTA all city-pairs including a city from Austria, Finland or Sweden are included, and, finally, in category Euro all city-pairs are included except city-pairs including a city from Denmark, Great Britain or Sweden.

There was a small but decreasing trend towards smaller price differences among the EU members until the end of 1990s. There were thus tendencies that, during and after the implementation of the SMP, price differences became smaller. What is more surprising is that after the introduction of EMU, price differences became larger. In 2000 price differences widened for all groups, even price convergence among the countries that belong to EMU, that is all city-pairs excluding cities in Sweden, Great Britain and Denmark, came to a halt. The monetary union has, however, only been "at work" for a short time period - two years - which makes it difficult to draw far-reaching conclusions about the longer term impact of EMU on price differences. This period also coincides with food scandals such as the BSE-crisis, which may have segmented food markets.

The mean relative price difference for all products for the whole period was 0.159 (corresponding to an average price deviation of 17.2 percent). Comparing price differences for larger product groups, price deviations were largest for fruit and vegetables with a mean of 0.176 (corresponding to an average price deviation of 19.2 percent). Relative price differences suggest that these product markets are most segmented. Price deviations for regulated goods within CAP, that is meat products, sugar, milk and white flour, were on the other hand relatively small with mean 0.147 (corresponding to an average price deviation of 15.8 percent). Administrative prices, which form common floor prices of producer goods, may be one explanation for these relatively small price differences for regulated products.

4.4 The Border Effect for Price Differences

To analyse whether national borders segment markets, a regression analysis is needed. Regression equations are therefore estimated in order to distinguish transport costs from other trade barriers for price deviations. Regression equations are estimated for all individual food items in order to study if, and to what extent, results differ between food products and food markets.[30]

4.4.1 The Border and Distance Effect

Regression equations are estimated for all individual food products. A regression is performed for each single item (a total of 56 regressions), and the equation is specified as

$$(5)\ Q_{ij} = \alpha + \beta_1 Dist_j + \beta_2 Trend + \beta_3 Border + \varepsilon_{ij}$$

where Q_{ij} is the mean of the absolute value of the logged price quotient on good *i* between city pair *j*, α is the constant and distj the log of the distance between city pair *j*. The calculated distance is a straight line between two cities, calculated using the great distance

[30] All results are presented from robust estimation, using the White heteroscedasticity consistent estimator.

formula.[31] Border is a dummy taking the value one if a national border separates the cities. Distance is logged as it is assumed that transport costs are not linear due to fixed costs such as costs for packaging.[32]

Table 4.1 Definitions of the variables in regression equation (5)

Variable	Definition
Q_{ij}	Relative price differences are defined as abs(ln(p_{ik}/p_{il}))for good *i* between city-pairs *j*
$Dist_j$	Distance is the logged distance (100 km) between citiy-pairs *j*
Trend	Trend is a trend variable for the time period 1990-2002
Border	Border is a dummy variable taking the value one if the cities are separated by a national border

Trend is a time variable that is included in the regression equation in order to include the integration process for *all* EU cities. Trend denotes a linear trend for the entire period. The integration process is expected to have continued during the time period, and the expected sign of the coefficient is negative, i.e. price differences are expected to narrow.

[31] The formula is derived from the mathematics of spherical geometry (see Nilsson (1997) for a description of the great distance formula).

[32] A non-linear relationship is also assumed in Jakobsson (2001), Engel and Rogers (1996, 1999) and Parsley and Wei (2001a, 2001b).

Table 4.2 Expected coefficient signs for distance and border

Variable	Expected sign of coefficient
Distance	+
Border	+
Trend	-

The equation has been estimated for 56 products. The explanatory power of the specification differs considerably across the regressions, with adjusted R^2 varying from just 0.002 to 0.217 and mean of 0.047. Table 3 reports the border effect and distance effect for all 56 items at the five-percent significance level. The border effect is significant for 35 products (almost two thirds of the food products). National borders are thus found to segment most of the food product markets. The distance effect is also significant and has a positive effect on price differences for most food products (40 goods).[33]

The border effect is largest for dairy products, white bread, filet mignon and some branded food products.[34] For these products, the border explains about 40 to 50 percent of the variation of the relative price differences.[35] The results show that national borders have a large role in market segmentation for dairy products and branded food products. For the other products with significant border coefficients, the border explains 10 to 35 percent of the variation of Q_{ij}. Smallest border effects are mainly found among meat products, fresh fruit and vegetables and cooking oils. Cocoa, tea, coffee products, canned food, sugar and rice constitute an

[33] The coefficient of the distance variable is negative for six products.

[34] Calculated by relating the border coefficient and mean Q_{ij}. This measure must, however, be carefully interpreted as omitted variables may lead to biased estimates.

[35] Cheese, milk, yoghurt, orange juice, drinking chocolate, frozen fish fingers, spaghetti, instant coffee, white bread and filet mignon.

intermediate group where national borders explain about 25 percent.

Table 4.3 Border and distance effects for all 56 food products

		Border	
Distance		Positive effect	No effect
	Positive effect	22 products	18 products
	No effect	13 products	3 products
Adjusted R^2 0.002-0.217 (mean 0.047)			
Number of observations: 2189-3113			

Notes: The category positive effect includes coefficients that are positive and significant at the five-percent significance level. The no effect category includes insignificant coefficients and negative coefficients significant at the five-percent significance level.

It is however not possible to distinguish what constitutes the border effect. Strong national trademarks may form informal trade barriers, prevent arbitrage and segment product markets (Jakobsson, 2001). Data for consumer preferences are needed to distinguish such border effects. However, for fresh products such as meat products and vegetables and fruit, arbitrage barriers can be assumed to be modest.

Trade penetration can be an indication of the level of integration of markets. Trade statistics also indicate that trade in fresh products as vegetables and fruit is relatively large (Statistics Sweden, 2001).[36] For some products with a large border effect, e.g. dairy products, trade between EU countries is relatively small.

For 22 items both Border and Distance coefficients are statistically significant. For these products we transform the border effect to distance in order to illustrate the border impact on price differences. Comparing the effect of border and distance for these products, the border effect ranges from 129 km (olive oil) to 120,884 km (white bread).[37] For twelve products the border effect is relatively modest,

[36] The value of Sweden's imports and exports of fresh fruit and vegetables was in 1999 about 25 percent of the value of consumption of these products. For dairy products, the value of imports and exports corresponded to about ten percent.

[37] The border effect compared to distance is calculated as exp(coefficient border/coefficient distance).

equivalent to 129 to 262 km, while for seven products the effect is larger than the average distance between the cities in the study, 1,181 km. The border effect compared to the effect of transport costs differs to a large extent between different food products. Illustrating the border effect, using this statistic, of course depends upon how much distance contributes to price dispersion.

For some product groups crossing the border implies larger price differences for every single item. The border adds to price differences for all dairy products, beverages and cooking oils. For beef products, on the other hand, the border effect is only significant for one out of five items. In other product groups the result is more ambiguous.

The result of the trend variable varies between food products, and is significant with the expected negative sign for almost half of the goods, 24 out of 56. Meat products are over represented in this group. For these products price differences narrow over time. For 17 products, however, relative price differences have widened between cities during the time period. Dairy products are over represented in this group.

4.4.2 The Border Effect over Time

To study the border effect over time for each item, an independent variable, Interact, is included in regression equation (5). In this specification the integration effect is decomposed into a general effect and a border effect. The variable is an interaction variable between the border and the trend variable, which gives the following empirical specification

$$Q_{ij} = \alpha + \beta_1 Dist_j + \beta_2 Trend + \beta_3 Border + \beta_4 Interact + \varepsilon_{ij} \quad (6)$$

The hypothesis is that the border effect is likely to decline over time along with the integration process. Prices are expected to narrow more between cities separated by a frontier than cities in the same country with the implementation of the SMP. The coefficient for Interact is thus expected to have a negative sign.

Table 4.4 Definition and expected sign of the variable Interact

Variable	Definition	Expected sign
Interact	Interact is the trend variable multiplied by the border variable	Negative

Twelve out of 56 items show the expected sign, i. e. the border effect diminishes over time. For these products, price differences between cities separated by a national border decrease more than price differences between cities belonging to the same country. Adding the variable Interact in the regression, however, does not increase the explanatory power. For most products (35 products), the coefficient is not significant at the five-percent level. For twelve products the border effect decreases over time.[38] It is, however, difficult to distinguish a pattern across these product groups. For eight products the border effect increases over time.[39] Among these products fresh products are over represented.

4.5 The Effect of EU Membership

As could be seen in figure 1, membership in regional schemes seems to matter when it comes to price differences. Relative price dispersion is on average larger between city-pairs including a city in former EFTA countries. This is not surprising as measures for deeper integration such as abolishment of barriers to arbitrage especially should have been taken for these countries. In order to study country-specific effects of integration of the former EFTA countries (Austria, Finland and Sweden) two variables are added to the regression equation (5). EFTAm is a dummy variable that takes the value of one if at least one of the countries was a member of EFTA before the year 1994 and EUent is a dummy that takes the value of one for the years 1995-2002 for the former EFTA countries. To control for good-specific effects, good-specific dummy variables, GD, are included.

[38] Entrecote, filet mignon, ham, white bread, frozen chicken, fresh chicken, tonic water, canned sliced pineapples, canned peaches, cornflakes, frozen fish fingers and veal chops.

[39] Veal roast, bacon, apples, oranges, olive oil, tea, milk and potatoes.

For former EFTA countries it is suggested that price convergence with other EU member states should be less than with the whole-period EU members, and the variable EFTAm is hence expected to be positive. As they become members the price gap between former EFTA countries and other EU members is expected to diminish and eventually vanish, and EUent is thus expected to have a negative sign. Including EFTAm, EUent and GD give the following empirical specification[40]

$$Q_{ij} = \alpha + \beta_1 Dist_j + \beta_2 Trend + \beta_3 Border + \beta_4 EFTAm + \beta_5 Euent + \sum_i GD_i + \varepsilon_{ij} \quad (7)$$

Regressions are run for the following categories of goods: branded food products and beverages, regulated food products and fruit and vegetables. [41] The three product groups have different characteristics. Fruit and vegetables are neither branded nor regulated.

The Commission has highlighted the importance of brands in manufacturers formation of market power (Buccirossi, Marette and Schiavina, 2002). The SMP is expected to facilitate entry of new competitors, manufacturers, and have a substantial disciplinary impact on market power and lower price differences. Formerly sheltered manufacturers are believed to be exposed to increased competitive pressures. The implementation of the SMP is, on the other hand, mainly expected to narrow price differences of branded goods.

Meat products, cereals and sugar are subject to extensive market regulation instruments in the EU, such as direct support to producers, regulated producer prices and market interventions. When joining the EU, the former EFTA countries immediately

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[40] All results are presented from robust estimation, using the White heteroscedasticity consistent estimator.

[41] These categories include most food products in the sample, 45 out of 56. Regulated products include the products pork (4 items), beef (5), lamb (3) and veal (3), sugar, white flour and milk. Fruit and vegetables include oranges, apples, bananas, lemons, potatoes, onions, tomatoes, carrots and lettuce. Branded products include canned food (4), beverages (4), coffee (2), drinking chocolate, frozen fish fingers, spaghetti, cornflakes, cooking oils (2), tea bags and cocoa.

adopted the CAP, which replaced national regulation.[42] This is particularly expected to level prices of regulated products.

Table 4.5 Definitions of the variables EFTAm and EUent

Variable	Definition	Expected sign
EFTAm	EFTAm is a dummy variable taking the value of one if one of the city-pairs is located in Finland, Sweden or Austria	Positive
Euent	EUent is a dummy variable taking the value of one if one of the city-pairs is located in Finland, Sweden or Austria for the years 1995-2002	Negative

When pooling regulated goods both EFTA and EUent coefficients are significant at the one-percent significance level with the expected signs. As expected, price differences have narrowed between cities in the former EFTA countries and other EU cities (see table 6). The adoption of CAP seems to have narrowed price differences for these products.

[42] Contrary to previous enlargement, where a gradual model was applied, the membership followed the "big bang" model, i.e. the market regulations were adopted immediately.

Table 4.6 Impact of EU entrance for different food product categories

Variables	Regulated goods	Branded goods	Fruit and vegetables
Constant	0.071*** (29.01)	0.156*** (55.38)	0.092*** (21.24)
Distj	0.011*** (12.28)	0.015*** (17.88)	0.038*** (27.96)
Trend	-0.0002 (-1.581)	-0.0004*** (-2.673)	-0.001*** (-4.28)
Border	0.023*** (10.78)	0.046*** (22.89)	0.007** (2.191)
EFTAm	0.034*** (16.51)	0.035*** (14.97)	-0.004 (-1.303)
EUent	-0.036*** (-14.98)	-0.031*** (-11.54)	-0.0043 (-1.1025)
Adjusted R^2	0.08	0.08	0.08
Number of Products	18	18	9
Number of observations	52,783	55,464	27,875
Dependent variable	Q_{ij}	Q_{ij}	Q_{ij}

Notes: The t-values are found in brackets. Three, two or one asterisk denote significance at 1, 5 and 10 percent level, respectively. Regulated products include pork (4 items), beef (5), lamb (3) and veal (3), sugar, white flour and milk. Fruit and vegetables include oranges, apples, bananas, lemons, potatoes, onions, tomatoes, carrots and lettuce. Branded products include canned food (4), beverages (4), coffee (2), drinking chocolate, frozen fish fingers, spaghetti, cornflakes, cooking oils (2), tea bags and cocoa.

Also, when pooling branded goods EFTA and EUent coefficients are highly significant with the expected signs. The result suggests that joining the EU had a pro-competitive effect on markets for branded goods in former EFTA countries. For fruit and vegetables, however, the coefficients are statistically insignificant at the five-percent level. The result thus indicates that EU membership has not levelled price levels between former EFTA countries and other EU countries for these homogenous unregulated goods.

4.6 Conclusions and summary

Economic integration is expected to narrow price differences between member countries. The implementation of the Single Market Programme (SMP) in 1992, which established free movement of goods, capital and labour, was an important step towards a unified market and expected price convergence on product markets.

On an integrated market price differences are expected to be small. Studies show that considerable price differences still exist on EU food product markets. In this study the relative price differences of 56 food products and beverages are analysed in order to study market segmentation for a wide range of markets for food and beverages. Data for the time period, 1990 until 2002, also facilitate the analysis of how both deeper and broader integration have affected market segmentation. By deeper integration we mean the implementation of SMP and monetary integration. By broader integration we mean the membership of Austria, Finland and Sweden in 1995.

Segmentation of EU food markets by national borders is found for most food and beverages. Barriers to arbitrage, such as barriers to entry and trade, may explain market segmentation by national borders. Arbitrage barriers may lead to different degrees of competition across countries and different prices. Different service costs and preferences for domestic products may also explain price differences.

The results also support the assertion that the degree of segmentation by national borders varies across product markets. Especially for dairy products and some branded food products, the consequence of crossing a national border, the border effect, explains a large part of the relative price differences of these products. For homogenous products, such like fresh products as meat, fruit and vegetables, the border effect is relatively small or statistically insignificant. Even though relative price differences are largest for fruit and vegetables, national borders do not explain price differences for these products. One explanation may be that these markets are local.

Even though price differences narrowed during the period, the study only provides modest support for a decreasing border effect.

A decreasing border effect is found for a minor part of the products studied. On some product markets price dispersion between countries even increased.

The effect of former EFTA countries' membership in the EU has had an impact on price disparities. Price differences between cities in Austria, Finland and Sweden, and the "older" member countries have narrowed in the 1990s. For regulated goods and branded goods, price differences have narrowed since the EU entrance. Implementing the CAP has likely narrowed price differences for the former products. The result for branded goods indicates that these food product markets have become more integrated. The SMP may have had a disciplinary effect on market power on these product markets. On the market for fresh fruit and vegetables, on the other hand, price disparities have not been narrowed by EU-membership.

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Appendix

Prices studied (Supermarket)	Mean Q_{ij}	Standard deviation Q_{ij}
Apples (1kg)	0.145	0.125
Bacon (1 kg)	0.172	0.132
Bananas (1 kg)	0.113	0.093
Beef: filet mignon (1 kg)	0.154	0.112
Beef: ground or minced beef (1 kg)	0.125	0.096
Beef: roast (1 kg)	0.146	0.114
Beef: steak, entrecote (1 kg)	0.126	0.097
Beef: stewing, shoulder (1 kg)	0.145	0.12
Butter (500 g)	0.121	0.085
Carrots (1 kg)	0.169	0.135
Cheese, imported (500 g)	0.11	0.147
Chicken, fresh (1 kg)	0.178	0.135
Chicken, frozen (1 kg)	0.165	0.127
Coca-Cola (1 l)	0.116	0.101
Cocoa (250 g)	0.169	0.126
Cornflakes (375 g)	0.112	0.09
Drinking Chocolate (500 g)	0.129	0.097
Eggs (12)	0.137	0.103
Flour, white (1 kg)	0.197	0.145
Fresh fish (1 kg)	0.193	0.151
Frozen fish fingers (1 kg)	0.192	0.135
Ground coffee (500 g)	0.151	0.116
Ham, Whole (1 kg)	0.178	0.135
Instant coffee (125 g)	0.132	0.094
Lamb, chops (1 kg)	0.169	0.124
Lamb, leg (1 kg)	0.173	0.147
Lamb, stewing (1 kg)	0.191	0.145
Lemons (1 kg)	0.225	0.165
Lettuce (1)	0.163	0.132
Margarine (500 g)	0.168	0.122
Milk, pasteurised (1 l)	0.077	0.105
Mineral water (1 l)	0.211	0.167
Mushrooms (1 kg)	0.148	0.12

Prices studied (Supermarket) *cont.*	Mean Q_{ij}	Standard deviation Q_{ij}
Olive oil (1 l)	0.192	0.143
Onions (1 kg)	0.176	0.134
Orange juices (1 l)	0.171	0.127
Oranges (1 kg)	0.182	0.166
Peaches, canned (500 g)	0.15	0.123
Peanut or corn oil (1 l)	0.206	0.166
Peas, canned (500 g)	0.161	0.127
Pork, chops (1 kg)	0.133	0.097
Pork, loin (1 kg)	0.163	0.142
Potatoes (2 kg)	0.22	0.164
Sliced pineapples, canned (500 g)	0.171	0.126
Spaghetti (1 kg)	0.166	0.132
Sugar, white (1 kg)	0.082	0.063
Tea bags (25 bags)	0.181	0.143
Tomatoes (1 kg)	0.17	0.137
Tomatoes, canned (250 g)	0.161	0.115
Tonic water, (200 ml)	0.141	0.116
Veal, chops (1 kg)	0.123	0.101
Veal, fillet (1 kg)	0.15	0.114
Veal, roast (1 kg)	0.142	0.105
White bread (1 kg)	0.178	0.14
White rice (1 kg)	0.148	0.116
Yoghurt, natural (150 g)	0.212	0.167

5 Competition and Pricing: An Analysis of the Market for Roasted Coffee

Dick Durevall

Executive Summary

The purpose of this study is to investigate the cause of the large differences in retail prices of roasted coffee across different EU countries. Since market concentration is high in most markets, the primary question is whether different levels of market power is the explanation for the price differences.

The analysis of market power is carried out within the framework of the Breshnahan -Lau model (Breshnahan, 1989), an oligopoly model that allows for the identification of market power using aggregated industry time series data. The econometric approach is to first test for long-run relationships between the data based on Johansen's (1995) procedure for cointegration analysis, and then to estimate single-equation models for the pricing behaviour. The analysis is based on quarterly data for the period 1988:1 – 2000:4 (in most cases). Countries covered are Austria, Denmark, Finland, Spain and Sweden. In addition, we report prices and costs for Belgium, Germany and the Netherlands and some results from other studies on coffee markets.

Our major finding is that no evidence of market power can be detected in any country using the Breshnahan-Lau model. However, the speed of price adjustment is generally quite low, which could be associated with asymmetric pricing. When testing for asymmetric responses to changes in costs, we find that the coefficient for increases in coffee bean prices is larger than the one for decreases in all countries, although the difference is only statistically significant in Finland and Austria. Other studies have found evidence of asymmetry in Germany and the Netherlands. Market power could be the cause of the pricing asymmetry.

The large price differences can partly be explained by large differences in costs and indirect taxes. When deducting VAT,

coffee tax and the cost of beans from the retail price, we find that the most expensive countries, such as Germany and Denmark, in fact have the lowest mark-ups while some low-price countries, such as Spain, have high mark-ups.

5.1 Introduction

Several studies indicate that Swedish consumer prices exceed those of other EU member states.[43] In a recent study by Konkurrensverket (2002) Swedish food prices were shown to exceed the EU average by 11 percent, or 6 percent after adjusting for differences in VAT. However, this price picture is not entirely uniform. The differences in price vary significantly between products and over time. In addition, studies exist which point to the contrary, i.e. that Swedish prices are quite low.[44] Critical voices also claim that the studies pointing to high Swedish prices are based on non-representative baskets of goods and comparison products (see for example Löfving, 2002).

The heated Swedish debate over food prices probably has its cause in the assumed close relationship between price levels and degree of competition. Are food prices in other countries lower than in Sweden because competition in these countries prevents actors from over-charging consumers? Arguments exist to support this view, but high Swedish production costs also contribute importantly to the price level (Konkurrensverket, 2000b).

It is important to note that even if Swedish food prices were found not to be high, competition in Sweden could still be weaker than in the EU in general. If demand is sufficiently price sensitive, even a monopolist could be persuaded to price at, or close to, the perfect-competition equilibrium price, since a higher price would cause consumers to stop demanding the company's products. To determine whether Swedish food prices are too high, we must therefore investigate the degree of market power of companies as well as the price sensitivity of demand.

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[43] See, for instance, Konkurrensverket (2000a; 2000b; 2002), European Commission (2002a) and DrKW (2002).

[44] ICA-nyheter (11/12 2002) reports an investigation by Christina Falkengård comparing baskets of goods in eight northern and central European countries. According to this study Sweden was the second cheapest country after the Netherlands.

According to the European Commission (2002a) coffee is expensive in Sweden. In fact, according to a survey performed between July 1999 and July 2000, Sweden had the highest EU prices for roasted coffee, with the exception of Great Britain, Ireland and Greece, which primarily consume instant coffee and tea. Swedish prices were 7 percent above the EU average. Thus, in this study we intend to investigate the determination of coffee prices in Sweden and a group of other EU-states.

The main purpose of the study is measure the degree of market power using econometric methods. We estimate the price sensitivity of demand (demand elasticity) and test whether consumer prices exceed marginal costs. In addition, we investigate the time it takes for cost increases to be transmitted to consumer prices and if there is asymmetric pricing, i.e. whether consumer prices rise faster when costs increase than vice versa.

Our approach has three advantages that merit a separate note. First, the analysis is based on price variations rather than actual price levels, which is important since actual price levels are difficult to measure correctly. Second, the use of time series provide more information than a price comparison at a fixed point in time does. Third, since each country is analysed separately, the analysis is independent of currency variations.

There are several reasons why the coffee market is particularly suitable for a study of market power. Coffee is an important product, consumed daily by a majority of the adult EU population (with some exceptions such as Great Britain). In Germany, for instance, 90 percent of the adult population drinks coffee daily (Kaffe-Digest 1, 2002). With an annual coffee consumption of 8 kg per capita, Swedes are among the largest consumers of coffee in the world. There are also good reasons to expect there to be market power, as most of the national coffee markets in the EU are dominated by a few companies; the four largest roasting-houses usually account for 70-80 percent of each national market. In addition, the exceptionally low world market price for coffee beans lately has brought the question of lack of competition further into focus. Roasting-houses have been more or less openly accused of making significant profits, while farmers in developing countries are unable to cover their costs (see amongst others Moore, 2002; Oxfam, 2002).

Also, it is of importance for the analysis that coffee is a simple product with a low degree of value added. Because of this, quality differences are largely reflected in the cost of imported coffee beans, which account for a significant share of the market price for coffee. Furthermore, the most significant price changes are caused by fluctuations in the price of coffee beans rather than product differentiation.

The study covers Sweden, Denmark, Finland, Austria and Spain. In addition information from Belgium, the Netherlands and Germany is reported. Studies of the competition in the German and Dutch coffee markets have been performed recently, and data problems prevent an analysis of Belgium.

The report is structured as follows. The next section covers concepts and economic theory as a background for the empirical analysis. Section 5.3 covers the relationship between theory and the empirical analysis. Section 5.4 provides a short description of the national coffee markets including a price comparison. Section 5.5 summarizes the empirical analysis and findings and section 5.6 gives a summary of the results and concluding remarks.

5.2 Theoretical Background

This section starts with a short description of the theory underlying the empirical analysis of market power. Then follows a description of a complementary approach, tests for asymmetric pricing.

To study the degree of competition we must first define perfect competition and market power.[45] Assuming that companies in the market for a particular good maximize their profits, then perfect competition prevails when the price of the product equals each company's marginal cost. Since profits are maximized when marginal cost equals marginal revenue, and a company without market power cannot influence the price, its marginal revenue is the revenue received from the sale of the last unit, which equals the price of the product. This relationship can be written as,

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[45] See Breshnahan (1989) for a thorough description of different approaches of measuring market power.

$$mr = P = mc, \qquad (5.1)$$

where *mr* is marginal revenue, *P* the price of the product and *mc* marginal cost.

In the absence of perfect competition, market price and marginal revenue differ at profit maximization. A company with market power will act in such a way as to increase the price above both marginal revenue and marginal cost. In the extreme case, when there is either one sole company in a market, or several forming a well-functioning cartel, the relationship between marginal revenue, price and marginal cost is as follows,

$$mr = P + Q\frac{\Delta P}{\Delta Q} = mc, \qquad (5.2)$$

where Q is the quantity of the good and Δ represents a small change in Q and P. The additional term, $Q\frac{\Delta P}{\Delta Q}$, indicates that a change in the supplied quantity will affect the price and hence marginal revenue. The magnitude of the price change depends on the effect that a supply change has on demand, which can be measured by the demand elasticity, ε, i.e. the percentage decrease in demand caused by a one percent increase in price. Thus, equation (5.2) can be rewritten to include the price elasticity by multiplying and dividing by P,

$$mr = P - \left(\frac{1}{\varepsilon}\right)P = mc, \qquad (5.3)$$

where Δ is defined as the price elasticity multiplied by -1. After rearranging terms we obtain,

$$P = mc + \left(\frac{1}{\varepsilon}\right)P. \qquad (5.4)$$

According to equation (5.4), the monopoly price is determined by marginal costs and the inverted price elasticity times the price. The price exceeds marginal costs as long as the elasticity, in absolute

terms, is not very high When ε is high the monopolist lacks market power since a price increase would cause a sharp reduction in demand for its products. Furthermore, according to this equation, ε must be equal or greater than one, or marginal cost would be negative, which is not possible.

In reality, most markets are neither perfectly competitive nor perfectly monopolistic and to describe these markets equation (5.4) must be modified. A major difference between a market with perfect competition and one where companies have market power is that in the latter one company's actions may affect the actions of other companies. This effect can be accounted for by introducing the term θ into Equation (5.4),

$$P = mc + \left(\frac{\theta}{\varepsilon}\right)P. \qquad (5.5)$$

If we interpret (5.5) as a summarizing the different companies' behaviour in a market, then θ describes the average degree of market power. Similarly 1-θ provides a measure of the intensity of competition. When θ equals 0 we have a situation of perfect competition, i.e. $P = mc$ and companies do not possess any market power. When θ equals 1 we have a monopoly situation as in Equation (5.4). A value between 0 and 1 indicates that there is an oligopolistic market.

From Equation (5.5) it is also clear that the price of a good depends on three factors; marginal cost, including VAT and other indirect taxes, the degree of market power and demand elasticity. Thus, the coffee price can be high in a certain country, despite a relatively competitive market, if the elasticity of demand is low or if marginal costs are high.

One of the objectives of this study is to estimate the values of θ and ε for the different coffee markets. These estimates will enable us to show whether markets are perfectly competitive, $\theta = 0$, monopolistic, $\theta = 1$, and how much market power companies have, i.e. how close θ is to 0 or 1.

5.2.1 Asymmetric Pricing

To empirically estimate θ is technically complex and puts great demands on the availability of relevant data. Therefore, we also test for pricing asymmetries, i.e. that companies utilize their market power to increase prices quicker when costs rise than vice versa. One explanation for asymmetric pricing is that companies, via tacit collusion or by watching each other, refrain from lowering their price as long as nobody else does. It is reasonable to assume that such behaviour is common in markets with few producers and where production costs fluctuate significantly, such as the roasted coffee market. All players benefit from this kind of behaviour. However, since an individual company may increase profits even more by lowering its price when production costs decrease, prices are likely to gradually adjust to the new production cost level. A complete, but asymmetric, price adjustment can be viewed as an indication that companies possess short-term, but not long-term, market power.

Although asymmetric pricing usually is interpreted as a evidence of cooperation between producers or price leadership, there are other possible causes. Companies could for instance prefer to offer different sorts of discounts when costs fall rather than immediately adjust the price. Another possible reason is the need to hold stocks. Companies could prefer to not lower prices quickly when costs fall to prevent a stock depletion, which could create additional costs (see Borenstein et al., 1997). Examples of recent studies indicating the existence of asymmetric pricing include Feuerstein (2002) on the German coffee market, Gomez and Koerner (2002) on the French, German and US coffee markets, and Asplund et al. (2000), on Swedish gasoline pricing.

5.3 Empirical Approach

The empirical analysis is based partly on Steen and Salvanes (1999) and partly on Bettendorf and Verboven (2000). Steen and Salvanes (1999) analysed the market power of Norwegian salmon importers to France by using a dynamic model, which takes stochastic trends in the variables into account. Bettendorf and Verboven (2000) analysed the Dutch coffee market.

To test whether θ differs from zero we estimate a pricing relation, which is used to test for asymmetry, and a demand function for each market. In addition, we calculate the time it takes until an increase in import prices affects consumer prices.

The pricing relation is based on the following formulation of equation (5.5)

$$P = (1+\tau)mc - \theta\frac{Q}{\Delta Q/\Delta P} + (1+\tau)a \qquad (5.6)$$

where P has been solved from price elasticity, and indirect taxes have been added explicitly; τ is VAT and a excise tax. Equation (5.6) is expressed in real terms; P is the real price and mc are real costs. To estimate (5.6) we must specify an approximation to the marginal cost function and estimate a demand function to obtain the value of $\frac{\Delta Q}{\Delta P}$.The roasted coffee production process is relatively simple. Approximately 1.19 kg beans are required to produce 1 kg of roasted coffee. Other costs include labour, packaging, energy and capital costs, each of which stands for less than 5 percent of total costs (Bettendorf and Verboven, 2000; Koerner, 2002b). There are few economies of scale, which allows us to assume that companies have similar cost functions, in spite of being of different sizes (Sutton, 1991). This leads us to the following marginal cost function, also used by Bettendorf and Verboven (2000),

$$mc = \beta_O O + \beta_W W + \beta_{IP} IP \qquad (5.7)$$

where IP is the real import price for coffee beans, W are real labour costs, and O stands for all other costs. We have observations for IP in terms of coffee bean prices, and for W, labour costs or salaries, but not for O. We assume that other costs follow the general price evolution and thus are included in the constant in the econometric analysis. Genovese and Mullen (1998), made the same assumption in their analysis of the US sugar market.

The estimation of coffee demand is based on the following model,

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 B \qquad (5.8)$$

where P is the real coffee price, Y real income, and B the size of the population. We assume that the demand for coffee is determined by the coffee price in relation to the price of the basket of goods included in the consumer price index. We could also have added relative prices for more specific coffee substitutes, e.g. tea, but it is unlikely that they influence coffee demand.[46] Instead, it seems more likely that an increase in the price of coffee primarily leads to better utilization of already purchased coffee, since studies show that as much as 20 percent of purchased coffee is not actually drunk (Bettendorf and Verboven, 2000).

The second variable in the demand function is income. Normally an increase in income leads to an increase in consumption. However, the coffee market is likely to be saturated in several countries, hence even if a consumer can afford to consume more coffee he/she will not.

The last variable is population. A common assumption is that large population leads to a high demand. However, since consumption pattern can differs significantly between different age groups, a population increase does not necessarily lead to an increase in demand. We assume that the population variable reflects long-term consumption changes that are not explained by changes in price or income. However, we do not carry out a detailed analysis of these changes, as the objective is to estimate price elasticities.

When analysing demand functions it is important to ensure that the estimated entity is indeed demand and not supply. In the case of coffee, however, the estimation of demand is simplified by the heavy fluctuations of the coffee bean price. Because of these fluctuations, the observed relationship between consumer prices and quantities is likely to be describing demand, not supply.[47]

The data analysis is performed in several steps. Since the mean and variance of at least some variables are not constant over time, we first use a method developed by Johansen (1995) to test for integration and cointegration, i.e. whether variables are stationary

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[46] Studies showing that the price of tea has no effect on coffee demand include Bettendorf and Verboven (2000) for the Netherlands and Feuerstein (2002) for Germany. Gomez and Koerner (2002), however, do find that Coca Cola is a complement to coffee in Germany.

[47] The demand function is identified because the supply equation fluctuates heavily.

or not, and if not, whether they co-vary in the long run. We start by analysing the long-run relationships (cointegration relationships) separately for demand and pricing, and whenever necessary we analyse all the relevant variables simultaneously. Then we estimate equilibrium correction models, ECMs[48], for the pricing, and in some cases for demand.

The formal test for the existence of market power consists of testing whether $Q^* = Q\left(\frac{\Delta P}{\Delta Q}\right)$ in the pricing ECM influences consumer prices in the short- and long-run, given marginal costs. This is illustrated below using a stylised version of the ECM based on equation (5.7),

$$\begin{aligned}\Delta P_t &= c + b_1 \Delta P_{t-1} + b_2 \Delta X_t + b_3 \Delta X_{t-1} \\ &+ b_4 Q^*_{t-2} + b_5 Z_{t-2} + \alpha_1 \left(P - \beta_1 IP - \beta_2 W\right)_{t-2} + \varepsilon_t\end{aligned} \tag{5.9}$$

where ΔX is a vector including all the explanatory variables except lags of ΔP_t, c is a vector of the constant and other deterministic variables, and ε_t is a white noise random term. The long-run relationships between the variables are captured by $(P - B_1 IP - B_2 W)$, Q^* and Z, where Z represents the variables that determine Q in the long run, and consequently Q^*. The level variables are lagged two periods to ensure that they do not affect the short-term dynamics.[49] We test for market power by testing whether b_4, which is $-\theta$, is smaller than zero. In addition, we test whether ΔQ^*, which is included in ΔX, affects ΔP, which would indicate that companies have short-term market power.

To investigate the existence of pricing asymmetry we separate import price changes, ΔIP, which are part of ΔX in equation (5.7), into positive and negative values and re-estimate the model. We then test whether the coefficients for the positive values are higher than those for the negative values.

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[48] Originally the term ECM was used as an abbreviation for ”error correction model”, but lately ”equilibrium correction model” is more frequently used.

[49] The choice of lag does not affect the long-run relations between the data but it has an impact on the short-term dynamics (see Hendry and Juselius, 2001).

5.4 Prices and Markets

The purpose of this section is to compare price levels for roasted coffee in several EU member states. We use data from two separate sources to demonstrate existing variations. We also compare prices after adjusting for import costs and indirect taxes. However, since the price of a good, to some extent is determined by specific market characteristics, we begin by describing the national coffee markets.

5.4.1 Coffee Markets

Table 5.1 shows data for eight national coffee markets in the EU. The per capita consumption figures show the popularity of coffee and indicate the size of the market. With its large population, and relatively high per capita consumption of 6.7 kg, Germany is the largest market. In fact, the German market is the second largest market in the world and approximately six times as large as the Swedish one. Spain is the next largest market after Germany in absolute terms, but with relatively low per capita consumption. The Spanish market is approximately 45 percent of the German one. The Dutch market is third in size. In terms of per capita consumption, Finland is the clear leader followed by Denmark, Sweden and Germany.

The consumption of roasted coffee dominates over instant coffee in most countries; important exceptions are Great Britain, Ireland, Japan and Greece. In our sample of eight countries, instant coffee only accounts for a significant share in Spain, approximately 30 percent. In the other seven countries it is at 10 percent or below.

The quality of coffee is primarily driven by bean type. There are two main types, Arabica and Robusta. The Arabica bean is more expensive and mainly used in high quality coffee, while Robusta is used in cheap, low quality, coffee, instant coffee, and in espresso due to its high caffeine level. While Robusta accounts for only 3 and 2 percent of the Swedish and Finnish coffee markets respectively, it accounts for over 50 percent of the Spanish market (see Table 5.1). This illustrates a distinct north-south dimension in terms of Arabica vs. Robusta consumption. It may also explain why the Spanish coffee price was half of the Swedish price according to the European Commission (2002a).

Another possible cause of the national price diversity is different indirect taxes. In Denmark VAT is 25 percent and there is an excise tax of 6.54 DKK per kg of roasted coffee. In the Netherlands and Spain VAT is only 6 and 7 percent, respectively, and there is no excise tax. German VAT is also low, but in Germany there is a sizeable excise tax of 2.19 Euros per kg, which is equivalent to roughly 30 percent of the price of one kg coffee in Sweden.

Table 5.1 Characteristics of National Coffee Markets, 2000

	SE	DK	FI	DE	BE/LU	NL	ES	AT
Per capita consumption, kg	8.0	8.6	9.9	6.7	3.8a	6.7	4.7	5.5
Instant coffee, %	10	4	4	11	6	5	30	10
Arabica imports, %	97	84	98	79	42	70	49	80
VAT, %	12	25	17	7	6	6	7	20
Excise tax, per kg roasted coffee	-	DKK 6.54 -		€ 2.19	€ 0.25b	-	-	-

Note: The following abbreviations have been used: SE = Sweden, DK = Denmark, FI = Finland, DE = Germany, BE/LU = Belgium and Luxembourg, NL = The Netherlands, ES = Spain, AT = Austria.
a) The Belgian per capita consumption in 2000 seems too low. In 1999 per capita consumption was at 5.3 kg.
b) The excise tax only concerns Belgium.
Sources: Coffee-Digest 1 (2002), Jaarverslag 2001 (2002), European Commission (2002) and Der Kaffee als Handelproduckt (2002)

The various national EU markets have similar structures. Each market consists of one or a couple of large and several small roasting-houses (see Sutton, 1992). The large ones usually account for more than 80 percent of the market together, while the market shares of each of the small ones is less than 5 percent. The large roasting-houses include both domestic and multi-national players, of which the largest are Kraft and Nestlé, with a global market share of 13 percent each, followed by Sara Lee with 10 percent, and Procter & Gamble and Tchibo with 4 percent each (Oxfam, 2002).

While Kraft, Nestlé and Sara Lee are present in many countries, Procter & Gamble is mainly active on the US market and Tchibo in Germany and Austria.

The market shares of the Swedish roasting-houses are shown in Table 5.2. Kraft, owned by Philip Morris, is the market leader with a 44 percent market share. Its brands are Gevalia, Maxwell House and Blå Mocca. Löfberg Lila is second largest with a market share somewhat below 20 percent, followed by Nestlé, with the Zoega brand, and Arvid Nordquist with the Classic brand, both with a 10 percent market share each. The smaller roasting-houses hold less than 3 percent of the Swedish market. A limited amount of coffee is also imported. COOP's Signum, for example, is roasted in Denmark.

The distribution of market shares in Denmark is very similar to that in Sweden, but in Denmark Sara Lee, with the Merrild brand, is market leader with a 31 percent market share. Kraft Morris with 27 percent market share is the second largest player, followed by two domestic companies, BKI (B·K·I Kaffe A/S) with a 17 percent and DKK (Dansk Kaffekompagni A/S) with a 14 percent. The remaining roasting-houses hold 11 percent of the market.[50] The roasting-houses also do private label production, which if included would alter the market shares somewhat.

We do not have detailed information on the market share distribution in Finland and the Netherlands. Nevertheless, in Finland Paulig is clear market leader with a market share of 50 percent (Paulig Group Journal, 2002). The other two large players are Meira, with a market share of 25 percent, and Viking Kaffe. In the Netherlands the largest players are Douwe Egberts, Ahold Coffee Company, Nestlé, and Drie Mollen. Douwe Egberts, owned by Sara Lee, is the market leader with a 60-70 percent market share according to Bettendorf and Verboven (1998).

Douwe Egberts is also the Belgian market leader with a 40 percent market share. The other large Belgian players are Colruyt with 14.5 percent, Carrefour with 11 percent and Aldi with 9 percent.

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[50] The information about the Danish market shares was provided by Max Havelaar Foundation in Copenhagen. It should be regarded as preliminary.

In Austria there are two large companies, Kraft Foods Jacobs with a 29 percent market share and Tchibo-Eduscho with a 25 percent market share, and three smaller players with a 10 percent market share each.[51]

Table 5.2 Swedish Market Shares for Roasted Coffee

Company	*Brand*	*Market share %*
Kraft Food	Gevalia, Maxwell House, Blå Mocca	44
Löfbergs Lila		18
Nestlé	Zoega	13
Arvid Nordquist	Classic	12
Lindvalls Kaffe		3
K W Karlberg		1.7
Kahls Kaffe		1.5
Bergstrands		1
Guldrutan		0.7
Övriga		5.1

Source: Företagaren Direkt (2002).

Until 1997 when Tchibo and Eduscho were merged, Kraft Jacob Suchard (KJS) dominated the German market. Now there are two dominant players, KJS with a 27 percent market share and Tchibo-Eduscho with a 24 percent market share (1999). The other large players include Melitta, 13.5 percent, Albrecht (Aldi) 12 percent, and Dallmayr (Nestlé) 8 percent (Clarke et al, 2002). The remaining 15.5 percent are divided across 39 companies (Koerner, 2002a). Despite the relatively high market concentration, the German market is considered to be quite competitive due to Aldi's forceful low-price strategy (see Koerner, 2002a). Lately a proper price was has broken out with Aldi, in September 2002, selling coffee at 4 Euros below the price of Tchibo's standard coffee. Hence, market shares have probably shifted somewhat in Aldi's favor lately (Hogan, 2002; Barrera, 2002).

The Spanish market is characterized by a lower market concentration than the other countries. The three largest players are

[51] The data for Belgium and Austria is based on information from the countries' producer organizations, Koffiebureaucafe and Kaffeeverband.

Nestlé, Douwe-Egberts and KJS with 16 percent, 12 percent and 11 percent market share each. The remaining 60 percent of the market is accounted for by a large number of roasting-houses and private label brands.

Hence, in almost all national markets there is a limited number of large companies, and some are multinationals. Therefore, there are reasons to suspect the presence of market power. One can also expect large differences in price driven by different indirect taxes (VAT and other) and differences in bean quality. Finally the markets are of very different size, which is of relevance, since large markets usually experience tougher competition and lower prices than do smaller ones (Asplund and Nocke 2002).

5.4.2 Coffee Prices

To provide a picture of the past few years' price level and evolution in the eight countries we have summarized data from two different sources, International Coffee Organization (ICO) and Economist Intelligence Unit (EIU). ICO's data is primarily collected by the various national statistics offices on a monthly basis, while EIU collects its own data in a number of large cities bi-annually and report the annual averages.

Table 5.3 shows the average per kg coffee price in SEK for the 1998-2001 period based on ICO's monthly data. These are the prices used in the empirical analysis. During 1998 price levels were relatively high in Sweden; only Denmark and Germany had higher prices, but these two had the highest indirect taxes. Finland was the cheapest country, with a price level somewhat below the ones for the Netherlands and Spain. One explanation for the surprisingly low price in Finland could be rebates. It is common in Finland to give rebates in the form of lower prices per package, while discounts in Sweden, for instance, are given on the purchase of several packages. Since price data is collected on a per package basis, this lead to lower observed prices than volume rebates.

The ranking was similar in 2001, with the exception that Sweden was now at the same level as Spain, i.e. the second cheapest country. A plausible explanation for the rapid decrease in Swedish prices was the depreciation of the SEK relative to the currencies of the other countries during the 1998-2001 period. Another possible

explanation is that Swedish prices reacted faster than those of most other countries to the approximately 50 percent decrease in the price of coffee beans (see Sub-section 5.2.3).

Table 5.3. Average Prices per kg Coffee (in SEK)

Year	SE	DK	FI	DE	BE	NL	ES	AT
1998	77.33	86.24	59.93	86.87	73.35	64.34	63.43	69.58
1999	63.84	71.55	47.29	78.79	64.66	56.56	58.72	59.61
2000	61.03	69.38	46.12	69.58	64.72	56.64	54.14	61.46
2001	57.61	72.44	44.99	72.27	68.11	58.01	57.75	66.90

Note: See Table 5.1 for definitions and abbreviations.
Source: International Coffee Organization and national statistics bureaus.

The involvement of several organizations in collecting the data in Table 5.3 and the fact that the figures are average prices for large regions complicate the comparison between countries. The data collected by the EIU resolves these problems, since it is collected from central retail outlets in large cities. The disadvantage of the EIU data, however, is that it overstates the average price level and is only reported on a yearly basis. Table 5.4 shows the price per kg for normal retail outlets. As shown in the Table, the EIU data more or less confirms the conclusions drawn in the previous section with a very similar ranking and evolution. Sweden, which was an expensive country in 1998, is a cheap country in 2001. Spain is the cheapest country throughout the period, as one would expect. A difference between Tables 5.3 and 5.4 concerns Austria, which is the most expensive country when represented by the prices in Vienna.

Table 5.4 Price per kg Roasted Coffee (in SEK)

	1998	1999	2000	2001
Amsterdam	79.92	67.94	68.6	67.00
Bryssels	69.78	73.80	66.16	73.40
Copenhagen	90.24	94.52	72.42	84.30
Hamburg	81.40	80.88	73.34	75.50
Helsinki	68.24	67.84	59.38	55.70
Madrid	56.52	56.12	44.46	48.70
Stockholm	95.00	79.80	69.00	65.80
Vienna	101.66	101.14	99.44	108.90

Source: Economist Intelligence Unit. Data reflects prices in normal retail outlets in the city centres.

A more representative cost comparison includes adjustments for different coffee qualities and indirect taxes. The main quality difference stems from the beans used, Arabica or Robusta, which have seen differences in the world market price from 50 to 100 percent during the late 1990s. Table 5.5 shows the price levels of coffee relative to import costs of coffee beans, VAT and excise tax.52 These values give an indication of the actual mark-ups, and depend to some extent on the degree of competition. However, note that all costs are not included and no adjustment has been made for the possibility that indirect taxes can influence pre-tax price levels. The EUI data for supermarkets were used in the calculations. Since these have been collected in the centres of major cities they are likely to lead to overestimation the price-cost margins.

Table 5.5 reports average values for the periods 1990-1995 and 1996-2001. There are relatively small differences between the periods, both for levels of ‘mark-ups’ and the ranking order. Germany, Finland and Denmark have the lowest margins; they are about 45 to 50 percent. This can to some extent be due to overestimation of the impact of the excise tax. However, price competition is known to be tough in Germany, and for the period 1998-2001 the margin was as low as 0.39 (not reported). Sweden and the Netherlands have ‘mark-ups’ of about 0.60, indicating that

52 To calculate the cost we have assumed that 1.19 kg beans are necessary to produce 1 kg of roasted coffee, that VAT is added to the cost of beans and that a coffee tax exists in some countries. The cost was calculated as (1+VAT)*1,19*import price+ (1 + VAT)*excise tax.

the comparatively low price in the Netherlands is due to low VAT and cheap import costs. Spain has the highest margin, about 0.80, in spite of having a low price. The main reason is that cheap Robusta coffee makes up a large share of total imports.

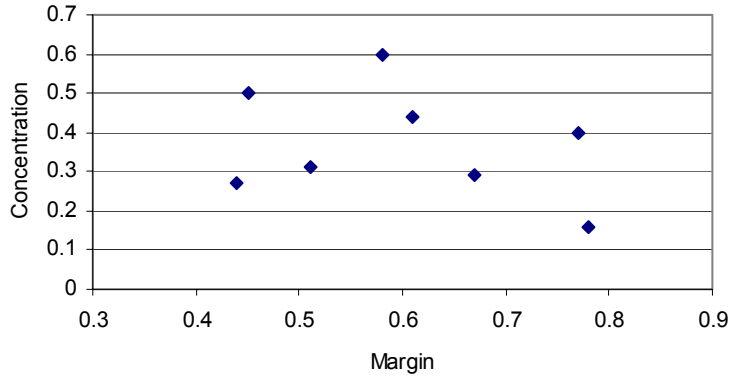
Table 5.5 Prices in Relation to Certain Costs[a]

Country (capital)	1990-95	1996-2001
Austria	0.72	0.67
Belgium	0.68	0.77
Denmark	0.48	0.51
Finland	0.49	0.45
Germany (Hamburg)	0.55	0.44
Netherlands	0.63	0.58
Spain	0.79	0.78
Sweden	0.61	0.61

Source: Consumer prices are based on EIU data for supermarkets in the capital of each country, except for Germany. Import prices are based on ICO data.
a) The 'mark-up' is estimated as (P-Cost)/P. Costs include Import costs, VAT and excise tax.

Market concentration usually is considered an important indicator of market power. Hence, to find out if there is such a relation in our data we have plotted market concentration, measured as the market share of the largest roasting house in each country, and the 'mark-ups' for the period 1996-2001. Figure 5.1 shows clearly that concentration cannot explain the variation in 'mark-ups'.

Figure 5.1 Margins and Market Concentration (C1)



Note: The concentration is given as the market share of the largest company in each market and the margins are given as the values in Table 5.5 for the period 1996-2001.

5.5 Empirical Analysis

In this section we describe the results of the econometric analysis for Sweden, Denmark, Finland, Spain and Austria. We also comment on results from other studies, mainly Feuerstein (2002), Gomez and Koerner (2002) and Koerner (2002a) on German the coffee market and Bettendorf and Verboven (1998; 2000) on the Dutch coffee market. Belgium/Luxemburg is not analysed due to lack of data.

We first perform the cointegration analysis, which provides information about the variables' stochastic characteristics, i.e. whether the variables are stationary and whether they co-vary in the long run. The cointegration analysis also allows us to test for long-run simultaneity. Subsequently, we estimate dynamic single-equation models where we account for simultaneity when necessary. Since the statistical analysis used yields a large number of results, we only summarize the findings in this section and provide a more thorough discussion in Appendix B.

5.5.1 Data Description

The data are summarized in Table 5.6, while detailed information on sources and definitions are given in Appendix A. Apart from consumer prices, reported in Table 5.3, the following variables were used in the empirical analysis. Total coffee consumption was calculated as imports minus exports of roasted coffee and un-roasted coffee. Import prices were obtained as the ratio between the value and volume of imported green coffee beans. Most of this data stems from ICO's database, with certain supplements and updates based on data from the national offices of statistics.

The availability of labour cost data varies between the countries. In Sweden, hourly labour costs in the food sector are available on a quarterly basis; in other countries labour costs are only available as an index for the entire manufacturing sector. However, as we show below, the lack of detailed data on labour costs are unlikely to effect on the results.

Income is measured directly as household expenditures according to the national accounts, which is common in demand studies.

Population data is normally available on an annual basis; hence we use interpolated variables for all countries except Denmark, which reports quarterly population figures. Since the purpose of the population variable is to reflect long-term evolution, we use it as a trend in the analysis; hence the interpolation should have a limited effect on results.

Since our main concern is the current state of the coffee market, we focus on the 1988-2001 period. The choice of 1988 as a starting point is due to lack of quarterly data for some countries prior to 1988, and turbulence in the coffee market after the mid-1980s. Hence, including the mid-1980s would have significantly complicated the analysis. Nevertheless, in some cases data from the beginning of 1980 had to be used to detect long run relations.

Table 5.6 Description of Variables

Variable	Name	Comment/ Definition
P	Consumer price of coffee deflated by CPI, per kg	Average real prices in local currency.
IP	Price of imported coffee beans deflated by CPI, per kg	Average real prices in local currency. Adjusted for VAT.
W	Labour costs deflated by CPI	Labour costs or wages adjusted for VAT. Exact definition varies between countries.
O	Other costs deflated by CPI	Included in the constant term in the regression.
Q	Coffee consumption	Calculated as coffee imports minus exports.
*Q**	$(\Delta P/\Delta Q)\ Q$	Calculated as the derivative of P in the demand function multiplied by consumption.
KPI	Consumer price index	Used to calculate real prices. 1995 = 1.
Y	Real Income	Household expenditures on private consumption.
B	Population	Inhabitants in million

Note. See Appendix A for a detailed description of variables.

5.5.2 Coffee Demand

The first step in the analysis of coffee demand consists of integration and cointegration tests on consumption, Q, real consumer prices, P, income, Y, and population, B. The results reflect the different national consumption evolutions in the 1990s when Swedish and Danish consumption decreased, Finnish consumption fluctuated around a constant level, Spanish consumption increased, and Austria experienced periods of both increases and decreases. The analysis shows that while Swedish and Danish long-term consumption is only determined by the population evolution, Austrian and Spanish is also affected by consumer prices. Finland has no long-run trend. In general the population variable can be interpreted as measuring either consumption increasing due to population growth or changes in

consumption driven by different preferences of the various age groups.

Based on the cointegration analysis we conclude that the relationship between Q^* and P as described by the supply relation in equation (5.6) does not in fact exist in several cases, i.e. consumption and prices are not related in the long run and do not, in any case, form a cointegration relation by themselves. Thus, when estimating the supply relation we must include the variables that determine consumption in the long run.

Table 5.7 reports the static equilibrium solutions of the estimated demand functions. These solutions are based on dynamic models and may be interpreted as averages for the period analysed. For all countries, except Austria, the static equilibrium solutions are obtained from the short-term dynamics single-equation models. For Austria the cointegration analysis yields a long-term relationship, which can be interpreted as a demand function. The price coefficient is significant and negative in all five models. It is also worth noting that the income level only affects long-run consumption in Spain; the markets are probably saturated in the other four countries.

Since the local currency is important for the price level, it is easier to interpret the price elasticity than the estimated coefficient. As shown by Table 5.8 that lists the average elasticities for 1990-2001, all are significantly below 1 in absolute terms except the Austrian, which is 2.17. Other studies that have obtained elasticities around 0.20 are Feuerstein (2002) for Germany and Bettendorf and Verboven (2000) for the Netherlands.

Table 5.7 Demand Functions for Coffee

	Sweden	Period 1988:1 - 2001:4		
	Constant	P	B	
Coefficient	110,4**	-0,084**	-9,69**	
t-ratio	6,57	-3,72	-5,07	
	Denmark	Period: 1989:1 - 2001:4		
	Constant	P	B	
Coefficient	52,58**	-0,045**	-7,11**	
t- ratio	10	-4,49	-7,2	
	Finland	Period: 1988:1 - 2001:4		
	Constant	P	ΔY	Dum
Coefficient	19,69**	-0,134**	1,185**	-2,63**
t- ratio	14	-2,84	3,1	-5,02
	Spain	Period: 1983:1 – 2001:4		
	Constant	EC^P	EC^Q	ΔYC
Coefficient	0,372	-0,316*	-0,313*	0,788
t- ratio	1,76	-2,47	-2,61	1,68
	Austria	Period: 1982:1- 1997:4.		
	Constant	P	B	
Coefficient	-	-0,266**	-31,12**	
t-ratio	-	-4,27	-3,98	

Note: Coefficients with a 95 and 99 percent significance are market with * and ** respectively. A dummy equal to one has been included for Finland for the 1995:1-2001:4 period. The dummy most likely takes care of changes in the data collection of imports. Two co-integration relationships have been included for Spain.. These are $EC^Q = Qc - 0.91 * Yc$ *and* $EC^P = Qc + 0.00035 * P - 0.22 * Dum$, where Qc and Yc are consumption and income per capita and *Dum* is a dummy with the value of one from 1996:1. The dummy reflects a level shift in the consumer price. The demand function for Austria is a co-integration relationship, estimated without a constant.

Since θ must be smaller than the absolute value of demand elasticity, we conclude that cartel cooperation does not occur in Sweden, Denmark, Finland or Spain. The difference between price and marginal cost may, nevertheless, be large since an increase in price only has a small effect on demand. The Austrian price elasticity was calculated for 1990-1997, since consumption data was unreliable for 1998-2001. A possible explanation for the high Austrian price elasticity is the substantial cross-border trade that took place during this period when approximately 30 percent of the coffee was bought by Czechs, Slovaks and Hungarians (Tea & Coffee. 2000). Later, the establishment of Kraft and other

multinationals in Eastern Europe raised the coffee quality and subsequently led to a decrease in the cross-border trade.

Table 5.8 Average Price Elasticities

Country	SE	DK	FI	ES	AT
	0.26	0.22	0.32	0.15	2.17

Note: Own calculations based on the results in Table 5.7

5.5.3 Testing for Market Power

The second step in the analysis consisted of testing for long-run relationships between the various supply-relation variables. In no case did Q^* have a significant long-run effect on consumer prices. We continued by estimating an ECM, based on equation 5.7, for each country and tested whether Q^* affects the change in consumer prices. We commenced by placing five lags on ΔP, ΔW, ΔIP, and ΔQ^* and included P, W, IP and Q^* lagged by two periods to ensure that they do not affect the short-run dynamics. We also included those variables that affected Q in the long run in the demand analysis. Q^* for Spain is included on a per capita basis, denoted $Q^*_{C,}$ since per-capita consumption is cointegrated with per-capita income, Y_C. VAT is included and W and IP stand for 1+VAT multiplied by real labour costs and real import prices, respectively. The Danish coffee tax was included as a separate variable, defined as the excise tax multiplied by 1+VAT. In a few cases we also included dummy variables to attain well-specified models. These variables are unity when consumer prices exhibit increases or decreases which cannot be explained by the other variables, and zero otherwise.

The empirical models of the price equations were developed by starting with general models, and excluding all variables that did not have significant coefficients, except for Q^* and those that determine Q^* in the long run. Moreover, a number of misspecification tests were implemented to ensure that the models were statistically valid. See appendix B for detailed results.

The price equation is formulated such that the Q^* coefficient must be negative whenever θ is positive, which it is in four of the five models, as shown in Table 5.9. However, none of the coefficients are significant and the estimated value is close to zero. Furthermore, the coefficients for the change in Q^*, ΔQ_t^* for t = 0…5 are not significant either. Thus, we cannot reject that θ=0 for any of the countries.

The long-run relationship between the consumer price and its determining factors is implicitly included in the ECM. The import price, after adjusting for VAT, significantly affects the average consumer price level in all countries except Austria. In Sweden a permanent 1 SEK increase in the import price leads to a 1.70 SEK increase in the consumer price, which we can see by dividing the coefficients for *IP* with that of *P* and changing the sign. This exceeds the technical relationship between coffee beans and coffee of 1.19 kg beans per 1 kg roasted coffee. A possible explanation for the high value is that the coefficient also reflects other costs that are directly proportional to the import price, e.g. the retail mark-up, which is usually set as a percentage of the purchase price. Thus, we conclude that the long-run marginal cost function for Sweden, i.e. *mc* in equation (5.7), consists of 1.7**IP* and a constant term of approximately 20 SEK in 1995 Kronor. The constant term reflects labour costs minus productivity improvements, as well as other costs and profits.

The results differ somewhat for Denmark, Finland and Spain. In Denmark we observe a weak trend in the relationship between *P* and *IP,* and hence used $IP^T = IP - 0{,}062*trend$ in the regression. The long-run effect of a permanent 1 DK increase in *IP* is 1.3, which is clearly lower than in Sweden. In Finland it is as low as 1.18. Spain has the highest coefficient, 2.59. Bettendorf and Verboven (2000) estimate the Dutch value to between 1.7 and 1.9.

Furthermore, the ECMs also show that import price changes have strong and significant affects on ΔP in the Scandinavian countries. Both the simultaneous and lagged coefficient for ΔIP are clearly significant, although they add to very different values for the different countries due to the inclusion of lagged ΔP for Sweden and Finland. In all three countries the total effect of an increase in ΔIP is somewhat below one, when taking short-term dynamics into

account. In Spain ΔIP only affects the change in ΔP, i.e. $\Delta\Delta P$, and in Austria the coefficient is only 0.256.

The labour cost variable is only significant in Spain and Sweden. In Sweden ΔP increases by 0.10 SEK for every 1 SEK increase in real hourly labour costs, but the t-ratio of the cost variable is just above 2. Since we use an index for Spanish labour costs, the coefficient has no natural interpretation. A possible explanation for the cost variable's weak effect on prices is that profit margins decrease when real wages increase. This is however only a short term phenomenon, as margins are constant in the long run in all countries but Austria.

Finally, it is interesting to determine the time it takes for a change in import prices to affect consumer prices, since if there is a significant lag one may suspect asymmetric pricing. This can be illustrated using cumulative responses, which shows how an increase in an explanatory variable affects the dependent variable (see Doornik and Hendry, 1994). We calculated the cumulative responses, based on monthly data, for all countries except Austria, because import price changes only have a temporary effect on Austrian consumer prices. The results are summarized in Table 5.10. The Swedish price response is also plotted in Figure 5.2. It shows the effect of an increase in the coffee bean price on the consumer price over time as a share of the total effect, which is normalized to one; i.e. 50 percent of an increase is passed on to consumers after one to two months, and the entire increase after one year. Two important reasons for this delay are the time it takes for imported coffee beans to reach retail outlets as roasted coffee, and active inventory management. However, it is also possible that asymmetric pricing or preferences for relatively stable consumer prices play a role. Outright contracts delaying the price adjustment do not exist in Sweden.[53]

Danish price adjustment is somewhat more rapid. Roughly 50 percent is passed on to consumers within a month, but for the full effect a year is required just as in Sweden. In Finland price flexibility is significantly lower, at least during the first couple of months. After one month only 20 percent of the price increase has

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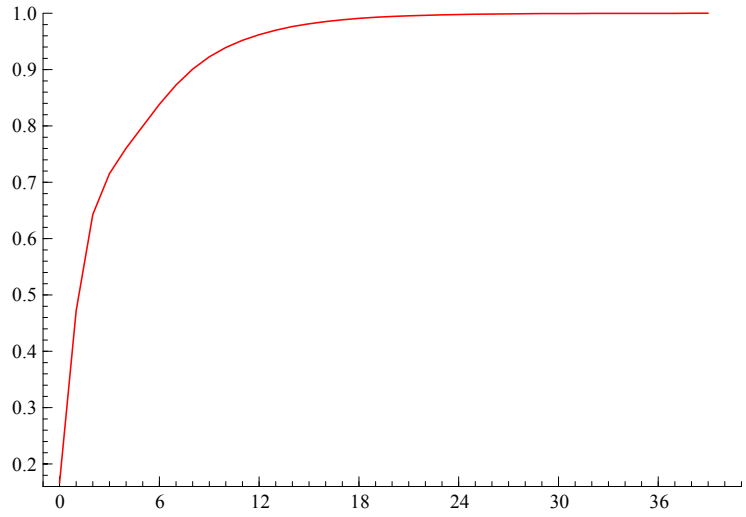
[53] According to Calle Åkerstedt, Svensk Kaffeinformation

been passed on, and for 50 percent three months are required. The Spanish adjustment is even slower; it takes up to one year for 50 percent of the increase to be passed on and more than two years for the entire effect. Hence, Spain differs from the Scandinavian markets in that Spanish prices are significantly less flexible.

Figure 5.2 Cumulative Effect on Monthly Consumer Prices Caused by an Increase in Import Prices



Note: The y-axis shows the share of the import price increase that has been passed on to the consumer price at a given month. The x-axis shows the number of months since the price increase. The total effect is normalized to one. The calculations are based on monthly data.

Table 5.9 ECM for ΔP and Testing for Market Power

SE[a]		DK[b]	FI[a]	ES[c]	AT[d]
Variable		Coefficients			
Constant	-17.4	27.7*	2.7	192.7**	70.1
ΔP_1	-0.498**		-0.185*		
ΔP_2	-0.151*		0.233**		
ΔP_3				0.133*	
ΔIP	0.641**	0.596**	0.311**	1.046**	0.256**
ΔIP_1	0.811**	0.475**	0.444**	-0.531*	
ΔIP_4				-0.859**	
ΔW_1				220.5**	
ΔW_3	0.183*				
P_2	-0.572**	-0.297**	-0.284**	-0.327**	-0.065
IP_2	0.969**		0.334**	0.777**	0.041
IP^T_2		0.384**			
B_2	3.402	-2.402			-8.278
Y_C_2				-11.650	
Q*_2	-0.0002 (0.014)	0.006 (0.005)	-0.009 (0.005)		-0.015 (0.034)
Q^*_C_2				-0.002 (0.006)	

Note: The 95 and 99 percent significant coefficients are market with * and ** respectively. Some of the equations contain dummy variables, which have not been reported. See appendix B.
a) Time period 1988:1 – 2001:4; b) Time period 1989:2 – 2001:4; c) Time period 1988:2 – 2001:4; d) Time period 1982:1 – 2001:4.

Table 5.10 Cumulative Effect on the Consumer Price by an Increase in the Import Price

Country/Months	0	1	3	6	12
Sweden	0.17	0.46	0.75	0.81	0.96
Denmark	0.24	0.56	0.77	0.94	0.97
Finland	0.05	0.22	0.66	0.88	0.98
Spain	0.00	0.08	0.22	0.36	0.50

Note: The calculation shows the share of the price adjustment which has occurred after x months. Complete adjustment is set to 1

5.5.4 Price Response and Asymmetry

As a last step we investigated whether consumer prices react asymmetrically to changes in the coffee bean price. To this end, we separated the change in the import price, *ΔIP*, into two variables, one for negative observations, *ΔIPneg*, and one for positive observations, *ΔIPpos*. We replaced *ΔIP* by these variables in the models shown in Table 5.9 and tested for differences between the values of *ΔIPneg* and *ΔIPpos* in each quarter and for differences in the sum of the two variables' coefficients. The estimated variables as well as the results of the tests are shown in Table 5.11. There are no results for Spain since the impact of a change in *ΔIP* is only transitory.

As shown in Table 5.11 the coefficient for *ΔIPpos* exceeds that for *ΔIPneg* in all countries, which indicates that companies raise consumer prices faster than they lower them. Furthermore, the sum of the coefficients for *ΔIPpos* exceeds that of *ΔIPneg*. However, when we test the difference of the sums, we find that they are only significant for Finland and Austria (see the last row of Table 5.11). The same result are obtained when testing for the contemporaneous effect of import price changes.

We can thus conclude that there is some evidence of asymmetry in Finland and Austria. Furthermore, in Finland consumer and import prices follow a similar long-run trend, i.e. are co-integrated, and thus the asymmetry is only short term. In Austria, however, there is no long-run relationship between consumer and import prices, so we can interpret the asymmetry as being both a short- and long-run phenomenon. It is important to note that the existence of asymmetric pricing does not necessarily indicate market power (see Borenstein *et al.* 1997). There are several other possible explanations for asymmetric pricing, e.g. companies may offer rebates rather than lower prices, or they may refrain from lowering prices to avoid too rapid depletion of inventories. Hence, further analysis is required to both validate and extend the results for all the four countries.

Table 5.11 Asymmetry Tests for ΔP

	SE	DK	FI	AT
ΔIPneg	0.621**	0.531**	0.139	-0.104
ΔIPneg_1	0.577**	0.409**	0.403**	0.264
ΔIPneg_2				0.195
ΔIPneg_3				-0.313
ΔIPpos	0.634**	0.712**	0.388**	0.487**
ΔIPpos_1	0.939**	0.423**	0.542**	0.193
ΔIPpos_2				-0.250
ΔIPpos_3				0.413*
		Sum of the coefficients		
ΔIPneg	0.739**	0.940**	0.523**	0.042
ΔIPpos	0.970**	1.135**	0.898**	0.845**
Asymmetry test $\chi^2(1)$	1.13 [0.29]	1.61 [0.20]	12.54 [0.0004]	5.70 [0.0169]

Note: Coefficients, which are significant at the 95 and 99 percent level are market with * and **. The estimated models are identical to the equations in Table 5.9, with two exceptions; first the separation of *ΔIP* into *ΔIPneg* and *ΔIPpos* and second the use of more lags for Austria. The asymmetry test is a test for equality between *ΔIPneg* and *ΔIPpos*. It is χ^2 distributed with 1 degree of freedom. The probability that the values are equal is shown in brackets. The test for Finland is made under the assumption that *IPneg* is zero, since the t-ratio is 1.22.

5.6 Summary and Conclusions

The purpose if this study was to investigate why there are large price differences of roasted coffee between EU states, and why coffee in Sweden is relatively expensive. Since concentration is quite high in all national markets, there are reasons to believe that leading players have market power. Therefore, differences in the degree of market power between the countries, and the effect of this on pricing, was the key question in the study.

Nonetheless, there are several other reasons for large price differences beside market power. Two of these are quality differences in imported beans and large variations in indirect taxes. Imports of cheap Robusta beans vary from 50 and 40 percent in Spain and Belgium respectively to about 2 percent in Sweden and

Finland. Since the world market price for Arabica can be up to twice that of Robusta, national differences in bean quality clearly affect the price level.

In Germany there is an excise tax of roughly 21 SEK per kg of roasted coffee, which is more than a third of the Swedish coffee price in 2001. The Danish excise tax is 6.54 DKK per kg and VAT is 25 percent, while the Dutch VAT is only 6 percent and there is no excise tax. As a clarifying example, consider coffee prices in Sweden and Denmark. They differed by 15 SEK in 2001 before taking VAT and excise tax into account, but were more or less equal after adjusting for these, assuming consumers paid the indirect taxes.

The market structure is rather similar in the various countries with a few large players accounting for roughly 70-80 percent of each market, and a large number of small companies sharing the rest. The exception to this is Spain, where the three largest roasting houses only have 40 percent of the market together. Concentrated markets such as these typically occur when technical barriers to entry are low and product branding, hence, must be supported by aggressive marketing to maintain a given market share level (Sutton, 1992).

Despite the high market concentration it turned out to be difficult to find clear indications of market power. We were unable to show that prices are higher than marginal costs in any of the five analysed countries. Similar results have also been obtained in recent studies of the German and Dutch coffee markets (see Koerner, 2002a, 2002b; Bettendorf and Verboven, 1998, 2000).[54]

There are, however, some differences in how prices are determined. In all countries, except Austria, we find a long-run relationship between the import and the consumer price, such that the average consumer price is determined by the price of imported coffee together with a constant. But the value of the coefficient, which determines how much the consumer price increases as a result of an increase in import prices, varies from 1.18 in Finland to 1.30 in Denmark, 1.70 in Sweden and the Netherlands and above 2 in Spain. A possible explanation for these differences is that the

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[54] Bettendorf and Verboven (2000) found that θ had a positive, although a very low, value.

margins of retailing sectors, usually set in percent of the wholesale price, vary across the countries. In the case of Austria, we were unable to find a variable determining the evolution of the coffee price in the long run. A plausible explanation for this is lack of competition, despite the non-significant test for market power.

In general, it takes a year or longer for an increase in the import price to be fully transmitted to the consumer price. The slow price adjustment is partly due to the time it takes for imported beans to reach retail outlets as roasted coffee, and partly to the existence of inventories, but asymmetric pricing could also cause it. We therefore investigated whether asymmetry exists in the sense that an increase in import prices more rapidly affects consumer prices than vice versa. We find asymmetry tendencies in all countries, except Spain where prices are so slow to adjust that we were unable to test the hypothesis. However, we only found statistically significant differences between the coefficients of import-price increases and decreases in Finland and Austria. In Sweden and Denmark the differences are rather small. Feuerstein (2002), Gomez and Koerner (2002), and Bettendorf and Verboven (2000) find evidence of asymmetric pricing in Germany, France and the Netherlands, respectively.

Although we did not find evidence of market power, the existence of asymmetric pricing and the slow response to changes in coffee bean prices nevertheless indicate that coffee markets do not function perfectly. Several potential explanations exist for this asymmetry.[55] It could, for example, be a matter of tacit collusion or price leadership during short periods of time. It is in the interest of all roasting houses to keep prices stable when costs decrease if the price elasticity is below one in absolute terms. However, individual roasting houses can benefit even more by lowering their price, assuming others do not follow suit. Therefore, it is reasonable to believe that delays in adjusting the consumer price are only short-term. There could also be a general tendency of roasting houses to avoid lowering the price when costs fall, since they make a larger profit per unit if they keep prices unchanged. The explanation could also be related to the interaction between retailers and producers. If retail chains have market power it will be difficult for producers to

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[55] See Borenstein et al. (1997) for explanations for the existence of asymmetric pricing.

raise the price when costs rise, which in turn would make them reluctant to lower the price when costs fall. Still another possible explanation is that producers refrain from lowering the price too quickly to avoid a too rapid depletion of inventories; a similar restriction naturally does not exist in case of a price increase. Finally, pricing asymmetry could arise because companies prefer to give quantity rebates, which are not registered as price decreases, when costs decline. However, since quantity rebates are uncommon in Finland where asymmetry exists, but quite common in Sweden, where we do not find asymmetry, this is not a plausible explanation.

According to our results, that market power does not automatically follow from a high market concentration. It might suffice that one of the leaders has an aggressive pricing policy, which is the case in Germany where Aldi has acted as price leader and put significant pressure on prices. Koerner (2002a) even claims that prices in Germany were below marginal costs during certain periods in the 1990s. In Sweden there are some small brands that seem to compete with low prices, whereas some large brands such as Gevalia, while using marketing to a great extent as a means to compete, also regularly offer substantial rebates.

Our conclusion is that the Swedish coffee market seems to function as well as, or even better than, other coffee markets in the EU. However, we cannot exclude the possibility that there is market power in Sweden, or in the other markets. It is possible that an analysis based on price and quantity data for individual brands would have yielded different results, but such data was not available. Furthermore, our analysis sheds no light on the role played by the retailing sector in setting the price.

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Appendix A: Description of Data

The following variables have been used in the empirical analysis:

Coffee consumer prices

Data from the International Coffee Organisation (ICO). Additional data from SCB and Statistik Austria.

Coffee imports and exports, roasted and unroasted, volume and value terms

Data from ICO. Additional data from SCB, Danish Statistics, and the custom authorities in Finland and Spain.

VAT and excise tax

Data from the European Commission (2002b), Kaffe-Digest 1 (2002) and the various national tax authorities.

Labor costs

Sweden: Labor cost per hour for employees in the food and beverage industry. Source: SCB.

Denmark: Wage index for the entire industry sector until 1995:4 and wage index for the food and beverage sector 1996:1-2001:4. Source: Danish Statistics.

Finland: Hourly wages in the manufacturing industry sector. Source: Ecowin database.

Spain: Index of wage costs per hour in the industry sector. Source: Ecowin database.

Austria: Hourly wages in the manufacturing the industry sector. Source: Ecowin database.

Consumer price index (CPI)

CPI based on data from International Financial Statistics database.

Population

Population statistics are based on data from The International Data Base (IDB), U.S. Bureau of the Census, for all countries but Denmark, which is based on Danish Statistics. Since population data is available on an annual basis we have used interpolated quarterly data for all countries except Denmark, where quarterly data is available.

Income

Income is measured as household expenditures divided by CPI. Source: International Financial Statistics.

Appendix B: Detailed Description of the Econometric Analysis

This appendix contains an account of the empirical analysis. Although the description is significantly more detailed than the one provided in Sub-section 5.5, it contains neither the cointegration analysis nor some of the test results, since including these would have led to a very large a number of tables.

B.1 Sweden

It often makes sense to depict the data in diagrams before performing an econometric analysis, as this provides information about the fundamental relationships between the variables, as well as an intuitive understanding of the econometric results. For the sake of brevity, we nevertheless only do so for Sweden, and comment on the other countries in the descriptions of their respective markets.

Let us begin with coffee demand. Coffee consumption and household income for 1988:1-2001:4 are shown in Figure B.1. Since coffee consumption decreased while real household income increased, it is clear that income has no effect on consumption in the long run. In Figure B.2 we have replaced household income by real coffee prices. In this graph we see that the coffee price fluctuates dramatically with little visible effect on consumption, and that there is no visible negative relation between the two variables, hence price cannot explain the long-term evolution of consumption. Finally we graph population and consumption in Figure B.3. Here, there is a clear negative trend, the larger the population the smaller the consumption. A possible interpretation is that people born around 1960 and later drink less coffee than the older generation, a phenomenon known in the industry,[56] and as the share of the old population declines so does coffee consumption. Hence, to the extent that price affects consumption, the effect must be measured controlling for population dynamics.

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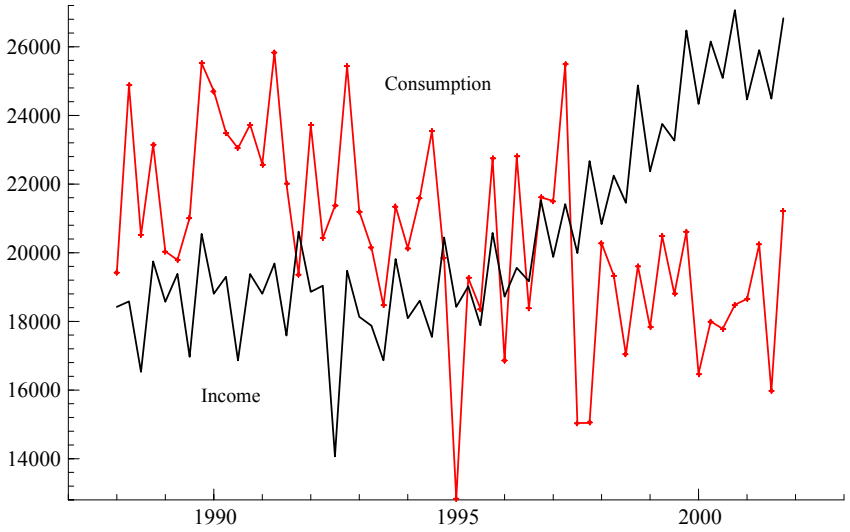
[56] According to a discussion with Calle Åkerstedt, Svensk Kaffeinformation

Figure B.1 Coffee Consumption and Household Income in Sweden



In the Figures B.1, B.2, B.3, and B.5. we have adjusted a variable in terms of its average and variance to facilitate the comparison. The values on the y-axes are therefore not interesting.

Figure B.2 Coffee Consumption and Consumer Price per kg Coffee in Sweden

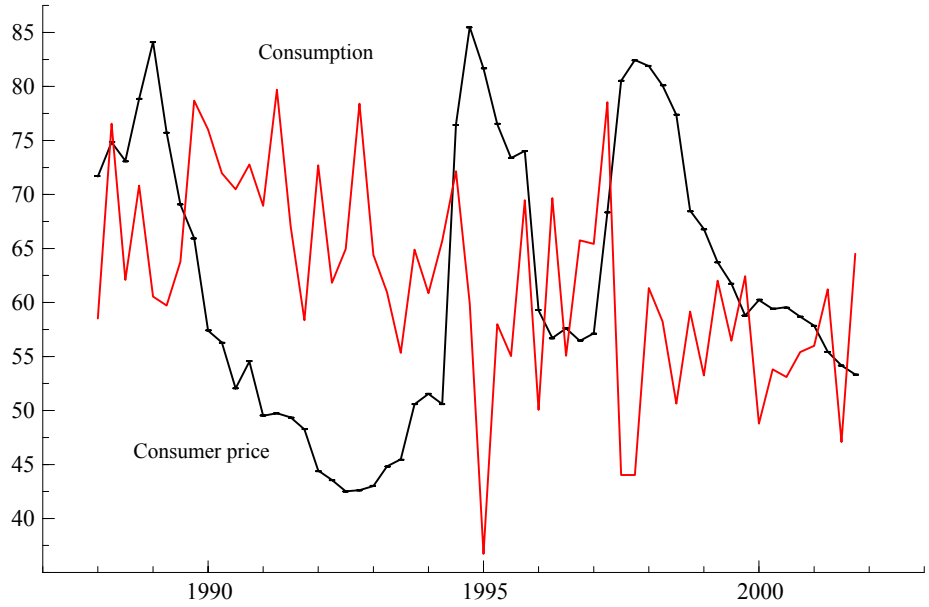


Figure B.3 Coffee Consumption and Population in Sweden

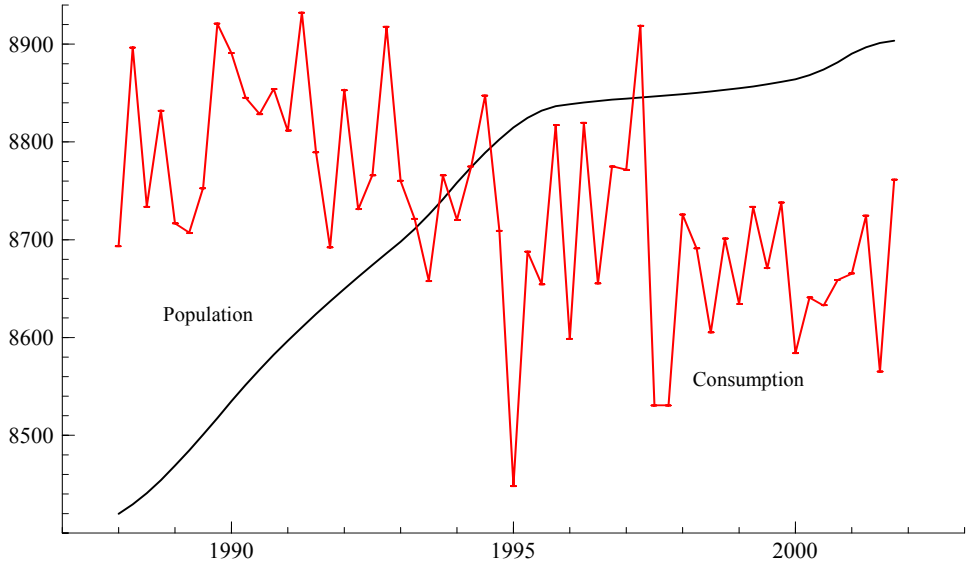


Figure B.4 shows real consumer and import prices during 1968:1-2001:4. The variables follow each other closely and it is clear that the import price is the most important determining factor for the consumer price. It is also evident that a shift in Swedish prices occurred in the mid 1980s. This shift also occurred in the other countries and is the reason we chose to start our analysis in 1988; we would have needed data from 1970 and onwards to model the entire 1980s.

Finally Figure B.5 shows the consumer price and labour costs in real terms during 1975:1-2001.4. Since the price decreases while labour costs rise, labour costs are hardly a determining factor for the price. This can be explained by increases in labour productivity, which offset labour cost increases in the long run, such that real labour costs per kg coffee are relatively constant over the period.

Figure B.4 Consumer and Import Prices in Sweden per kg

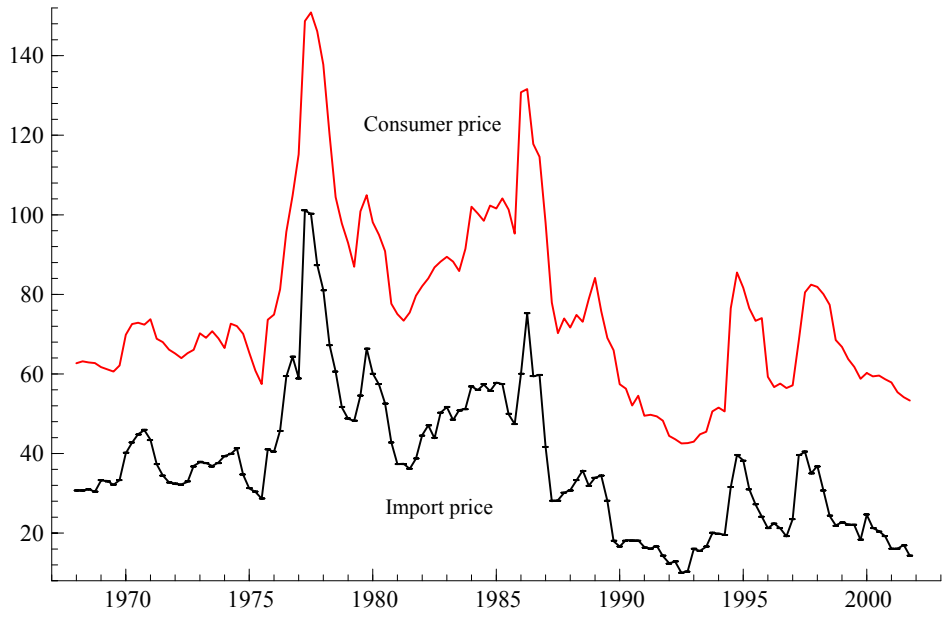
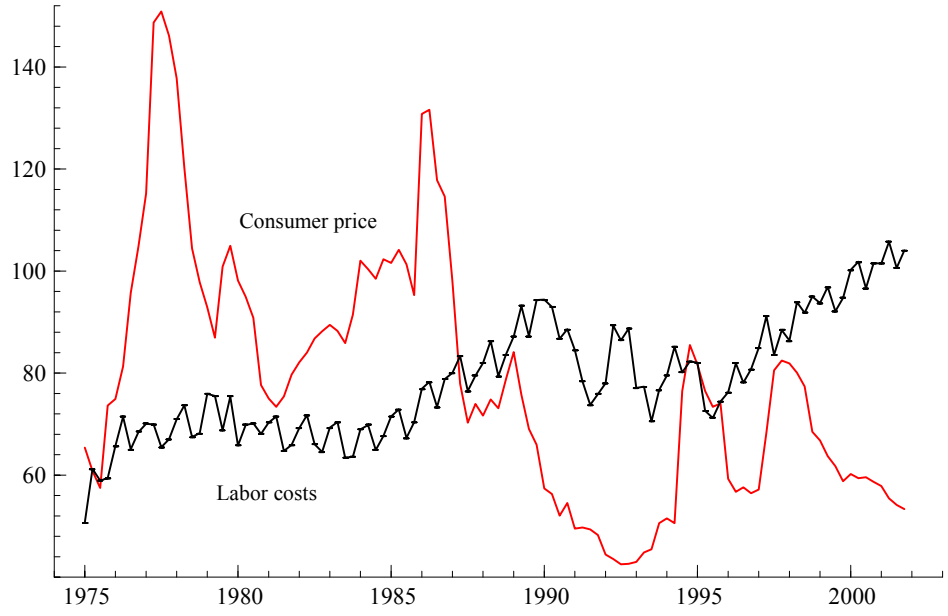


Figure B.5 Consumer Price and Labor Costs in Sweden



The first step in the analysis of coffee demand is to perform integration and cointegration analyses on the consumption, Q, real consumer prices, P, income, Y, and population, B. We find that Q and B are cointegrated, P is stationary, and Y is integrated but not related to any of the other variables. The long-run relationship between Q and B is $Q = -9.5B + c$, where c is a constant. Thus, a population increase has a negative effect on consumption, which we interpret as reflecting the differences in consumption between different age groups.

Based on the cointegration analysis we also conclude that neither Q nor B affects the price, i.e. the price is weakly exogenous. Thus, we have no simultaneity problem and can estimate a dynamic single-equation model to establish a value for the price elasticity. The model should be regarded as statistically acceptable, since none of the misspecification tests is significant.[57]. The long-run static

[57] The described tests are all based on the null hypothesis that the model is well specified. AR tests for auto-correlation; ARCH for auto-correlation in the variance of the residual;

solution, reported in Table B.1, can be viewed as a kind of average of the dynamic model closely related to the theoretical models in Section 2.2. According to the solution, price has a negative effect on demand with an average price elasticity of 0.26; Feuerstein (2002) and Bettendorf and Verboven (2002) obtain similar values for Germany and the Netherlands.

Since *P* is stationary during 1988:1-2001:4, we can assume that the import price, *IP*, is stationary as well, which proves to be the case when testing for cointegration between the variables in the supply relationship. The labor cost, *W*, on the other hand, is not stationary. Hence, labor costs do not affect price in the long run, as shown in Figure B.5. It is likely that labor costs net of labor productivity, together with other costs such as distribution and packaging, follow the general price evolution and thus are included in the constant.

Table B.1 Sweden: Static Solution for *Q*

	Coefficient	Standard error	
Constant	110.359	16.800	6.570
P	-0.084	0.023	-3.720
B	-9.690	1.913	-5.070
:1 – 2001:4			
F(4.46) = 0.34009 [0.8495]			
st: F(4.42) = 1.5969 [0.1929]			
st: Chi^2(2) = 0.039367 [0.9805]			
F(7.42) = 0.47570 [0.8467]			
F(1.49) = 1.1762 [0.2834]			

Note: See footnote 15 for a description of the tests.

The second step is to estimate an ECM for the consumer price based on equation 5.7. We start with five lags on ΔP, ΔW, ΔIP, and ΔQ^* and place P, W, IP, Q^* and B on the second lag to ensure that they do not affect short-run dynamics.[58] B is included to reflect the

Normality tests whether the residual has a normal distribution; Hetero whether the residual is heteroskedastic; and RESET tests whether the functional form is acceptable. A detailed description of the tests and of references can be found in Doornik and Hendry (1994).

[58] The position of the level variables in an ECM only affect the short-run dynamics, not the long-run part of the model (see Hendry and Juselius, 2001).

long-run evolution of Q^*. We also include a dummy, set to one during the third quarter of 1994, when the consumer price rose rapidly rise, and to zero the rest of the time. All variables without significant coefficients are then excluded, except for Q^* and B. As shown in Table B.2 the coefficient for Q^* is far from significant and the estimated value is close to zero. The model is formulated such that the coefficient is negative when θ is positive.

By calculating the long-run (steady state) solution, the interpretation of the model is simplified. An increase in the growth of the import price leads to an almost identical increase in consumer prices; the coefficient is 0.89. Similarly an increase in the growth of real labour costs by 1 SEK per hour leads to an increase in the change of the consumer price by approximately 0.10 SEK. Furthermore, in the long-run, the consumer price is determined by the import price, VAT, and a constant term set at approximately 20 SEK in 1995 kronor. A permanent increase in the import price of 1 SEK leads to an increase of the consumer price by approximately 1.70 SEK, which is larger than the technical relationship between beans and roasted coffee, according to which 1.19 kg beans produce 1 kg roasted coffee. The coefficient probably reflects certain other costs, such as margins in retailing, which usually are proportional to the wholesale price of roasted coffee. We also note that Bettendorf and Verboven (2000) obtain values between 1.7 and 1.9 for the Netherlands.

To test for pricing asymmetry we separate ΔIP into $\Delta IPneg$, for negative observations, and $\Delta IPpos$, for positive observations, and check whether there is a difference in the sum of the coefficients. As shown in Tables B.4 and B.5, the coefficients for $\Delta IPpos$ are somewhat larger than for $\Delta IPneg$. The difference is not, however, statistically significant (see Table B.5). Hence we do not find any evidence for the hypothesis that producers lower prices at a slower pace when raw material costs decrease than vice versa.

Table B.2 Sweden: ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	-17.352	27.990	-0.62
ΔP_1	-0.498	0.114	-4.36
ΔP_2	-0.151	0.074	-2.05
ΔIP	0.641	0.103	6.21
ΔIP_1	0.811	0.134	6.08
ΔW_3	0.183	0.096	1.92
P_2	-0.572	0.089	-6.4
IP_2	0.969	0.153	6.32
B_2	3.402	2.910	1.17
Q*_2	-0.0002	0.014	-0.016
Dum94:3	15.882	2.909	5.46

Period 1988:1 – 2001:4

R^2 0.86 F(13.42) = 19.89 [0.000]**

AR 1-4 test: F(4.38) = 1.0094 [0.4147]

ARCH 1-4 test: F(4.34) = 0.80142 [0.5328]

Normality test: Chi^2(2) = 1.0063 [0.6046]

Hetero test: F(22.19) = 0.80536 [0.6895]

RESET test: F(1.41) = 0.43843 [0.5116]

In spite of our results, consumers often have the impression that asymmetric pricing exists. A possible explanation could be the long time it takes for a change in the cost level to affect consumer prices. This can be illustrated by investigating the time during which an increase in an explanatory variable affects a dependant variable as illustrated in Figure B.6 (see Doornik and Hendry, 1994). To estimate the transmission effect we use monthly data for *P* and *IP* and condition on IP_t and 6 lags of each variable The diagram shows the monthly effect of an increase in the bean price on the consumer price in relation to the total effect, which is set to 1. After one to two months half of the increase is transmitted to the consumer price and after slightly more than one year the entire increase is transmitted. A possible explanation for the slow adjustment is that

it takes time for imported beans to reach retailers as roasted coffee; existing inventories slow this process further. Another explanation is that relatively stable consumer prices are preferred, which is supported by the fact that the variance in the consumer price is approximately half of that of the import price.

Table B.3 Sweden: Steady State Solution for ΔP

	Coefficient	Standard error	t-ratio
Constant	7.415	1.501	4.940
ΔIP	0.887	0.077	11.600
ΔW	0.119	0.061	1.960
P	-0.340	0.043	-7.940
IP	0.572	0.066	8.640
Dum94:3	10.050	2.096	4.790

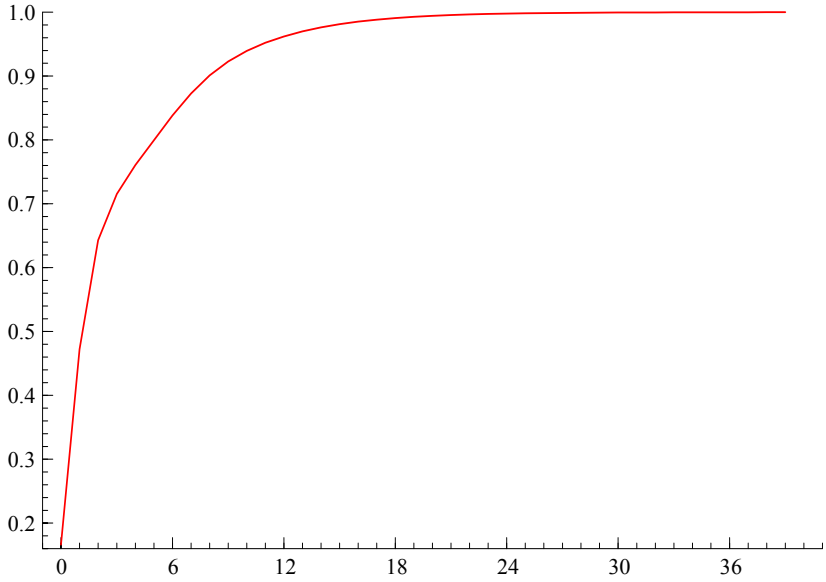
Period: 1988:1 – 2001:4

Table B.4 Sweden: Asymmetry - ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	12.182	2.594	4.7
ΔP_1	-0.506	0.118	-4.29
ΔP_2	-0.116	0.071	-1.63
ΔW_3	0.176	0.096	1.83
P_2	-0.553	0.089	-6.18
IP_2	0.903	0.156	5.78
D um94:3	16.452	3.061	5.38
ΔIpneg	0.621	0.200	3.11
ΔIPneg_1	0.577	0.193	2.99
ΔIPpos	0.634	0.140	4.51
ΔIPpos_1	0.939	0.174	5.4

Period: 1988:1 – 2001:4

Figure B.6 Sweden: Cumulative Monthly Effect on the Consumer Price Caused by an Increase in the Import Price



Note: The y-axis shows the share of the increase in the import price that is reflected in the consumer price at a given month. The x-axis shows the number of months since the price increase. The total effect is set to 1. The estimations are made using monthly data.

Table B.5 Sweden: Asymmetry – Steady State Solution for ΔP

	Coefficient	Standard error	t-ratio
Constant	7.513	1.481	5.07
ΔW	0.108	0.060	1.8
P	-0.341	0.042	-8.06
IP	0.557	0.069	8.05
Dum94:3	10.145	2.100	4.83
ΔIPneg	0.739	0.159	4.64
ΔIPpos	0.970	0.110	8.79

Test for asymmetry: the sum of the coefficients for *ΔIPpos* equals that of *ΔIPneg*; $\chi 2(1) = 1.1251$ [0.289]

B.2 Denmark

The Danish consumption analysis yields results similar to those obtained for Sweden. The main difference is that Danish consumption does not decrease as rapidly as the Swedish one. It does, however, decrease throughout the entire period and cannot be explained by the income evolution. The cointegration analysis yields the following long-run relationship between consumption and population in the long run.

$$Q = -7.0B + c$$

where c is a constant. The consumer price is a stationary variable and weakly exogenous; hence we estimate a dynamic model to determine price elasticity. Table B.6 reports the static solution and misspecification tests. The price elasticity is calculated at an average of 0.22 during 1988:1-2001:4, i.e. somewhat lower than in Sweden

Table B.6 Denmark: Static Solution for *Q*

	Coefficient	Standard error	t-ratio
Constant	52.578	5.235	10
P	-0.045	0.010	-4.49
B	-7.106	0.987	-7.2

Period: 1989:1 – 2001:4

AR 1-4 test: F(4.40) = 1.8882 [0.1314]

ARCH 1-4 test: F(4.36) = 0.95618 [0.4433]

Normality test: Chi^2(2) = 3.2294 [0.1989]

Hetero test: F(11.32) = 1.0571 [0.4237]

RESET test: F(1.43) = 2.0652 [0.1579]

We then test for long-run relationships on the supply side, using the variables *P*. *IP*. *W* and *AVG*. where *AVG* is the real excise tax multiplied by one plus VAT. We commence the analysis in 1989:2, since the period before is turbulent and would have required dummy variables. The analysis shows that *P* is stationary, while *W* and *AVG* exhibit stochastic trends, and IP is stationary around a

deterministic trend. It is difficult to determine the cause of this trend; it is definitely a local phenomenon, but it has to be included in the analysis to find an economically plausible relationship between *P* and *IP*. *AVG* is close to being a deterministic trend, and we could have replaced the trend with *AVG*. However, its coefficient has the wrong sign; an increase in the excise tax would have led to a decrease in the consumer price. Thus, we use the following relationship in the model for ΔP;

$$IP^T = IP - 0.062 \text{ trend}.$$

First we estimate the ECM for ΔP using five lags on ΔP, ΔW, ΔIP, ΔAVG and ΔQ^* with P, W, IP^T, Q^* and B lagged twice. We also include two dummy variables, one with a value of 1 for 1997:2 and one with a value of 1 for 1994:3 and 1995:1. The final model and the misspecification tests are shown in Table B.7. There is some autocorrelation according to the AR-4 test, but it disappears when the non-significant variables are excluded. The autocorrelation has no impact on the results.

We find that Q^* has no effect on pricing; its coefficient positive and the t-value is 1.2. Furthermore, no lag of ΔQ^* is significant. Thus we find no support for the hypothesis that roasting houses have market power in Denmark either.

The long-run solution, which is calculated without Q^* and B and with *IP* and *trend* as separate variables, shows that an increase in the change of the import price leads to a similar increase in the change of the consumer price, and that labour costs have neither a short-term nor a long-term effect on the consumer price. In the long run the consumer price is determined by the 1.33 *IP* minus 0.1**trend*.

Table B.7 Denmark: ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	27.743	9.536	2.91
ΔIP	0.596	0.050	11.8
ΔIP_1	0.475	0.049	9.64
P_2	-0.297	0.052	-5.71
IP^T_2	0.384	0.067	5.77
B_2	-2.402	1.623	-1.48
Q*_2	0.006	0.005	1.2
Dum94:3	5.970	0.852	7
Dum94:3_2	-5.373	0.965	-5.57
Dum97:2	3.148	0.866	3.64

Period 1989:2 – 2001:4

R^2 0.96. F(12.38) = 84.25 [0.000]**

AR 1-4 test: F(4.34) = 3.2834 [0.0222]*

ARCH 1-4 test: F(4.30) = 1.5564 [0.2115]

Normality test: Chi^2(2) = 2.2446 [0.3255]

Hetero test: F(18.19) = 0.46167 [0.9463]

RESET test: F(1.37) = 0.00124 [0.9721]

Table B.8 Denmark: Steady State Solution for ΔP

	Coefficient	Standard error	t-ratio
Constant	14.580	2.665	5.47
ΔIP	1.067	0.055	19.5
P	-0.302	0.052	-5.79
IP	0.401	0.066	6.11
Trend	-0.032	0.008	-3.87
Dum97:2	3.110	0.870	3.57
Dum94:3	0.581	1.211	0.48

As a second step we test for the existence of short-run pricing asymmetry by separating the change in the import price *ΔIP* into two variables, *ΔIPpos* for increases and *ΔIPneg* for decreases. The

estimated model and static solution are reported in Table B9 and B10. An increase in the bean price has a quicker effect on consumer prices than does a decrease, and the sum of the coefficients is larger for *ΔIPpos,* 1.13, than for *ΔIPneg,* 0.94. We perform several tests to determine if there is a statistically significant difference but that is not the case. The test of the differences of the sums of the coefficients is χ^2 distributed with one degree of freedom. It has a value of 1.61 and a p-value of 0.20.

Table B.9 Denmark: Asymmetry - ECM för Δ*P*

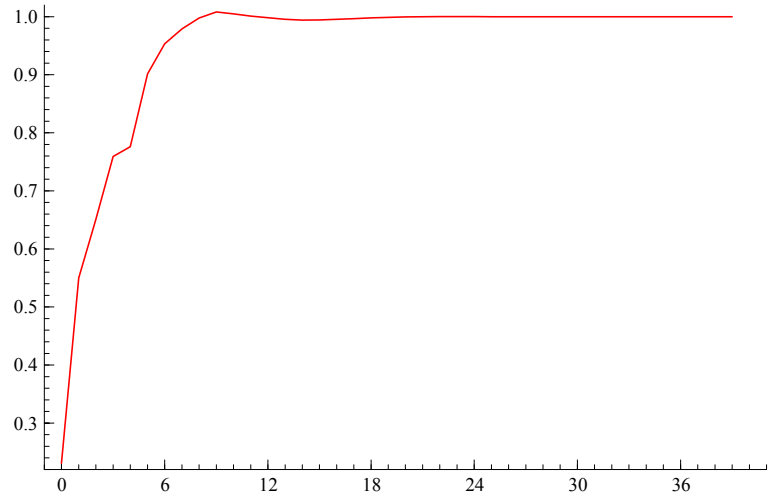
	Coefficient	Standard error	t-ratio
Constant	12.999	2.342	5.55
P_2	-0.288	0.050	-5.78
IP^T_2	0.359	0.068	5.3
ΔIpneg	0.531	0.075	7.12
ΔIPneg_1	0.409	0.069	5.93
ΔIPpos	0.712	0.113	6.29
ΔIPpos_1	0.423	0.098	4.3
Dum94:3	5.540	1.083	5.11
Dum94:3_2	-5.053	1.172	-4.31
Dum97:2	2.492	1.129	2.21

Table B.10 Denmark: Asymmetry – Steady State Solution for Δ*P*

	Coefficient	Standard error	t-ratio
Constant	12.999	2.342	5.55
P	-0.288	0.050	-5.78
IP^T_2	0.359	0.068	5.3
ΔIPneg	0.940	0.102	9.25
ΔIPpos	1.135	0.084	13.5
Dum97:2	2.492	1.129	2.21
Dum94:3	0.487	1.251	0.389

Finally we estimate the time it takes for a change in import prices to fully affect consumer prices based on monthly data and using a model with *P* and *IP* with 6 lags. As shown by Figure B.7, it takes approximately one month for half the increase to be transmitted and approximately one year for the full adjustment.

Figure B.7 Denmark: Cumulative Monthly Effect on the Consumer Price Caused by an Increase in the Import Price



Note: See Figure B. 6.

B.3 Finland

During the screening of the Finnish data we discovered a problem with the consumption variable. The variable is based on import data and during 1995 reported values significantly decreased, which was not reflected in annual coffee consumption data; it showed a relatively stable evolution (Statistikcentralen, 2002). It is therefore likely that imported values were affected by changes in reporting procedures related to EU's internal market. In the analysis we assume that procedures changed and include a level dummy to reflect this. The dummy variable is necessary to obtain a well-specified model.

The cointegration analysis confirms that both consumption and price both can be described as stationary variables, while population and income are non-stationary. The price exhibits larger fluctuations than consumption, but shows no clear tendency to rise or decline. Consumption is stationary, whether we condition on the dummy variable or not. Hence, we conclude that income is not driving coffee consumption in the long run.

We estimate demand by placing five lags on each variable and then excluding variables with clearly non-significant parameters. The static long-run relation and usual tests are reported in Table B.11. Contrary to Sweden and Denmark *B* has no effect. Changes in the population could, however, be of importance, as in Sweden, but we do not need to model them to estimate the price elasticity. Changes in income do affect consumption, since consumption is stationary and thus, the regression reflects the short-term income effect. The results show that a price increase of 1 Markka in real terms leads to a consumption decrease by 0.13 million kg, and that a 1 billion Markka income increase leads to a consumption increase of approximately one million kg. The average price elasticity for the 1988:1-2001:4 period is estimated to 0.32, somewhat above the Swedish level.

Table B.11 Finland: Static Solution for Q

	Coefficient	Standard error	t-ratio
Constant	19.688	1.411	14
ΔY	1.185	0.383	3.1
P	-0.134	0.047	-2.84
DumS95:1	-2.634	0.525	-5.02

Period 1988:1 – 2001:4

AR 1-4 test: F(4.39) = 2.1680 [0.0906]

ARCH 1-4 test: F(4.35) = 1.5111 [0.2202]

Normality test: $Chi^2(2)$ = 1.0101 [0.6035]

Hetero test: F(14.28) = 0.87506 [0.5912]

RESET test: F(1.42) = 0.084093 [0.7733]

Note: DumS95:1 is a step dummy with the value of one after 1995:1.

Before we model the coffee pricing we test whether the import price and labor costs, measured as average hourly wages in the manufacturing industry, are stationary and find that the import price is, but not the labour costs. We then estimate an ECM with five lags of the first difference on all variables, and with the consumption price and import price lagged by two quarters. We use a dummy variable, which reflects a sharp increase in the consumer price change during 1997:3 and a subsequent decrease during 1998:1, to

obtain a well-specified model. Table B.12 and B.13 report the preferred model and the long-run solution, respectively.

Table B.12 Finland: ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	2.653	1.245	2.13
ΔP_1	-0.185	0.091	-2.03
ΔP_2	0.233	0.062	3.74
ΔIP	0.311	0.054	5.74
ΔIP_1	0.444	0.075	5.95
P_2	-0.284	0.068	-4.18
IP_2	0.334	0.084	3.95
Dum	6.312	0.841	7.51
DumS95:1	0.189	0.247	0.766
Q*_2	-0.009	0.005	-1.79

Period 1988:1 – 2001:4

R^2 0.92. F(12.43) = 40.12 [0.000]**

AR 1-4 test: F(4.39) = 0.32008 [0.8628]

ARCH 1-4 test: F(4.35) = 0.075553 [0.9892]

Normality test: $Chi^2(2)$ = 4.5021 [0.1053]

Hetero test: F(20.22) = 0.39675 [0.9791]

RESET test: F(1.42) = 1.0189 [0.3186]

Note: Dum has the value of 1 in 1997:3 and –1 in 1998:1.

We are unable to show that Q^* affects the price, as for Sweden and Denmark; the F-test on contemporaneous Q^* and five lags yields F(6.39) = 1.2264 [0.3139], i.e. Q^* is not significant. In Table B.12 we have kept the lag with the highest t-value in absolute terms, Q^*_{t-1}, in the model. This lag is significant to the 10 percent level, but has a very low θ value. Table B.12, also shows that labor costs have neither a short-term nor a long-term effect on the price.

Table B.13 Finland: Steady State Solution Δ*P*

	Coefficient	Standard error	t-ratio
Constant	3.979	0.796	5.000
ΔIP	0.787	0.077	10.200
P	-0.301	0.047	-6.410
IP	0.355	0.059	6.060
Dum	-1.450	1.558	-0.931

Note: Dum is set to1 in 1997:3 and to –1 in 1998:1 and zero during all other periods.

The long-run solution yields a coefficient for *ΔIP* of 0.8, which is lower than in Sweden and Denmark. The coefficient on *IP* is 1.18, which is close to the technical process relationship of 1.19.

It is possible that we obtain a low value for the coefficient on *ΔIP* because we do not take asymmetries into account. As reported in Table B.14 and B.15, when we allow different reactions to changes in the import price it is clear than an increase in the import price is passed on to the consumer price faster than a decrease. The coefficient for a contemporaneous decrease in *ΔIP* is 0.13 and has a t-value of 1.22, while the coefficient for an increase is 0.39 with a t-value of 5.26. The lagged effect is also larger for an increase than a decrease, 0.54 compared to 0.4. When we test the null hypothesis that the sum of the coefficients, which are 0.9 and 0.5, are equal, we are able to discard it with 93 percent certainty. We also perform the test after the model had been re-estimated, excluding the insignificant $\Delta Ipneg_t$. By excluding the noise caused by the variable we are able to firmly discard the null hypothesis (see Table B.14). Hence, we conclude that pricing asymmetry probably exists in Finland.

Table B.14 Finland: Asymmetry - ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	4.167	0.996	4.18
ΔP_1	-0.224	0.094	-2.39
ΔP_2	0.189	0.061	3.07
P_2	-0.306	0.068	-4.51
IP_2	0.330	0.085	3.89
Dum97:3	4.441	1.232	3.61
Dum98:1	-6.765	1.334	-5.06
ΔIPneg	0.139	0.114	1.22
ΔIPneg_1	0.403	0.104	3.87
ΔIppos	0.388	0.074	5.26
ΔIPpos_1	0.542	0.112	4.86

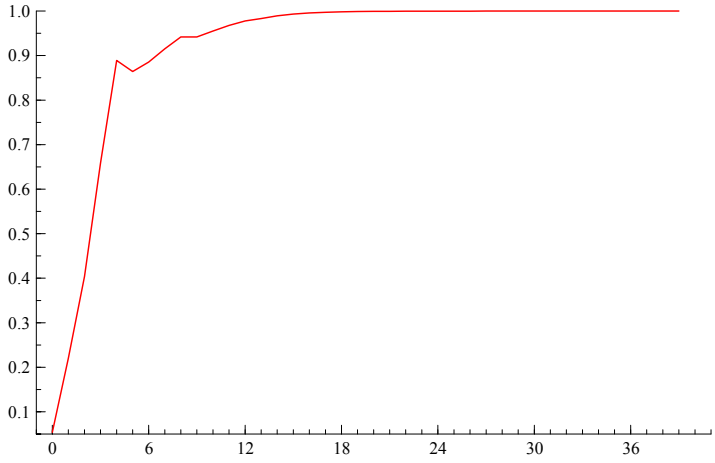
Test for asymmetry: the sum of the coefficients for *ΔIPpos* equals those of *ΔIPneg*; $\chi 2(1) = 12.54$ [0.0004].

Finally we estimate the time it takes for an increase in import prices to affect the consumer price, using monthly data. As Figure B.8 shows, the price response in Finland is somewhat slower than in Sweden and Denmark. After approximately 3 months half of the increase has been passed on, and after approximately one year the entire increase has been passed on.

Table B.15 Finland: Asymmetry – Steady State Solution for Δ*P*

	Coefficient	Standard error	t-ratio
Constant	4.023	0.760	5.29
P	-0.295	0.045	-6.52
IP	0.318	0.061	5.24
Dum	-2.295	1.891	-1.21
ΔIPneg	0.523	0.154	3.41
ΔIPpos	0.898	0.099	9.1

Figure B.8 Finland: Cumulative Monthly Effect on the Consumer Price Caused by an Increase in the Import Price



Note: See fig. B.6

B.4 Spain

The Spanish price dynamics differ quite substantially from those in the Nordic countries. It is also more difficult to model Spanish demand and pricing, partly due to the slow adjustment of consumer prices in relation to consumption and import prices, which leads to fuzzy dynamics. Furthermore, a longer period is required to estimate the relationships; hence we use data from the beginning of the 1980s for part of the analysis.

During the 1980s and 1990s consumption exhibited both periods of growth and of relative stability but largely followed consumer prices, but with the opposite sign. In the beginning of 1995, however, there was a significant one-time increase in the price that did not lead to a subsequent decrease in consumption. The abrupt price increase seems to be due to a change in data collection, although this is denied by INE, the Spanish central statistical bureau. Since consumption follows income, it is not likely to be a problem with the consumption data. Hence, we test for the existence of two long-run relationships between consumption,

consumer price, income and a structural break in 1995 using cointegration analysis. Two representations of the two relationships are,

$$EC^{Q} = Qc - 0.91 * Yc$$

$$EC^{P} = Qc + 0.00035 * P - 0.22 * DumS96,$$

where *Qc* is per capita coffee consumption and *Yc* per capita income. The cointegration between consumption and income indicate that the Spanish market is not yet saturated, which is further supported by the relatively low per capita consumption of 4.7 kg

To determine whether consumption is an endogenous variable in the relationships we test for weak exogeneity, which we are able to reject. The existence of two long-run relationships indicates that the price ought to be endogenous as well. We find that EC^{Q} but not EC^{P} affects the price. We then estimate an ECM for the demand with EC^{Q} and EC^{P}; hence the simultaneity is accounted for in the long-run relationships. The long-run solution and the misspecification tests are described below. As expected both ECM-terms are significant. Furthermore, the change in income does have a certain effect, but is only significant to the 10 percent level.

The price elasticity, based on the long-run solution to the model in Table B.16, is on average 0.15 for the period 1990 – 2001. From the low price elasticity we infer that θ cannot be high, but despite this companies can set high prices relative to marginal costs if they have some market power.

Table B.16 Spain: Steady State Solution for ΔQ

	Coefficient	Standard error	t-ratio
Constant	0.372	0.211	1.76
ΔYC	0.788	0.469	1.68
EC^P	-0.316	0.128	-2.47
EC^Q	-0.313	0.120	-2.61

Period: 1983:1 – 2001:4

AR 1-5 test: F(5.62) = 0.98866 [0.4320]

ARCH 1-4 test: F(4.59) = 0.39937 [0.8083]

Normality test: Chi^2(2) = 5.7269 [0.0571]

Hetero test: F(13.53) = 0.60032 [0.8429]

RESET test: F(1.66) = 0.028280 [0.8670]

Note: The two equilibrium correction terms are defined as follows: ECQ = Qc - 0.91 * Yc and ECP = Qc + 0.00035 * P - 0.22 * DumS96:1.

As a first step in the pricing analysis we test whether cointegration exists between *P. IP. W* and *Qc** for the 1983:1 – 2001:4 period and we find that *P* and *IP* are cointegrated with the following relationship,

$$EC^{IP} = P - 2.59 * IP.$$

The shift in *P* in 1995 does not require a step dummy because it is reflected by *IP* in the long-run relationship.

As a second step we estimate an ECM for the price with five lags of *ΔP, ΔW, ΔIP*, and *ΔQ** and with *P, IP, Qc** and *Yc* lagged two periods. *Yc* is included to control for the trend in *Q**. We then exclude all variables with non-significant parameters. The period analysed is 1988:2 – 2001:4.[59] *Q** is insignificant as shown in Table B.17. However, *P* and *IP* are clearly significant. Furthermore, their long-run coefficients are almost identical to those obtained in the cointegration analysis, despite performing the cointegration

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[59] We commenced the analysis in 1988:2, because 1988:1 had an unusually high value, which would have required a dummy variable

analysis on the period 1983:1 – 2001:4. This is evident when both coefficients are divided by the coefficient of P. Changes in ΔIP have a very short-run effect on ΔP, i.e. they affect the change in ΔP, but not its level. Hence, ΔIP is not significant in the steady state solution. Changes in income, however, clearly do have a significant coefficient, although its value is not easy to interpret since we have used an index.

Since ΔIP only has a temporary effect on ΔP we attempt to test for asymmetry using monthly instead of quarterly data. However, ΔIP only affects $\Delta\Delta P$ and thus a test for asymmetry does not make sense. Then, to test whether it is the functional form that prevents us from obtaining a clear-cut result we perform the asymmetry test using the logarithms of the variables. However, the short-term dynamics remain the same.

Finally, we also calculate the time it takes on average for an increase in IP to affect P. In Figure B.9 we show that it takes more than a year until 50 percent of the increase has been passed on to P and more than two years for the full increase to be transmitted. Thus. Spain differs from the Nordic countries in that Spanish prices are significantly slower to adjust.

Table B.17 Spain: ECM for ΔP

	Coefficient	Standard error	t-ratio
Constant	192.675	62.650	3.08
ΔP_3	0.133	0.064	2.1
ΔIP_1	1.046	0.194	5.4
ΔIP_2	-0.531	0.212	-2.51
ΔIP_4	-0.859	0.209	-4.11
ΔW_1	220.543	52.530	4.2
P_2	-0.327	0.042	-7.78
IP_2	0.777	0.116	6.7
Dum94:4	173.201	31.710	5.46
Yc_2	-11.650	40.200	-0.29
Q*c_2	-0.002	0.006	-0.392

Period: 1988:2 – 2001:4

R^2 = 0.88. F(13.41) = 22.43 [0.000]**

AR 1-4 test: F(4.37) = 0.13662 [0.9677]

ARCH 1-4 test: F(4.33) = 0.93572 [0.4554]

Normality test: $Chi^2(2)$ = 1.6461 [0.4391]

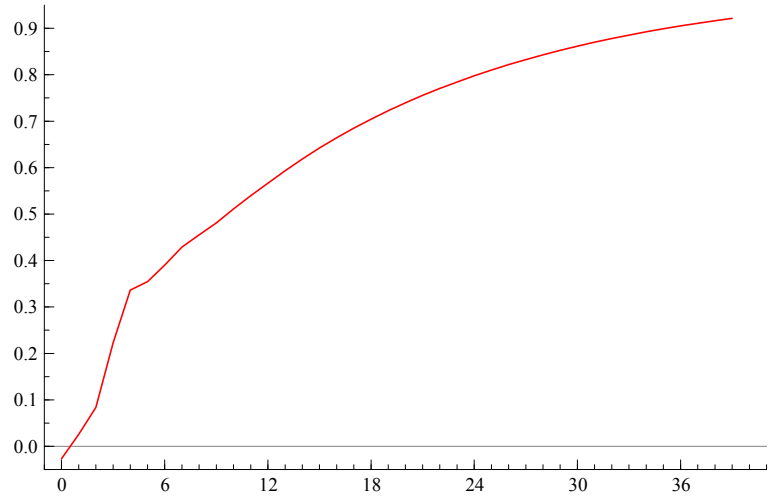
Hetero test: F(22.18) = 1.3357 [0.2687]

RESET test: F(1.40) = 0.47931 [0.4927]

Table B.18 Spain: Steady State Solution for ΔP

	Coefficient	Standard error	t-ratio
Constant	186.86	32.06	5.83
ΔIP	-0.054	0.328	-0.165
ΔW	235.26	67.16	3.5
P	-0.314	0.048	-6.55
IP	0.704	0.135	5.23
Dum94:4	241.134	38.58	6.25

Figure B.9 Spain: Cumulative Monthly Effect on the Consumer Price Caused by an Increase in the Import Price



Note: See Figure B. 6.

B.5 Austria

The analysis of coffee demand in Austria indicates that Q, P, Y and B all exhibit stochastic trends. It is also evident from the analysis that the import time series was changed during 1998. There is a long-run relationship that can be interpreted as the demand function for the period 1982:1 – 1997:4, but after 1997 consumption is below the levels indicated by consumer prices and population. This could be caused by a structural change or by the omission of a relevant variable. However, it seems more plausible that there was a change in the reporting of the data. From 1998 onwards imports are published on a quarterly basis and there is a shift in the level and variance as compared to pre-1998 period. Since we are unable to capture this shift using a dummy, we carry out the demand analysis for the period 1982:1 – 1997:4 instead. The long-run relationship is.

$$EC^{Q} = Q + 0.2657 * P + 31.12 * B.$$

To investigate whether EC^{Q} can be interpreted as a demand function we test for weak exogeneity, which we are able to reject for *Q*. The test for P is not significant at the 5 percent level, but significant at the 10 percent level. There is, however, a large difference between *P* and *Q* in the speed of adjustment towards the long-run relationship: it is 0.72 per period for *Q* and 0.16 for *P*. Thus, we assume that we have estimated a demand function and calculate the average price elasticity at 2.17 for the 1990-1997 period.

A possible explanation for the high price elasticity is the significant cross-border trade, which accounted for approximately 30 percent of the Austrian market in the beginning of the 1990s (Tea & Coffee, 2000). This border trade with Czechs, Slovaks and Hungarians has decreased recently with the establishment of leading players in Eastern Europe, such as Kraft, and the subsequent improvement of the quality of the coffee.

The results of the pricing analysis for the period 1982:1 – 2001:4 are shown in Table B.19. We have excluded all non-significant variables except those commented below. Because the relationships are weak we use a longer period than normal for the analysis. We are unable to find any evidence of co-integration between consumer and import prices, as reflected by the low t-values of *P* and *IP*. We also added a deterministic trend and investigated the existence of structural interruptions, but without success. We are not able to find any evidence of market power; and as for the other countries θ is insignificant; neither Q^* nor ΔQ^* has an effect on ΔP; and including *B* and *P* to pick up the trend in Q^* does not change this.

Furthermore, we are unable to properly model the short-term dynamics. A change in the import price does immediately affect the consumer price, but the coefficient is only 0.25, which is much lower than in the Nordic countries, where it is close to 1. Neither are we able to show that changes in wage costs affect consumer prices. Furthermore, we need three dummy variables to reflect unexplainable changes in the consumer price. These dummy variables are an important for explaining the relatively high R^2 of 0.66.

Table B.19 Austria: Dynamic Model for ΔP

	Coefficient	Standard error	t-ratio
Constant	70.126	59.370	1.18
ΔIP	0.256	0.090	2.83
P_2	-0.065	0.054	-1.21
IP_2	0.041	0.038	1.07
B_2	-8.278	6.724	-1.23
Q*_2	-0.015	0.034	-0.428
Dum87:4	-20.952	4.918	-4.26
Dum95:4	38.550	4.808	8.02
Dum97:1	-16.352	4.812	-3.4

Period: 1982:1 – 2001:4.

R^2 = 0.67. F(11.68) = 11.9 [0.000]**

AR 1-5 test: F(5.63) = 0.48462 [0.7865]

ARCH 1-4 test: F(4.60) = 0.64917 [0.6297]

Normalitety test: $Chi^2(2)$ = 6.4681 [0.0394]*

Hetero test: F(16.51) = 0.81622 [0.6616]

RESET test: F(1.67) = 2.8386 [0.0967]

Since, we do not find a long-term relationship between consumer and import prices; one may suspect pricing asymmetry, which we test for by replacing ΔIP_t with 5 lags of *ΔIPneg* and *ΔIppos*. The fourth and fifth lags are clearly not significant and are thus removed. We then calculate the sum of the coefficients for *ΔIPneg* and *ΔIPpos*. As shown in Table B.20, the sum of the coefficients for import price increases is 0.85, but not statistically different from 1. The sum of the coefficients for import price decreases is, however, only 0.042 and not statistically different from 0. Thus, there is clearly asymmetry in the pricing.

Table B.20 Austria: Asymmetry - Dynamic Modell for ΔP

	Coefficient	Standard error	t-ratio
Constant	-2.757	0.919	-3
Dum87:4	-21.636	5.357	-4.04
Dum95:4	38.012	4.526	8.4
Dum97:1	-17.497	4.476	-3.91
ΔIPneg	0.042	0.209	0.201
ΔIPpos	0.845	0.249	3.39

Test for asymmetry: the sum of the coefficients of *ΔIPpos* equals that of *ΔIPneg*; $\chi 2(1) = 5.70$ [0.0169]

6 Vertical restraints, distribution and the price impact of parallel imports: Implications for the European Union and Sweden

Mattias Ganslandt and Keith E. Maskus

Executive Summary

We discuss the major policy questions surrounding the issue of the benefits and costs of parallel imports (PI), which are goods traded without the authorization of an owner of associated intellectual property rights (IPRs). The issue is controversial for a number of reasons, mainly arising from the fact that PI exist in second-best policy environments. As a result, universal statements about their effects on efficiency or welfare are impossible in general.

With that background, we study two canonical models of why PI exist: to arbitrage international retail price differences and to profit from international margins between retail and wholesale prices arising from vertical price control. We find that while the possibility of PI can increase retail-market competition and enhance market integration, it can also affect an IPRs owner's incentive in setting the wholesale price it charges a distributor, thereby reducing vertical pricing efficiency. The relationships between wholesale prices, retail prices, and trade costs are complex and dependent on circumstances.

Our empirical evidence supports the view that there are multiple causes for PI. Econometric analysis of prices suggests that arbitrage as well as vertical control problems are important practical explanations for such trade. Pricing behavior by exporters from high-price markets – such as Denmark and the United Kingdom – suggests that they increase export prices in countries that are in close proximity (and therefore have low trade costs) in an attempt to deter PI.

Welfare implications are also complicated. For example, other authors have argued that parallel imports may allow distributors to free ride on the costly promotional activities of legitimate distributors and reduce incentives to invest in those activities. In such an event, a case may be made for the prevention of PI. Our analysis suggests that there are other reasons why it can improve welfare to restrain PI under certain circumstances. In particular, the need to achieve vertical price efficiency by a manufacturer and the costs of wasting resources in PI activities can make it desirable to prevent such trade. These arguments may be particularly important in industries that are characterized by high R&D costs but low marginal costs of production and distribution. Concerns about parallel trade exist most acutely in pharmaceuticals, biotechnology, and certain copyright sectors, which meet these characteristics.[60]

However, it is possible that PI could raise well-being through arbitrage and competition. Indeed, parallel imports are more likely to increase welfare within a region (such as the EU) than in the entire world trading system.[61] Our analysis suggests that there is a need to coordinate international policy towards PI with other trade policies. Specifically, if the EU were to deregulate its restrictions on parallel trade from outside the region, two principles would be important. First, such deregulation would be more likely to enhance welfare if it were restricted to trading partners with similar income levels and protection for intellectual property. Second, if PI were deregulated its gains would be maximized by attempts to reduce other impediments that that raise the costs of trade.

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[60] Ganslandt and Maskus (2001 and 2002) analyze the welfare effects of parallel trade in pharmaceutical products. For a related discussion see also Ganslandt, Maskus and Wong (2001).

[61] Interestingly, Malueg and Schwartz (1994) offer a similar policy implication, although for a different reason.

6.1 Alternative explanations for parallel imports[62]

Parallel imports[63] occur because significant price differences between countries exist for many goods and services.[64] The legality of PI stems from the territorial exhaustion of intellectual property rights (IPRs). More precisely, under the EU doctrine of community exhaustion, distribution rights are exhausted upon first sale within the internal market while IPRs-owners may prevent PI from abroad. As noted below, the exhaustion principle for any country or region may vary across the type of IPRs involved, with trademarked goods generally more subject to PI than copyrighted and patented goods. However, the EU tends to treat all forms of IPRs equally.

A fundamental economic condition for parallel trade to exist is that it is profitable. Stated more precisely, the net margin between revenues and costs for arbitrageurs has to be positive, i.e. the retail price in the import market has to be higher than the price in the export market plus trade costs. According to the economic literature, this situation can exist for a number of reasons.[65]

Research on PI has focused on a number of possible explanations for this phenomenon. Most formal analysis treats parallel trade as an arbitrage response at the retail level to "third-degree international price discrimination", in which original IPRs holders set prices that differ across countries (but not individual consumers) according to local demand conditions (Malueg and Schwartz, 1994; Richardson, 2002). The business literature focuses on problems that emerge when parallel traders take advantage of the marketing and service investments of authorized distributors without having to face such costs themselves (Chard and Mellor, 1989; Barfield and

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62 For two related surveys see Maskus and Chen (2002) and Ganslandt (1999).

63 Parallel imports are goods imported legally into a country without the authorization of the firm that owns an intellectual property right (patent, copyright, or trademark) in that country. These goods originally were placed into circulation legitimately in another market by the rights-owner or her authorized distributor; thus, they are not counterfeit or black-market products.

64 Because parallel imports are not recorded, it is unclear how significant they are. Survey evidence suggests that they capture an important share of national markets for certain products (NERA, 1999 and KKV, 1999). For example, it is estimated that up to 20 percent of the market for Coca-Cola in the United Kingdom is served by PI coming from wholesalers in other European markets (see "Coke's Public-Relations Trouble Was Worsened by Gray Trade," The Wall Street Journal, July 6, 1999).

65 Hilke (1988) presents several possible explanations for parallel imports and he concludes that many are important in practice.

Groombridge, 1998). A third possibility is that PI may arise because IPR owners attempt to control vertical pricing relationships between wholesalers and retailers across countries (Maskus and Chen, 2002 and 2003).[66]

Arriving at a satisfactory explanation of PI is important because the welfare consequences of permitting or banning such trade will be quite different depending on which of the explanations is most relevant. For example, simple retail arbitrage raises total welfare as long as the total volume sold does not fall as prices converge across borders and the costs of engaging in PI are not high. In contrast, free-riding on fixed marketing investment costs could result in a suboptimal amount of market development and product introduction in certain countries. This problem could reduce total welfare unless, in the absence of PI, there is excessive investment of this kind. Finally, permitting PI in the context of firms solving the vertical control problem may or may not raise welfare, depending on the severity of the distortion in vertical prices and the magnitude of resources absorbed in parallel trade activities.

In principle, parallel imports and arbitrage can be profitable in two quite different ways. In some cases, *retail prices* differ sufficiently between different geographical markets that the gap covers trade costs. These differences create some scope for parallel trade, which is horizontal by nature since it is trade at the same level of the distribution chain.[67] In other cases, the retail price difference between different geographical markets may be small while the *retail margin*, or the difference between the retail price in the import market and the wholesale price in the export market, is sufficient to cover the trade costs of arbitrageurs. In these cases parallel trade is vertical by nature because it is a flow of products from the wholesale level in the export market to the retail level in the import market.[68]

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66 Ganslandt and Maskus (2002) combine elements of price discrimination and vertical control.

67 One can, for instance, think of a Swedish citizen who could choose either to buy a car from a Swedish retailer or to buy it from a retailer in Germany and ship it back to Sweden.

68 The IPR-holder would naturally prefer to control the vertical distribution through her authorized distribution system but may have only limited means to do so (due to competition law and other legal restrictions).

Horizontal PI can flow only from low-price to high-price markets since trade costs have to be covered by the retail price difference. Vertical PI, however, can flow in both directions due to the fact that it is the retail margin rather than the retail price difference that determines the scope for such trade. At least in principle, one can imagine cases in which vertical parallel trade can be profitable in two opposite directions simultaneously.

A critical issue in this context is what the underlying causes for horizontal and vertical parallel trade might be. Starting with the fundamental condition for horizontal PI, i.e. retail price differences, we have a number of possible explanations.

The first explanation of retail price differences is third-degree price discrimination. Optimal pricing by a firm with some degree of market power implies that it should set a higher price in a market in which demand is less elastic and a lower price in a market in which demand is more elastic.[69] Typically demand-elasticity is negatively correlated with income, i.e. high-income consumers are less price-sensitive than low-income consumers. International third-degree price discrimination can, therefore, be explained to some extent by the difference in income levels between countries.

The second explanation is that the amount and quality of local services provided at the retail level vary between markets. Retail prices in different markets depend on these relative service levels. High retail prices can to some extent reflect a high level of pre-sales and post-sales services, including good-will, product information, marketing, guarantees, and the like.

The third explanation is that the quality of a particular brand or product may differ between countries. Higher quality is typically reflected in a higher price. Parallel trade can be profitable, if the consumer is misinformed or uninformed about differences between the variety sold by the authorized retailer and the variety sold by the parallel importer.

The fourth and last explanation for retail price differences between countries is that exchange rate fluctuations can cause prices to

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[69] Tirole (1988) and Varian (1989) give excellent surveys of the economic literature on price discrimination.

diverge. Prices in local currencies may be sticky for competitive reasons and there may be significant costs of changing prices and notifying such changes to customers (so-called "menu costs"). These factors can result in temporary price differences that can be exploited by parallel importers.

Turning to vertical PI, the scope for this activity depends on the retail margin, defined more precisely as the difference between the retail price in the import market and the wholesale price in the export market. There are at least two reasons why such a margin between retail and wholesale prices can exist.

First, the retail margin needs to cover investments in marketing and services. It is, consequently, partly determined by the absolute level of services at the retail level. To some extent such services and marketing are local public goods, in the sense that their provision by authorized retailers builds demand that can be met by all suppliers. However, such activities are costly. Parallel importers can exploit the margin required to cover these costs and free-ride on the market-building local services.

The second important explanation for a considerable margin at the retail level stems from the need of manufacturers to exert vertical price control across borders. Specifically, a manufacturing firm with market power has an incentive to set a low wholesale price to distributors in an export market in order to induce an optimal retail price in that market, which avoids a double mark-up problem at the retail level. To explain, suppose that a manufacturer (which owns the IPRs on a product) sells its product through a distributor in a particular country but cannot directly mandate the retail price there, a case that is consistent with the reality of competition policy in many jurisdictions. In this framework, the manufacturer would maximize profits by charging the distributor a wholesale price that is sufficiently low to induce the desired retail price on that market. Because this wholesale price would ordinarily differ from the retail price in another market, an opportunity arises for the distributor to sell the product profitably elsewhere without the authorization of the rights holder. This process entails a number of tradeoffs between efficient vertical pricing and costs of engaging in PI, with the manufacturer's competitive decisions depending crucially on these factors. We refer to this last explanation as the vertical price control (“VPC”) theory of parallel trade.

In our view, the horizontal arbitrage theory and the VPC theory are the two most general, and most informative, of the explanations for PI. Accordingly, we will focus on arbitrage and vertical price control problems in the subsequent analysis. In the theoretical section we derive analytical predictions and their implications for welfare. In the empirical section we try to discriminate between the competing explanations and measure the relative importance of the VPC and arbitrage theories of parallel trade in the European Union. Finally, we analyze the implications for welfare in Sweden and other Member States and discuss some policy issues.

6.2 Policy and legal framework for parallel imports

6.2.1 EU policy and case law

Put briefly, the current European case law firmly establishes a principle of community exhaustion. Intellectual property rights applying to a particular piece of merchandise are exhausted upon the first sale of the product within a Member State of the European Union.[70] Parallel imports and arbitrage within the single market are explicitly permitted even for products that are subject to different degrees of regulatory price control. Parallel imports of goods from countries outside the EU market, however, are not allowed without the consent of the holder of the intellectual property rights.

The principle of free circulation of goods is at the heart of European integration. Through free movement of goods and services, as well as capital and labor, the ultimate goal of the European Union is to create an integrated market without barriers.[71] Article 28 (ex 30) in the EC Treaty states that "Quantitative restrictions on imports and all measures having equivalent effect shall be prohibited between Member States".

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[70] Keep in mind that exhaustion refers to the expiration of the rights to control further distribution. It does not affect the original IPRs holders' rights to control further production or copying. Nevertheless, exhaustion of distribution control is a significant limitation on the scope of IPRs.

[71] Article 7A in the Treaty of Rome outlines the objective of the European Union to create an internal market and the "free movement of goods, persons, services and capital is ensured in accordance with the provisions of this Treaty."

A second goal of the European Union is to protect industrial property, including intangible asset such as innovations, brands and design. Among the most important policy instruments to protect industrial property are strong intellectual property rights, such as trademarks, copyright and patents. Article 30 (ex 36) in the Treaty of Rome states that Article 28 "shall not preclude prohibitions or restrictions on imports, exports or goods in transit justified on the grounds of the protection of industrial and commercial property."[72]

The principle of free movement of goods allows individuals or firms within the European Union to trade goods across Member State borders without the consent of the producer, while IPRs give the holder of a patent or trademark an exclusive right to determine how and when to put a product on the market. This creates a potential conflict between the two principles.

While there may be numerous limitations on the scope of IPRs provided, a central one is determined by the rule of exhaustion. To the extent that an intellectual property right is exhausted, other parties can sell or trade the product without the consent of the holder of the patent or trademark.

As noted initially, the current EC policy is “community exhaustion” of IPRs.[73] In other words, the first sale of a product within the internal market exhausts the intellectual property right, while the sale of a product outside the territory does not. This rule effectively allows for arbitrage (i.e. "parallel imports" or "gray-market imports") within the EU and prevents arbitrage between the EU and other countries. Within a territory of exhaustion there may, nevertheless, be several geographical jurisdictions such as the Member States of the European Union. Exhaustion across autonomous political jurisdictions allows parallel importers to profit from differences in local regulatory policies, including variations in

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[72] Article 222 states that the treaty "shall in no way prejudice the rules in Member States governing the system of property ownership", which explicitly establishes the right of individual member states to determine the extent and design of IPR within its territory.

[73] There are some important international differences for different types of IPRs. The geographical rule of exhaustion of patents and copyrights has generally been more narrow than exhaustion of trademarks. Most developed countries - including Europe, the US and Japan - apply a rule of territorial or national exhaustion to goods protected by patents. For trademarks, on the other hand, many countries, including New Zealand, South Africa, Japan, and (with limits) the United States, apply a rule of international exhaustion, making them open to PI. Australia, New Zealand, and Singapore recently have liberalized their restrictions on PI of such copyrighted goods as compact disks and books.

IPRs and price controls. In this case, the rights of arbitrageurs and rights of IPRs holders are clearly in conflict.

According to European case law, as established by The European Court of Justice (ECJ), free circulation of goods within the European market take precedence over IPRs, including patents, trademarks and copyright.[74] In *Merck v Stephar* (C 187/80) the ECJ held that a patent holder which is marketing its product in two different member states cannot prevent arbitrage between the two local markets, despite differences in intellectual property protection in the two countries.[75]

Despite this principle, the exhaustion of IPRs in the European Union has some important limitations. First and foremost, it does not extend to countries outside the common market. In other words, the ECJ has established a principle of "community exhaustion", but rejected the idea of international exhaustion. In *EMI v CBS* (C-51/75) the use of a trademark right to prevent the importation of goods from countries outside the European Union was held to be compatible with Article 28. In a more recent case, *Silhouette v Hartlauer* (C-355/96), the Court reconfirmed this position and went further to establish that it is not compatible with the common market for a single Member State to apply a unilateral principle of international exhaustion of trademarks.

Second, the exhaustion of intellectual property rights is partly determined by the nature of national policies in the various member states. The ECJ has established that community exhaustion of IPRs is compatible with differences in national price regulations across member states, but not compatible with compulsory marketing of products. More specifically, the principle of community exhaustion is limited in such a way that it does not extend to cases when the goods are sold in a member state under a compulsory license. In *Pharmon v Hoechst* (C-19/84) the Court argued that the compulsory placement of goods on a local market did not permit free circulation

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[74] Community exhaustion goes back to *Consten and Grundig v Commission* (C-56/64) in the case of trademarks, *Merck v Stephar* (C-187/80) for patents and *Deutsche Grammophon v Metro* (C-78/70) for copyrights.

[75] In *Merck v Stephar* (C 198/80), Merck marketed its drug products in Holland under the strength of a strong Dutch patent, while marketing in Italy was without benefit of any patent protection. Nevertheless, ECJ held that once Merck marketed its products in Italy without reward of a patent, purchasers were free to resell the product in the Netherlands or other higher priced, patent-protected markets.

of the goods within the European Union. However, price differences stemming from different degrees of price control do not justify preclusion of PI from countries with more rigorous regulations to markets with less rigorous control. This was explicitly stated by the European Court of Justice in *Merck v Primecrown* (joined cases C-267/95 and C-268/95), in which the Court stated that "...although the imposition of price control is indeed a factor which may, in certain conditions, distort competition between Member States, that circumstance cannot justify a derogation from the principle of free movement of goods."

In some respects the principles of free circulation of goods and services, and consequently the rights of parallel importers, are more extensive than community exhaustion of IPRs. First, exhaustion not only gives parallel importers the right to resell the product within the European Union but also the right to use the trademark in its marketing of the product. In *Dior vs Evora* (C-337/95) the ECJ stated that "...when trademarked goods have been put on the Community market by the proprietor of the trademark or with his consent, a reseller, besides being free to resell those goods, is also free to make use of the trademark in order to bring to the public's attention the further commercialization of those goods."

Second, the right of arbitrageurs to re-package and re-affix trademarks on PI goods to promote market integration is now well established in European case law.[76] Re-packaging is, however, only excluded from being an act of infringement of the IPRs to the extent that different trademarks and packaging systems have been used artificially to partition the European market. In *BMS and Others v Paranova* (Joined Cases C-427/93, C-429/93 and C-436/93) the Court stated that a trademark owner can prevent further marketing of PI that have been repackaged unless "…it is established that the trademark is being used to prevent marketing of repackaged products in a way that would contribute to the artificial partitioning of the single market". Moreover, the parallel importer has to show that the re-packaging does not adversely affect the product and notify the proprietor as well as include his own name on the re-packaging material. It should be noted that, despite the fairly detailed conditions stated by the Court, arbitrageurs have a

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[76] The right of parallel importers to repackage and reaffix trademarks goes back to *Hoffman-La Roche v Centrafarm* (C-107/76) and *Pfizer v Eurim-Pharm* (C-1/81)

rather extensive right to modify the package and use the trademark to overcome local differences in the European market.

Third, in *Rhône-Poulenc Rorer* (C-94/98) the Court stated that, as regards pharmaceutical products, so long as two products have the same active ingredients and therapeutic effect and are sold in two different Member States by the same manufacturer, a parallel importer can obtain a PI license from the competent authority in the import country. This pertains even if the market authorization of one of the products has ceased to have effect in one of the countries. In other words, the manufacturer cannot partition the single market by introducing a new variety in a Member State where its product is subject to competition from PI.

In summary, the Court has established that different packaging, different trademarks or withdrawal of licensed products cannot be used by an IPRs holder to sustain an artificial partitioning of the internal market. In contrast, parallel importers are allowed to take such measures as re-packaging, re-affixing of trademarks and re-introduction of withdrawn products to the extent that national differences in trademarks, packaging and product varieties constitute an artificial segmentation of the European market.

6.2.2 Arguments in the policy debate

It is difficult to establish optimal regimes for the legal treatment of parallel imports because they have numerous and potentially conflicting impacts on economic well-being and the economic interests of different market participants. Because PI exist in an inherently second-best world, involving trade costs, market segmenting barriers, imperfect competition, differential regulatory regimes, and the like, it is unsurprising that whether they are beneficial or detrimental depends on circumstances. In this section we describe economic benefits and costs of permitting PI.[77] While some references are made to specific theoretical insights, the discussion here is intentionally kept general to highlight basic tradeoffs for policy makers.

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[77] For further discussion see Maskus (2000b), Hilke (1988), Abbott (1998), Barfield and Groombridge (1998) and Chard and Mellor (1989).

Begin with potential benefits of parallel trade. The principle of community exhaustion would seem to be integral to establishing and supporting the Single Market objective. National exhaustion, by which each Member State would prevent PI, would amount to government-supported exclusive territorial restraints in distribution. This situation would support a complete form of market segmentation tied to national borders. If the Single Market is seen as important in building a European identity, then for political purposes it would be costly to prevent nationals of one country to purchase products available in another.

Next, and more directly, the essential intention of an integrated market is to achieve price convergence and to reduce prices in higher-priced markets. As simple models of horizontal arbitrage demonstrate, the principal impact of PI should be to cause retail prices between countries to converge to some gap covering trade costs and some competitive economic return. Indeed, in markets open to PI and large potential supplies of arbitrage goods, no actual PI need take place for this price convergence to occur (Ganslandt and Maskus, 2002). There are three essential gains from price convergence. First, if prices are consistent across markets, consumers and input purchasers need not seek out the lowest prices across geographic areas. This activity can entail significant costs, either through distributors or through direct travel. Thus, price integration through PI can reduce consumer search costs. It should be noted that this benefit is somewhat misleading. If PI were illegal, consumers could not look abroad and would therefore not incur these search costs. Thus, the benefit arises where PI is a legal activity and also has the effect of overcoming other forms of market segmentation. Second, if there is uncertainty in prices in one market, perhaps due to random shifts in demand or production shocks, having access to anticipated prices in other markets could be a valuable form of hedging. Third, price convergence is a gain to consumers in those countries where prices fall as a result of PI.

The first-sale doctrine is important in establishing the almost seamless integration of American states into a single market in the United States (Hilke, 1988). Temporary shortages in retail outlets in one part of the country may be met by (both authorized and unauthorized) shipments from distributors in other parts, supporting a remarkable degree of price uniformity.

Finally, arbitrage generates an important source of intra-brand competition, which should have a pro-competitive effect in wholesale and retail distribution in different markets. Indeed, the exhaustion principle is considered a basic element of competition policy in the United States and the EU. In principle, the fact that under threat from PI, original manufacturers have diminished control over supplies and therefore on pricing margins should expand competition to the benefit of consumers and input purchasers. Unfortunately we do not have evidence on the extent of this pro-competitive effect in the EU.

Parallel imports bear certain costs as well. First, to the extent that PI actually happen they devote resources to the costs of re-packaging and transporting them between markets. Second, as noted earlier, parallel importers have the opportunity to free ride on the service and marketing costs of authorized distributors. If the import competition is sufficient to erode expected profitability from investing in such market-building costs, a country that is open to PI may suffer inadequate entry of authorized distribution firms and sub-optimal levels of services and information provision.

Third, market segmentation implies the existence of differential prices, depending on local demand conditions. Thus, even as consumers in higher-priced markets might gain from price convergence, consumers in lower-priced markets could suffer losses from higher costs. The interesting issue in this context is the degree to which convergence comes from diminishing or rising prices across markets. There is virtually no practical evidence on this issue, though presumably it would depend on relative market sizes, competition among distributors, the availability of substitute products, and related factors. An extreme, but practically relevant, variant of this cost is that IPRs owners could choose not to supply lower-priced markets at all in the presence of legal PI. This could happen because there would be little reason for local distributors to undertake market development costs. More directly, available supplies might be exported to other markets rather than retained at home. Finally, original manufacturers could refuse to supply

distributors in markets from which parallel exports might emanate.[78]

A fourth problem is that openness to PI may run risks of increasing consumer confusion about the true origin of goods. In principle this problem should not arise because parallel imports are legitimate goods, with the ultimate producer being the original manufacturer or its licensees. However, because exhaustion permits goods to escape the manufacturer's distribution chain, products that were not authorized may be more easily passed off as parallel imports. Such goods might be produced as overruns by licensees (in which case they are not misleading as to origin if not authorization) or might be counterfeit goods (in which case they are both misleading and illegitimate).

Counterfeiting is a form of piracy, which is an infringement of recognized IPRs. It should be noted that the likelihood of counterfeit products originating in countries with strong IPRs regimes is remote. Thus, concern over trade in counterfeit products should not be significant within the Member States of the EU, which share generally similar legal regimes, though the degree of enforcement may vary widely. Neither should it be a concern if the EU were to deregulate PI from such countries as the United States, Canada, or Japan. However, it is a legitimate worry in the event that PI were to be permitted from countries with weaker systems of intellectual property protection.

A final cost is that by limiting the scope of price discrimination under IPRs, parallel imports reduce the profitability of original manufacturers. As a result it becomes more difficult to finance future R&D programs from sales on existing products. Thus, PI can impose a dynamic cost in terms of reduced innovation. Countries that tend to be net developers and exporters of intellectual property, such as the United States, Germany, and the UK, may oppose PI on the grounds that such trade reduces profits of its firms. However, consumers in all countries could suffer from slower product introduction and reduced product variety. An important question for further research would be to quantify this dynamic cost.

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[78] The idea that manufacturers might withdraw from low-priced markets underlies the conclusion in Malueg and Schwartz (1994) that a uniform international pricing regime under unrestricted PI would not be globally optimal.

The international policy debate looms largest in the area of patented or brand-name pharmaceutical products. Consistent with the Doha Declaration on Public Health, developing countries wish to retain access to such drugs that may be available through PI.[79]

For its part, some members of the U.S. Congress have proposed legislation to liberalize restraints on PI in drugs from Canada. The reason is that market prices of drugs for patients whose insurance companies do not pay for them is considerably higher in the United States than in Canada, prompting individual Americans to pay the costs of acquiring such drugs from the latter country. This proposed legislation is of considerable concern to Canadian policy makers, who are concerned about the implications for supplies on their market.[80]

Finally, while PI in drugs within the European Union is legal, pharmaceutical companies continue to try to raise legal barriers through the courts (Ganslandt and Maskus, 2002). Note also that Member States would be affected by a U.S. decision to deregulate PI of drugs if such deregulation extended to supplies from the EU, a policy that made it into American legislation in the year 2000 but was never implemented.

6.2.3 International legal divergence

Exhaustion is a central element of competition-based regulation of IPRs. The traditional approach has been for each country or region to choose its own policy covering parallel imports, reflecting the fact that the scope of IPRs is a national regulatory prerogative. This national sovereignty was preserved in Article 6 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in the Uruguay Round.

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[79] Note that this is a different issue from the current negotiations over permitting poor countries without production capacity to issue compulsory licenses for imports. Compulsory licenses have the effect of introducing generic drugs into a market, whereas PI exist in brand-name drugs. However, with an open PI regime poor countries might be able to purchase branded drugs from distributors in such countries as Spain and Greece.

[80] In this regard note that Glaxo Wellcome recently notified Canadian distributors of its products that they needed to stop offering them to U.S. residents through internet sales or they would face an end to their supplies.

Considerable debate persists about altering the TRIPS language on exhaustion. On the one hand, some analysts argue for a global ban on parallel imports to permit intellectual property owners to control international distribution (Barfield and Groombridge, 1998). At the other extreme, some observers prefer a global rule of international exhaustion, believing such market integration would achieve consumer gains and discipline abusive price discrimination and collusion from private territorial restraints (Abbott, 1998).

As noted earlier, the European Union follows a policy of Community-wide exhaustion in all forms of IPRs but excludes PI from outside its territory. The European Court of Justice consistently has upheld the right of traders to re-sell goods within the Community as an important means of completing the internal market and promoting competition. Recently the European Commission has undertaken a series of reviews to determine circumstances under which it might be sensible to deregulate restraints on PI from outside the region.

Within its borders the United States enforces the first-sale doctrine, under which rights are exhausted when a good is purchased outside the vertical distribution chain. Thus, American rights holders cannot prevent customers from re-selling products anywhere within the United States. Regarding imports from outside the country, the United States follows a "common-control exception" in trademarked goods, affirmed in a recent Supreme Court decision.[81] This principle allows trademark owners to exclude PI except when both the foreign and U.S. trademarks are owned by the same entity or when the foreign and U.S. trademark owners are in a parent-subsidiary relationship (Palia and Keown, 1991; National Economic Research Associates, 1999). In addition, to block such imports the rights holder must show that they are not identical in quality to original products and may confuse consumers. Thus, U.S. trademark owners typically find it difficult to bar PI. In contrast, patent holders are protected from PI under an explicit right of importation. Finally, copyrighted goods may not be parallel imported under terms of the Copyright Act of 1976.

Australia generally permits PI in trademarked goods but allows patent owners to restrict them. Australia removed protection for

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[81] *K-Mart Corporation vs. Cartier*, 486 U.S. 281 (1987).

copyrighted compact disks in late 1998, complementing its earlier limited deregulation of book imports. Similarly, New Zealand and Singapore recently have liberalized restraints on PI of copyrighted goods. Thus, small, high-income nations that are net importers of intellectual property tend to prefer more open regimes (Richardson, 2002). Japan permits PI in trademarked and patented goods unless they are explicitly restrained by private contract provisions or the original sale of such goods was subject to price regulation abroad (Maskus, 2000a). Under its legal regime, Japan is substantially more open to PI than are the United States and the EU (Abbott, 1998).

Few developing countries restrict PI in any area. In part this policy mirrors the general absence of competition policies. However, many countries believe it advantageous to maintain an open regime in order to be able to source products at the lowest international cost, failing to recognize that such openness may limit the willingness of IPR holders to service their markets. They may also view PI as a device to restrain price collusion from exclusive territorial distribution contracts and see parallel exports as an opportunity for penetrating foreign markets (Maskus, 2000a).

6.3 Theoretical analysis of parallel imports

Of all the possible explanations for parallel trade the economic literature has focused on three: arbitrageurs responding to international price discrimination, distributors free-riding on local services and distributors responding to vertical price control.

In our view, arbitrage and the VPC explanation are the two most general and most informative of these theories. Accordingly, in this section we focus on arbitrage and vertical price control problems.[82]

Our aim is to derive theoretical predictions and implications that can be used for empirical testing and welfare analysis. The predictions will be empirically tested in the next section. The welfare and policy implications will conclude our analysis in the last section.

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[82] A formal model is presented in the Appendix.

6.3.1 Models of parallel imports

Parallel imports can be analyzed in a simple framework. A single manufacturing firm (the IPRs holder) sells its product in two markets (A and B) through two independent distributors, one in each market. There is a variable trade cost (t) for each unit traded between markets A and B. The distributor pays a wholesale price (w) and a fixed franchise fee (F) to the manufacturing firm and chooses a quantity (q) which induces a retail price (r) in the local market. The two markets can be of different size and different with respect to their willingness to pay for the product sold by the manufacturing firm. For simplicity we will assume that demand is less elastic with respect to price in market A and more elastic in market B. We refer to market A as the high-income (import) market and B as the low-income (export) market.

We analyze two cases: arbitrage and VPC. The arbitrage case is a case of perfectly elastic parallel trade at the retail level. In order to simplify the analysis we assume that arbitrage only occurs at the retail level and the distributors do not sell the product outside their geographical area. In this case, arbitrageurs will exploit the retail price differential between the high-income and low-income markets. Consequently, retail prices in the high-income and low-income markets cannot differ more than the variable trade cost.

The VPC case can be thought to be a case of horizontal competition between distributors. The distributor in the low-income market will exploit the possibility to sell the product not only in his country but also in the high-income country if the retail margin (the difference between the retail price and the distributor's wholesale price) is sufficiently high to cover the variable trade cost. In other words, the main difference between the two cases we analyze is that in the arbitrage case it is the difference in retail prices between different geographical areas that determine the scope for PI, while it is the retail margin that determines the profitability of horizontal competition in the VPC case. After this brief introduction, we analyze how wholesale and retail prices depend on trade costs in an equilibrium in which parallel traded is permitted. We then turn to an analysis of profits and consumer welfare (i.e. consumer surplus).

6.3.2 Wholesale and retail prices

The equilibrium wholesale prices will differ significantly in the arbitrage and VPC cases. If retail markets are subject to perfectly elastic arbitrage trade, the manufacturing firm will set its wholesale prices subject to a constraint that retail prices cannot differ more than the variable unit trade cost. The wholesale price in the high-income market will be set to minimize the mark-up problem in the retail market and to reduce the pressure from potential arbitrage. The wholesale price in the high-income market will, therefore, be set at the minimum level and will be independent of the variable trade cost. The wholesale price in the low-income market, however, will be set to maximize the joint profit made in both the low-income and high-income markets.

There will be two relevant ranges of trade costs. In the case of very high trade costs, arbitrage is not profitable and the wholesale price in the low-income market can be set without considering the high-income market. Consequently, for high trade costs the wholesale price will be set at the minimum level to reduce the mark-up problem in the low-income market. In the case of low and intermediate trade costs, arbitrage trade would potentially be profitable if the manufacturing firm did not take it into account in its decision to determine wholesale prices. The wholesale price in the low-income market will be strictly positive and exactly high enough to induce retail prices such that arbitrage is not profitable. The lower the variable trade cost, the higher the wholesale price in the low-income market.

Next, turning to the VPC case the analysis is somewhat more complicated. Parallel imports reduce the profits of the manufacturer (or the joint industry profits in two countries), not only because they create competition in the country receiving PI, but also because they incur additional transaction (transportation) costs and prevent the manufacturer from achieving efficient vertical pricing. When the manufacturer is unable effectively to impose a territorial restraint, it can still reduce or eliminate (that is, deter) PI by raising the wholesale price to the independent agent. However, this strategy leads to a less-profitable retail price in the country where PI originate. In equilibrium, the manufacturer balances the needs to exercise optimal vertical price control and to limit parallel imports.

In this case, we have to consider four relevant ranges of variable trade costs. In the case of very high trade costs, markets are segmented and the manufacturing firm can set its wholesale prices to induce optimal retail prices in both markets. In other words, the vertical control problem can be solved perfectly. In the case of high (but not very high) trade costs, markets are almost segmented and the manufacturing firm can set a wholesale price in the low-income (export) market to make it unprofitable for the distributor to sell its product in the high-income market. In other words, parallel trade is blocked. This will result in a mark-up problem in the low-income market but there are no resources wasted in parallel trade in equilibrium and the only disadvantage to the manufacturing firm is a retail price in the low-income market that is slightly higher than optimal.

The lower the trade cost, the higher the wholesale price has to be in the low-income market to block parallel trade. At some level of intermediate trade costs it is no longer profitable to block parallel trade for the manufacturing firm. The distortion in the low-income market is simply too large and it is more profitable to accommodate the PI. This takes us to the next range of trade costs. In the case of intermediate trade costs, the manufacturing firm will set a relatively high wholesale price in the low-income market to reduce the competitive pressure in the high-income market from parallel trade but also to reduce the volume of such trade in equilibrium. The higher the variable trade cost, the stronger is the incentive to reduce the volume of PI and, consequently, the higher is the optimal wholesale price in the low-income export market.

Finally, in the range of very low trade costs, the manufacturing firm has an incentive to reduce the competitive pressure in the high-income market but not necessarily to reduce the volume of PI since very few resources are used in the trade activities. In this range we have to consider two alternatives. The best alternative for the manufacturing firm is to reduce competition in the high-income market by raising the wholesale price of the distributor in this market and choosing a lower wholesale price in the low-income market (see the appendix for analysis). There will be no mark-up problem in the high-income market since competition between the two distributors results in an equilibrium retail price lower than the monopoly price. The mark-up problem in the low-income market will be relatively limited as the wholesale price in this market will be relatively low. The higher the trade cost, however, the stronger is

the incentive to reduce the volume of parallel trade and, consequently, the lower is the wholesale price in the high-income market and the higher is the wholesale price in the low-income market.

Another alternative (analyzed in Maskus and Chen, 2002 and 2003) is to reduce competition in the high-income market by raising the wholesale price in the low-income market. In this case, the higher the variable trade cost, the higher is the optimal wholesale price in the low-income export market. Retail competition in the high-income market will be more aggressive relative to the alternative in which the manufacturing firm solves the problem with a higher wholesale price in the high-income market.

The wholesale price in the low-income (export) market, as a function of the variable trade cost, is illustrated in Figure 6.1. From this figure the main differences between the arbitrage and VPC case can be seen quite clearly. First, in the arbitrage case the wholesale price falls as the variable trade cost rises, up to an intermediate point where it becomes flat.[83] In the VPC case the wholesale price first rises, then falls as the variable trade cost goes up. The function is, consequently, convex in the arbitrage case and concave in the VPC case.

Second, for low variable trade costs the wholesale price falls in the arbitrage case and rises in the VPC case. Finally, parallel imports have important effects on the wholesale prices in a much wider range of variable trade costs in the VPC case as compared to the arbitrage case. The reason is that the retail margin is much higher than the retail price differential between the high-income and low-income markets. Consequently, parallel trade has implications for the wholesale prices at much higher trade costs in the VPC case.

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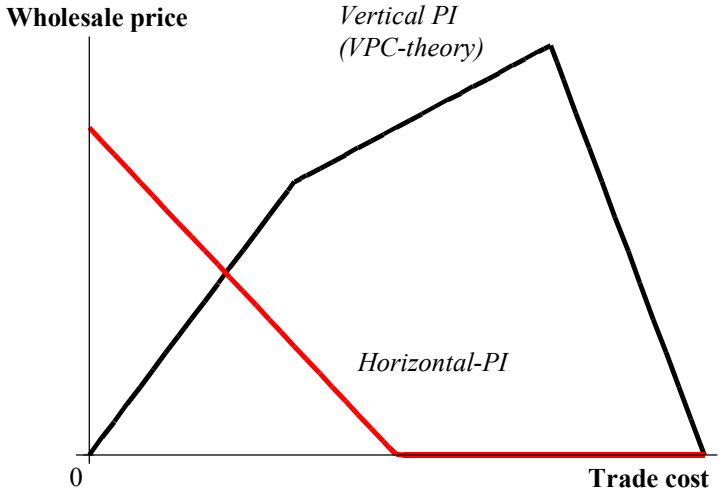
[83] In the diagram it becomes zero simply by virtue of the assumption in the model of a zero (and constant) marginal production cost. In general the price would become flat at the level of marginal cost.

Figure 6.1 Wholesale price in the low-income market as a function of trade cost (t).



Next, retail prices follow from the optimal wholesale prices set by the manufacturing firm. Starting with the arbitrage case, it is obvious that retail prices will converge as the variable trade cost is reduced. If trade costs are zero, retail prices must be identical in both markets. The higher the trade cost, the lower is the retail price in the low-income market and the higher is the retail price in the high-income market. At some level of intermediate variable trade costs markets will become segmented and both retail prices will be at their monopoly levels.

It is interesting and important to note that the effects of arbitrage on retail prices depend on the relative size of the two markets. When the low-income (export) market is large in relative terms, arbitrage will primarily result in a lower price in the high-income market and the retail price in the low-income market will be closer to the segmented price level. In other words, if parallel trade is permitted and results in perfectly elastic arbitrage it will result in a significant price reduction in small, high-income markets and only limited price effects in larger markets. This provides an answer to one of the policy questions raised earlier.

In the VPC case, retail prices depend on both the wholesale prices and the volume of PI. If the variable trade cost is very high, the manufacturing firm sets the wholesale price in the low-income

market to block the distributor from engaging in PI. The retail price in the low-income market will consequently fall when the variable trade cost rises (there is no need to set the wholesale price at the same high level if trade costs are a sufficient barrier to block parallel trade). In other words, the price differential between the two markets will be reduced as the markets become more integrated due to a lower variable trade cost. But this effect is due to a higher price in the low-income market and no effect in the high-income market.

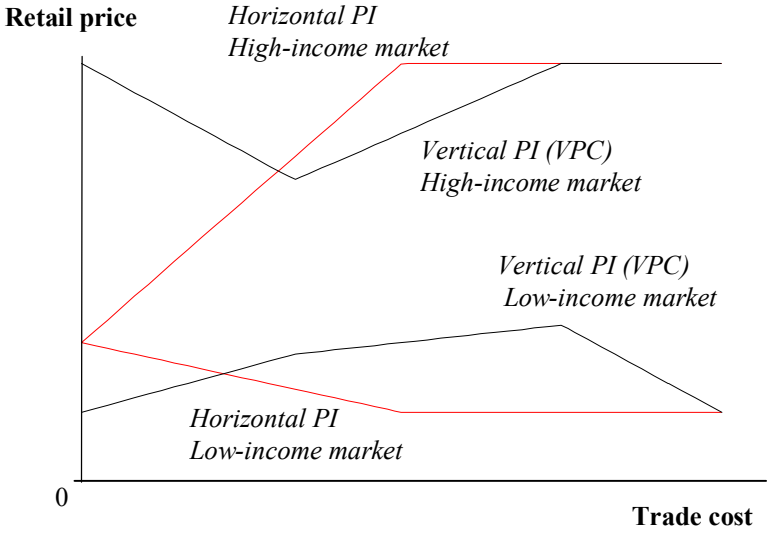
In the range of high trade costs, the retail price in the high-income market is unaffected by PI and is, thus, independent of variations in variable trade costs. In a lower, intermediate range of variable trade costs, however, retail prices in both markets will be affected by parallel trade. For intermediate trade costs, PI occur in equilibrium and the manufacturing firm sets a wholesale price in the low-income market to reduce the incentives for it. The retail price in the low-income market is, consequently, higher than in the segmented equilibrium. The retail price in the high-income market will be lower than in the segmented equilibrium since parallel trade competes with the supplies of the local distributor. It is interesting to note that in the intermediate range of trade costs, retail prices in both markets fall and the price differential is reduced as markets become more integrated (variable trade costs are reduced). In other words, market integration results in partial price convergence and benefit consumers in both markets in this intermediate range of trade costs.

At very low variable trade costs, the effects of PI depend on the alternatives available to the manufacturing firm. If the only alternative is to limit the volume of PI, and competition in the high-income market, by setting the wholesale price in the low-income market, then retail prices would be lower than in the intermediate range of trade costs and the price differential would be smaller. However, if the manufacturing firm can reduce competition in the high-income market by choosing a higher wholesale price for the distributor in this market, then the retail price in the high-income market can be higher than in the intermediate range of trade costs and the price differential can be larger. In fact, in the latter case prices will diverge to the segmented level at zero trade costs.

Figure 6.2 illustrates retail prices as functions of variable trade costs. The differences between the arbitrage and VPC cases are

multiple. First, in the arbitrage case the retail price in the low-income market decreases as variable trade cost rises, then becomes flat with market segmentation. It first rises and then falls in the VPC case. Second, the retail price in the high-income market increases as the variable trade cost goes up in the arbitrage case, becoming flat when markets are segmented and the monopoly price is sustained. It first falls and then rises in the VPC case before the monopoly price prevails. Third, in the intermediate range of trade costs the retail price in the high-income market is lower in the VPC case compared to the arbitrage case. The opposite is true for the low-income market. Fourth, for an intermediate range of trade costs in the VPC case, retail prices in both markets are increasing functions of the variable trade cost, a pattern never occurring in the arbitrage case.

Figure 6.2 Retail prices in the high-income and low-income markets as functions of trade cost (t).



Note: The figure illustrates the VPC case in which the IPR holder reacts by changing the wholesale prices in both the low-income and high-income market.

6.3.3 Consumer surplus and profits

The effects of trade cost on consumer welfare differ between the two markets. Essentially consumer welfare is a function of the

equilibrium retail price and it has a pattern that is similar to the consumer retail price.[84] In the arbitrage case, consumer welfare in the low-income market rises as trade cost increase to an intermediate level, where it flattens out and remains at its segmented level. In other words, consumers in the low-income market benefit from market segmentation and would prefer an equilibrium in which parallel trade is not permitted. Consumer welfare in the high-income country, on the other hand, falls as variable trade costs rise. Consumers in the high-income market benefit from market integration and prefer an equilibrium in which PI are permitted. The combined consumer surplus is less obvious to analyze and the aggregate effect of PI on consumer welfare depends on the functional form of the demand curves. For instance, in the case with linear demand curves the combined consumer surplus in the high-income and low-income countries falls as variable trade costs increase. Welfare for the consumers as a group is, therefore, positively affected by market integration and parallel trade. From a combined consumer perspective, therefore, trade liberalization (or reductions in transaction costs) and PI are important complements in the arbitrage case.

In the VPC case, consumer welfare in the high-income market is always higher with PI than in an equilibrium in which parallel trade is not permitted. Consumer welfare in the low-income market initially falls as the variable trade cost increases but then rises at high levels of trade costs. Consumers in the low-income market would benefit from a ban on parallel trade. However, if PI are allowed these consumers would gain from reducing trade costs as much as possible.

Combined consumer surplus depends on the alternatives available to the manufacturing firm. First, starting with a case in which the manufacturing firm cannot reduce competition in the high-income market by choosing a higher wholesale price there, combined consumer surplus will fall and then increase as the variable trade cost rises. Combined consumer surplus will be at a maximum in a completely integrated equilibrium. It will reach a minimum at moderately high trade costs, where the retail price in the low-income market is high due to the efforts by the manufacturing firm to block parallel trade. Second, if the manufacturing firm has the

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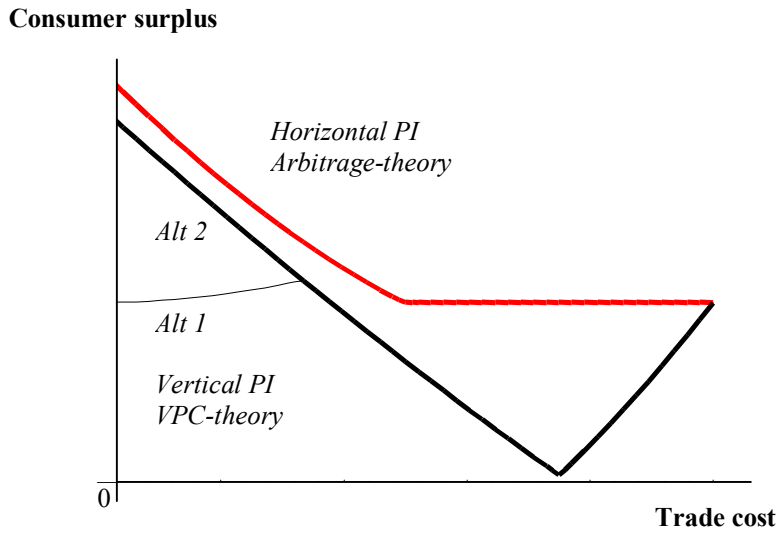
[84] We ignore dynamic consumer welfare effects from reduced product innovation.

ability to reduce competition in the high-income market with a higher wholesale price in this market, combined consumer surplus would be significantly lower in the completely integrated equilibrium as competition would be less aggressive.

Combined consumer surplus is illustrated in Figure 6.3. To summarize, parallel trade and market integration typically benefit consumers in the high-income (import) markets while consumers in low-income (export) markets may be hurt. Moreover, market integration at intermediate levels of variable trade costs is typically in the interest of all consumers.

Figure 6.3 Combined consumer surplus in the low-income and high-income markets as a function of trade cost (t).

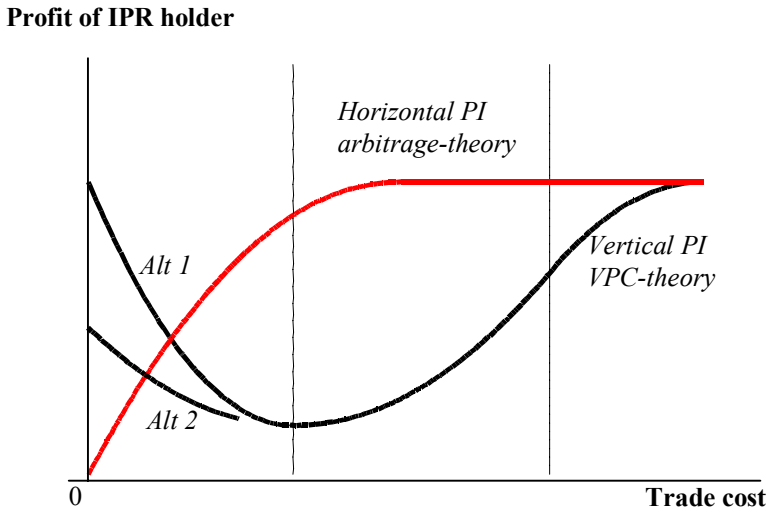


Note: The VPC case (lower lines) with wholesale price reaction in both markets (Alt 1) and the low-income market only (Alt 2).

Finally, turn to the profits of the IPR-holder. In the arbitrage case, the profit of the manufacturing firm increases as the variable trade cost rises. It reaches its maximum at the variable trade cost level that blocks parallel trade and remains at that monopoly level for all higher trade costs. Thus, in the arbitrage case, market segmentation through a ban on parallel trade is in the interest of manufacturing firms and IPR holders in general.

In the VPC case, profits fall as variable trade costs rise when the situation is close to a completely integrated equilibrium. The reason is that resources are wasted in costly arbitrage activities and the effort to reduce the volume of parallel trade causes a distortion in the low-income market. At an intermediate level of trade costs, the profit of the manufacturing firm starts to rise as the variable trade cost goes up. The reasons are that trade costs reduce the incentive for the low-income market distributor to engage in parallel trade, fewer resources are used in trade activities and the wholesale price can be set closer to the optimal (segmented) level. The profit of the manufacturing firm eventually reaches the monopoly level when markets are completely segmented. The profit of the manufacturing firm as a function of the variable trade cost is illustrated in Figure 6.4.

Figure 6.4 The IPR holder's profit as a function of trade cost (t).



Note: The VPC case (the quasi-convex functions) with wholesale price reaction in both markets (Alt 1) and the low-income market only (Alt 2).

6.3.4 Theoretical hypotheses

The analysis of PI as either arbitrage or a vertical price control problem results in a number of theoretical predictions. Some can be tested directly or indirectly and used to verify or reject the two competing explanations that we have presented. Table 6.1 summarizes some of the most important implications of our models.

Retail and wholesale prices are often observable and are good candidates for possible tests of our models. It is particularly relevant to note that the arbitrage and VPC models have opposite predictions for wholesale prices. The arbitrage theory predicts that the wholesale price in the low-income (export) market should be a falling and convex function in trade costs. We should expect a negative effect of linear trade costs and a positive effect of squared trade costs. The VPC theory, in contrast, predicts that the wholesale price in the low-income (export) market should be a rising and eventually falling function of trade costs. We should expect a positive effect of linear trade costs and a negative effect of the trade cost squared. This is essentially the theoretical prediction we will test in the next section.

Correspondingly, one can derive testable predictions for the retail prices. The arbitrage theory predicts that the retail price in the low-income (export) market should be a falling and convex function of trade costs. We should expect a negative effect of linear trade costs and a positive effect of the trade cost squared. The VPC theory, predicts that the retail price in the low-income (export) market should be a rising and eventually falling function of trade costs. We should expect a positive effect of linear trade costs and a negative effect of the trade cost squared.

Table 6.1 Theoretical predictions and welfare implications

Panel A: The arbitrage theory of parallel imports			
Variable	Trade cost	Trade c sqr	PI regime
Wholesale price in exp market	-	+	Higher
Wholesale price in imp market	0	0	No diff.
Retail price in exp market	-	+	Higher
Retail price in imp market	+	-	Lower
Consumer welfare in exp market	-	+	Lower
Consumer welfare in imp market	+	-	Higher
Consumer welfare (combined)	-	+	Higher
Profit of IPR holder	+	-	Lower
Welfare	-	+	Higher

Panel B: The VPC theory of parallel imports			
Variable	Trade cost	Trade c sqr	PI regime
Wholesale price in exp market	+/-	-	Higher
Wholesale price in imp market	-	+	Higher/ no diff.
Retail price in exp market	+/-	-	Higher
Retail price in imp market	-/+	+	Lower
Consumer welfare in exp market	-/+	+	Lower
Consumer welfare in imp market	+/-	+/-	Higher
Consumer welfare (combined)	Ambig.	Ambig.	Ambig.
Profit of IPR holder	-	+/-	Lower
Welfare	-	Ambig	Lower

Note: ”PI regime” refers to the level of the variable in an equilibrium in which parallel trade is permitted relative to the level in an equilibrium in which parallel trade is banned, i.e. ”higher” (”lower”) means the variable is higher (lower) when PI is permitted compared to when it is not.

A number of other potentially testable predictions can be pointed out. First, the arbitrage theory of parallel trade predicts that PI will not occur in equilibrium while the VPC theory predicts that it will (for low and intermediate trade costs). Second, the arbitrage theory of parallel trade predicts that arbitrage only restricts pricing in countries with relatively high retail prices. The VPC theory predicts that parallel trade can flow from countries with high retail prices to countries with lower retail prices. We will not test these predictions formally.[85]

The predictions about consumer and total welfare effects cannot be tested directly since we observe neither consumer surplus nor total welfare. It is nevertheless important to observe that the theoretical predictions have important implications for our policy discussion once we have used prices to verify or reject our models. If data on prices support the arbitrage theory of parallel trade, the result would imply that consumers in the high-income market will benefit, consumers in the low-income market will lose and IPRs holders will lose when markets become more integrated. In this case IPRs holders and consumers in low-income countries may prefer a PI ban to a partially integrated equilibrium in which parallel trade is permitted. Despite these interests, it can still be the case that total welfare is higher in the integrated equilibrium with arbitrage than in a segmented equilibrium with a PI ban.

If data support the VPC theory of parallel trade, the result would indicate that consumers in the high-income market are better off with PI than in a segmented market. Moreover, it implies that consumers in the low-income market are worse off. If the pro-competitive effect in the high-income market is sufficiently strong, then combined consumer surplus would be higher than in a segmented equilibrium. However, it is possible that total consumer surplus is lower under a PI equilibrium with a weak pro-competitive impact. In addition, the VPC theory implies that real resources are wasted in parallel trade, reducing profits as well as total welfare. Finally, at relatively low trade costs it is in the interest of all groups to continue market integration (that is, drive trade

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[85] Maskus and Chen (2002, 2003) discuss survey evidence that is relevant for these predictions, noting in particular cases where parallel trade flows from high-retail price countries to low-retail price countries.

costs toward zero) as consumers in both low-income and high-income markets and also producers would benefit.

6.4 Empirical analysis

Customs authorities do not collect data on parallel imports, making systematic empirical analysis of such trade flows difficult. Instead, we perform an econometric analysis of price data that is aimed at testing key implications of the VPC and arbitrage models.

Because they are not collected, we do not have data on quantities of PI. Still, we may use econometric analysis of international wholesale prices (specifically, distribution-level export prices) to test indirectly our predictions. Our regression analysis is designed to exploit the prediction from the VPC model that the equilibrium wholesale price set by the manufacturer in low-income markets has an inverted U-shape. It initially increases and then decreases in the cost of engaging in parallel importing. In contrast, the arbitrage model predicts a relationship that is convex rather than concave. Thus, quadratic regressions of the international distribution of wholesale prices on trade costs should provide evidence on these predictions. For this purpose, the trade cost between a high-income market and a low-income market is a good measure of this cost because the manufacturer is concerned about wholesalers (or PI firms) in the latter area exporting its products to the former area.

An appropriate empirical framework in which to test our model is one in which a single manufacturer sets varying wholesale prices in different export destinations. For this purpose, we employ intra-EU export prices in 53 highly disaggregated (8-digit Harmonized System (HS) classification) products that may be thought subject to parallel trade in eight member states of the European Union (Sweden, Denmark, Germany, UK, France, Italy, Spain and Greece) in two years (1998 and 1999).[86] The export unit-value data and CIF rates for 1998 and 1999 were taken from the COMEXT CD-ROM 2000 compiled by Eurostat. In our view, these international trade prices should capture wholesale prices because substantial amounts of trade occur through distributors (Maskus and

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[86] Later in the report we present some earlier econometric results using data on U.S. export prices to many countries.

Chen, 2002). We define the wholesale price as the export price at the border of the source market. The 53 categories we use are listed in the Appendix.

We adopt the following regression equation:

$$e_{ij} = a + b_1 Y_j + b_2 TC_i + b_3 TC_i^2 + \varepsilon_{ij}$$

In this equation, e_{ij} is the export price at the border. Thus, we are attempting to analyze statistically the structure of export prices set by the manufacturer at the port. The variable TC is the percentage transport costs as estimated from differences in the bilateral values of intra-EU exports to each market, measured with and without charges for cost, insurance, and freight (CIF). As an alternative measure, we use the geographical distance in kilometers between the export and import market as a proxy for the variable trade cost. The VPC theory predicts a positive sign on the linear term and a negative sign on the quadratic term. The arbitrage theory predicts a negative sign on the linear term and a positive sign on the quadratic term. Finally, the variable Y is relative population in the importing country (that is, importer population divided by exporter population). This variable would have a negative coefficient if it reflects relative demand size[87], for a large export market would generate a high price but a low population ratio. However, this is only one conjecture. It is conceivable, for example, that the coefficient would be negative if larger export markets tend to have more competitive wholesale distribution sectors. It is included here as a control for such price determinants without a strong prediction as to its sign.

In the regressions we also incorporate country dummy variables. We include these fixed effects in order to control for idiosyncratic pricing decisions associated with specific countries. We exclude the dummy for Sweden, making it the reference case. Furthermore, in the regressions we also incorporate product dummy variables, controlling for idiosyncratic pricing decisions associated with product categories. Summary statistics for the main variables used in the regressions are presented in the Appendix.

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[87] We use population rather than GDP as a proxy for market size since the latter has the problem that it is also a measure of income and could potentially affect the elasticity of demand.

In the regressions we consider two samples. The first regression uses the entire sample with all eight countries as source markets. However, the vertical control problem is likely to be more relevant for high-income, high-price markets since one can expect these countries to be likely targets for parallel imports. In our sample there are two countries with a relatively high average price level, Denmark and the UK. Table 6.2 presents the average wholesale price in our sample for each country. The UK has an average price level that is 6,5 percent above the mean while Denmark's price level is 10,7 percent above the mean. Sweden has a price level slightly (approximately 1 percent) above the average, while Spain has a price level more than 6 percent below the average. It is interesting to note that the dispersion in wholesale prices in this sample seems to be significantly less than the typical price dispersion one finds in retail price surveys.

Table 6.2 Average export prices to a specific country to a specific country relative to the mean export price to eight EU-markets, 1998-1999

Country	Price level
France	95,0%
Germany	96,9%
Italy	96,4%
The United Kingdom	106,5%
Denmark	110,7%
Greece	100,2%
Spain	93,9%
Sweden	101,0%

Note: The price level was computed as the mean of the deviations from the average export price of each product. Authors' calculations based on Eurostat data from COMEXT CD-ROM 2000 suppl.

Table 6.3 presents our regression results, performed with ordinary least squares but adjusting the standard errors to be heteroskedastic-consistent.[88] The dependent variable in all cases is the export price

[88] Because the list of products covers goods with widely divergent median unit prices, the presence of heteroskedasticity is likely.

to a specific market. Panel A is the regression with the entire sample, that is, all countries are both exporters and importers. Panel B use price data for just Denmark and UK as exporters, reflecting the possibility that these two countries are the most likely recipients of PI. In the first column we include direct measure of trade costs, while in the second column we incorporate both trade costs and distance.

Our first result is that relative population exerts a negative influence on wholesale price in the aggregate sample. The result is not statistically significant, except weakly in one case with Denmark and the UK.

Second, a key finding is that the CIF/FOB trade cost, a measurable component of the costs of parallel-exporting goods back from distributor markets abroad to the home market, operates as predicted by the arbitrage theory for the entire sample. Specifically, there is a quadratic relationship between wholesale price in the export market and the CIF/FOB trade cost by product category. Note, however, that only the linear term is significant (at the five percent level) while the quadratic term is only significant at the 25 percent-level. Focusing on this linear term, it seems that wholesale prices set in different export markets are a falling function of trade costs. This result suggests that price differentials across geographical markets within the EU would be reduced if market integration continued in the form of lower transactions costs.

Most of the country dummy variables are insignificant. The major exceptions are the UK, Greece and Spain, which register negative coefficients. This suggests that export prices from these three markets are significantly lower than export prices from Sweden. In the case of the UK this highlights the possibility that there is a potential vertical control problem. In the case of Greece and Spain it perhaps can be explained by product heterogeneity within each product category in our sample. These countries might be expected to export goods that are lower-quality on average and therefore command a lower price premium.

Table 6.3 Regressions on wholesale price in export market

Panel A: All countries			
Exogen. Variable	Coefficient		Std error
Trade cost	-2,04	**	0,88
Trade cost sqr	0,19	(*)	0,17
Population	-0,16		0,11
France	-0,66		1,04
Germany	-1,45		1,00
Italy	-1,08		1,04
UK	-2,14	**	1,06
Denmark	-0,42		1,24
Greece	-1,48	*	0,84
Spain	-2,46	**	0,98
Constant	12,19	***	3,51
Dummy variables	Yes	***	
Number of obs	1320		
R-squared	0,72		

Note: Robust std errors. Significance levels: * denotes significance at the 10%-level, ** denotes significance the 5 %-level and *** denotes significance at the 10 %-level. The estimated coefficient for trade cost squared is significant at the 25%-level. Authors' regressions based on Eurostat data from COMEXT CD-ROM 2000 suppl.

Panel B: UK and Denmark					
	Reg I			Reg II	
Exog. Variable	Coeff	Std err	Coeff		Std err
Trade cost	1,75	1,49	1,33		1,38
Trade cost sqr	-0,39	0,24	-0,33		0,23
Distance			0,01	**	2,8E-03
Distance sqr			-3,2E-06	**	1,3E-06
Population	-0,18	0,15	-0,26	*	0,15
UK	-2,77	2,12	-3,02		2,16
Constant	24,70	16,09	24,32	*	14,19
Dummy variables	Yes	***	Yes	***	
Number of obs	279		279		
R-squared	0,76		0,77		

Note: See panel A

Next, having identified the UK and Denmark as high-income export countries we turn to the results for these two markets only. In Panel B we report the results for wholesale prices in partner countries of the UK and Denmark. As noted, the effect of population in the export market is negative. Interestingly, the wholesale price is a positive and concave function of variable trade cost. The signs of the coefficients behave in this fashion but are insignificant using the direct measure of trade costs. Using bilateral distance, however, we find a clear and significant quadratic function as predicted. A joint test of the parameters in both the trade cost and distance variables rejects the hypothesis that the parameters are equal to zero in both the linear and quadratic terms.

This result is consistent with the VPC theory of parallel trade. Thus, for products facing low transport costs, exporters in the UK and Denmark set foreign wholesale prices that rise with those costs in order to deter re-imports of parallel goods. But for products with high trade costs, exporters set wholesale prices that fall as transport costs rise. We can find no reason outside our model why foreign prices should vary in this way as trade costs increase. This last result supports our hypothesis that the VPC theory of parallel trade is likely to be particularly relevant for exporters in high-income, high-price, IPR-intensive markets (such as the UK and Denmark) while the arbitrage theory of parallel trade seems to be important in general.

Finally, turning to results for specific exporters we report results for the UK, Denmark and Sweden in table 6.4. Again our results confirm that wholesale price is a positive and concave function in variable trade cost for the UK and Denmark. In the case of the UK the parameters for distance and distance squared have the expected signs and are both significant. The parameters for CIF/FOB trade cost have the right signs but are insignificant. In the case of Denmark the parameters for distance and distance squared have the expected signs but are both insignificant. The parameters for CIF/FOB trade cost have the right signs and are both significant. In the regression for Sweden, the parameters have alternating signs for CIF/FOB trade costs and distance and none of the estimated parameters are significant. This could suggest that neither the arbitrage theory nor the VPC theory dominates as an explanation for wholesale prices set by Swedish IPR holders. In fact, both explanations could be important depending on the particular product.

Table 6.4 Regressions on wholesale price in export market

Panel A: UK						
		I			II	
Exog. Variable	Coeff		Std err	Coeff		Std err
Trade cost	1,48	(*)	1,25			
Trade cost sqr	-0,29	(*)	0,20			
Distance	6,1E-03	**	3,5E-03	3,9E-03	*	2,1E-03
Distance sqr	-2,8E-06	*	1,7E-06	-1,3E-06	*	7,3E-07
Population	-0,63		0,95	-0,67		0,92
Constant	21,23		15,08	7,47		5,40
Dummy var	Yes	***		Yes	***	
No of obs	188			629		
R-squared	0,84			0,57		

Note: Robust std errors. Significance levels: * denotes significance at the 10%-level, ** denotes significance the 5 %-level and *** denotes significance at the 10 %-level. It is worth noting that the estimated coefficients for trade cost and trade cost squared are significant at the less conventional 25%-level. Authors' regressions based on Eurostat data from COMEXT CD-ROM 2000 suppl.

Panel B: Denmark						
		I			II	
Exog. Variable	Coeff		Std err	Coeff		Std err
Trade cost	4,50	*	2,38	4,40	*	2,43
Trade cost sqr	-1,73	***	0,52	-1,70	***	0,54
Distance	3,4E-03		5,6E-03			
Distance sqr	-1,9E-06		2,2E-06			
Population	-0,10		0,10	-0,06		0,07
Constant	82,89	***	2,43	-1,87		2,24
Dummy var	Yes	***		Yes	***	
No of obs	91			91		
R-squared	0,97			0,96		

Note: Robust std errors. Significance levels: * denotes significance at the 10%-level, ** denotes significance the 5 %-level and *** denotes significance at the 10 %-level. Authors' regressions based on Eurostat data from COMEXT CD-ROM 2000 suppl.

Panel C: Sweden			
Exog. Variable	Coefficient		Std error
Trade cost	-8,32	(*)	5,23
Trade cost sqr	0,96	(*)	0,77
Distance	3,89E-03		1,30E-02
Distance sqr	-4,45E-07		3,89E-06
Population	-0,36		0,68
Constant	12,93		11,67
Dummy variables	Yes	***	
Number of obs	102		
R-squared	0,77		

Note: Robust std errors. Significance levels: * denotes significance at the 10%-level, ** denotes significance the 5 %-level and *** denotes significance at the 10 %-level. The estimated coefficient for trade cost is significant (negative) at the 15%-level and the estimated coefficient for trade cost squared is significant (positive) at the 25%-level. Authors' regressions based on Eurostat data from COMEXT CD-ROM 2000 suppl.

6.5 Policy discussion

In this section we discuss some policy issues regarding parallel trade, beginning with intra-EU trade and then turning to external trade. While we relate the discussion to the model and empirical analysis to the extent possible, the issues are inevitably broader.

6.5.1 Intra-EU parallel imports

Despite several decades with a formally integrated "single market" in the European Union in which parallel trade is permitted, prices of products traded within the EU remain widely dispersed. [89] This indicates that parallel trade has had a limited impact in many consumer markets in Europe. The remaining market segmentation is likely caused by non-tariff barriers to trade and barriers to entry or the strategic behavior by firms active in the internal market. This suggests that several policy instruments can be important complements to PI in the continuing process of market integration.

[89] See e.g. "Ekonomirådets rapport 2002: Gränslös konkurrens", SNS Förlag, 2002.

First and foremost, one has to note that the market power of IPRs holders is ultimately determined by the availability of substitutes for customers. The scope for price discrimination and monopoly pricing is limited as long as the horizontal (inter-brand) competition between different IPRs owners is intense. Measures taken to reduce barriers to entry will consequently have a direct positive effect on consumer welfare in the European Union.

Second, turning to the limited impact of PI we observe that several factors are important. Generally, both trade barriers *and* firm behavior limit the scope for market integration. The former problem can be dealt with using additional liberalization and integration policies, including attempts to reduce transactions costs in trade, while the latter has to be handled with competition policy.

Integration and liberalization policy can be an important instrument to reinforce the market integrating effect of parallel trade. Integration policy can reduce and remove remaining technical barriers to trade, such as different technical standards for consumer products.[90] Liberalization policy, on the other hand, can be an important instrument in facilitating entry in distribution and to foster competition in the retail sector. Legal and economic barriers to entry at the retail level will obviously restrict the possibilities for parallel importers to sell traded products to consumers in high-price markets.

Finally, competition policy in the European Union ultimately determines to what extent IPRs holders are allowed to take counteracting measures to restrict the scope for parallel trade within the internal market. Manufacturing firms and IPRs owners will naturally try to take measures to prevent market integration for consumers. Our theoretical and empirical analysis suggests that manufacturers try to prevent arbitrage by raising the wholesale prices in low-price markets. Similar in spirit, "inventory-management-systems" are introduced to put curbs on parallel trade. In addition, vertical mergers and acquisitions also result in limitations for parallel trade and cross-border arbitrage.

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[90] It is key to observe that harmonization (rather than mutual recognition) of standards is critical for parallel trade to be an efficient constraint on international price discrimination since small differences in technical standards can be significant barriers to trade for individuals.

Competition policy thus has to strike a delicate balance between market integration, on the one hand, and an efficient vertical organization of industries in Europe, on the other. The important conclusion, however, is that it seems to be impossible to have a strongly liberal policy towards vertical restraints and achieve full European market integration at the same time.

6.5.2 EU trade policy and parallel imports

The European Commission recently has deliberated the issue of whether to recommend a deregulation of PI from outside the common market. Our analysis suggests some points that are relevant for this consideration.

First, if external parallel trade were to be liberalized, policy makers should consider limiting this deregulation to partner countries with similarly high incomes and IPRs regimes that are approximately as strong as that in the EU. To take the latter point first, to open the EU to parallel imports from countries with weak protection and enforcement of IPRs would raise considerable concerns about the true origin of goods, the willingness and ability of original manufacturers to offer warranties, and the risk of counterfeit products entering the market. Moreover, European firms would face difficulties in enforcing rights against infringement in countries with weak IPRs. In order to compete with lower-priced imitation goods in those markets, such firms would need to charge lower prices of legitimate products, raising the scope for actual parallel trade.

Putting the problem in different terms, it is important to recognize that there exists an indirect problem from divergent intellectual property protection in different countries. Parallel imports reduce the original manufacturers control over distribution. As a consequence there is a risk that trade in copies and imitation goods would increase under open PI unless the original IPRs holder is permitted to take countermeasures to control the authenticity of imported products. It could do this by verifying the original sources, controlling the distribution chain or undertaking unique

labeling.[91] The problem with these measures is that the IPRs holder has an incentive to control distribution for two reasons. The first is to verify the authenticity of the product and the second is to limit the scope for arbitrage by restricting supply to arbitrageurs up-stream in the distribution chain. In other words, there is a potential conflict between the scope for arbitrage and the legitimate interest of IPRs owners to limit the scope for illegal trade with counterfeits.

Regarding the issue of income differences, an open policy of PI with poor countries as potential source markets would risk extensive arbitrage of goods from those areas to the EU. While consumers in the EU would gain and IPRs holders would lose, a concern exists that original manufacturers would choose to raise prices in the source countries or pull out of them altogether. Thus, this policy would be anti-competitive in the developing countries. However, as regards trade with countries at similar levels of income we would expect a mix of pro-competitive price impacts because of expanded intra-brand competition.

This optimistic conclusion needs to be moderated, however, by noting that IPRs owners cannot be expected to react passively to a significant change in the regulatory regime. If a bilateral agreement were to make parallel trade legal between the EU and the United States, for example, firms in both regions would react in ways that could offset the pro-competitive impacts. Results shown in Table 6.5 demonstrate that there is significant evidence that the VPC model is relevant for the international pricing of American products. In that estimation, which included numerous control variables that are not listed here, the structure of U.S. export prices across markets was related to the U.S. tariff rate by product and the tariff rate squared. These variables represent the quadratic specification of trade costs in shipping PI back to the United States. It is found that costs bear a concave relationship with these costs, consistent with the VPC theory.

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[91] Cf. *New Zealand Herald: Copyright summit asks for help to stop pirates, 24-Aug-1999 och Microsoft hits back in CD piracy battle, New Zealand Herald; 21-Aug-1999*

Table 6.5 Estimation of the VPC Model for the US

Variable	Export Price	Export Price
Constant	51.5	-2405**
GDPPC	-0.17**	-0.09
US Tariff	329115***	332717***
US Tariff Squared	-0.53e+7***	-0.52e+7***
Sample size	522	972
Adjusted R2	0.26	0.24

Note: coefficients are indicated as significantly different from zero at the five- percent level (**) and one-percent level (***), based on heteroskedasticity-consistent standard errors.
Source: Maskus and Chen (2003).

What this result suggests is that, as demonstrated in our theoretical analysis, an open regime of PI between the United States and the EU would not necessarily achieve pro-competitive reductions in European prices. For one thing, American firms could choose to restrict supplies to European distributors. Within the context of the model, it is possible that wholesale prices in the EU could rise if PI were deregulated, for the current segmentation in branded goods presumably permits more efficient vertical pricing. Thus, it clearly cannot be guaranteed that deregulation with the United States would sustain lower prices in the European Union. Of course, the opposite is true as well, as European firms might raise their wholesale prices in the United States in reaction to deregulation. Thus the empirical issue is critical. Our work cannot provide a definitive prediction on what will happen but surely some elements of vertical pricing would be evident in company reactions.

Despite this ambiguity, one clear result comes from our analysis, which is that there is a complementarity between the treatment of parallel trade and trade liberalization. It is clear from the VPC model that, if the European Union were to deregulate its restrictions on PI from outside the region, its gains would be maximized by integrating with its trading partners to the fullest extent possible. This is because permitting PI subject to real trade costs is wasteful. Thus, policy-based restrictions on trade, or anti-competitive arrangements that raise trade costs, would best be removed in an environment of open PI.

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Appendix A: Summary statistics

Variable	Obs	Mean	Std. Dev.
Exp price (eur/unit)	4247	6,48	16,80
Trade cost	1320	1,83	0,95
Trade cost sqr	1320	4,24	5,37
Distance	28	1 424	643
Distance sqr	28	2 440 907	1 928 389
Relative population	28	2,43	3,36
Population	8	40,2	27,0
Relative GDP/cap	28	1,03	0,24
GDP/cap	8	20 803	3 092

Note: Eurostat, COMEXT CD-ROM 2000 suppl.

Appendix B: List of products in the full sample

(Source: Comext CD-rom, Eurostat, 2000)

17041011 CHEWING GUM
17049030 WHITE CHOCOLATE
17049065 CONFECTIONERY
17049075 TOFFEES, CARAMELS AND SIMILAR SWEETS
17049099 MARZIPAN, NOUGAT ETC
18063100 CHOCOLATE
22011011 MINERAL WATERS, NAT, NOT CARBONATED
22011019 MINERAL WATERS, NAT, CARBONATED
22029010 NON-ALCOHOLIC BEVERAGES
22041011 CHAMPAGNE
22042166 QUALITY WINES PRODUCED IN TOSCANA
22083011 BOURBON WHISKEY
22086011 VODKA
33030010 PERFUMES
33030090 TOILET WATERS
33041000 LIP MAKE-UP PREPARATIONS
33042000 EYE MAKE-UP PREPARATIONS
33071000 SHAVING PREPARATIONS
61022010 WOMEN'S OR GIRLS' OVERCOATS
61031100 MEN'S OR BOYS' SUITS OF WOOL
61031900 MEN'S OR BOYS' SUITS OF TEXTILE
61046210 WOMEN'S OR GIRLS' TROUSERS
61082200 WOMEN'S OR GIRLS' BRIEFS
61082900 WOMEN'S OR GIRLS' BRIEFS OF TEXTILE
61091000 T-SHIRTS
64021210 SKI-BOOTS AND X-CTRY SKI FOOTWEAR
64031900 SPORTS FOOTWEAR
64035935 MEN'S FOOTWEAR
64035939 WOMEN'S FOOTWEAR
64041100 TENNIS, BASKETBALL, GYM SHOES
84158190 AIR CONDITIONING MACHINES
84158280 AIR CONDITIONING MACHINES
84158390 AIR CONDITIONING MACHINES
84181091 COMBINED REFRIGERATOR-FREEZERS
84182110 HOUSEHOLD REFRIGER, CAPACITY > 340 L
84182151 HOUSEHOLD REFRIGER, TABLE MODEL
84182159 HOUSEHOLD REFRIGER, BUILDING-IN TYPE
84211200 CENTRIFUGAL CLOTHES-DRYERS

84221100 DISH-WASHING MACHINES
84221900 DISH-WASHING MACHINES
84501111 LAUNDRY-TYPE FRONT-LOADING
84501119 LAUNDRY-TYPE TOP-LOADING MACHINES
84501190 FULLY-AUTOMATIC LAUNDRY MACH
84501200 HOUSEHOLD OR LAUNDRY-TYPE MACH
85241000 GRAMOPHONE RECORDS
85243200 MUSIC CDS
85243990 DVDS
85254099 VIDEO CAMERA RECORDERS
85271210 POCKET-SIZE RADIO/CASSETTE-PLAYERS
85271290 WALKMAN CASSETTE-PLAYERS
85271391 CASSETTE RADIOS
85281222 TELEVISION RECEIVERS, INCORP A VIDEO
85281256 TELEVISION RECEIVERS > 52 CM TO 72 CM
85281258 TELEVISION RECEIVERS, SCREEN OF > 72 CM
90065100 SINGLE LENS REFLEX CAMERAS
90065300 CAMERAS FOR ROLL FILM OF OF 35 MM
90065310 DISPOSABLE CAMERAS

APPENDIX A THEORETICAL MODEL OF PARALLEL IMPORTS

A manufacturer, M, sells its product in two countries, A and B. In country A and B, M sells its product through independent exclusive distributors, L_A and L_B. The demand in A is $q = 1 - p$, and that in B is $q = S(1 - bp)$. For convenience, assume $b \geq 1$ and, hence, demand is more elastic in B (for any given price p). S is the population of market B, assuming that the population in A is normalized to 1. Manufacturer M has a constant marginal cost of production c, which is normalized to zero, and the marginal cost of retailing in both countries is normalized to zero as well.

Suppose that M can offer distributor L_i $(i = A, B)$ any contract in the form of (w_i, T_i), where w_i is the wholesale price at which L_i purchases from M and T_i is a transfer payment (franchise fee) from L_i to M. However, M cannot prevent L_B from selling the product in A, either directly or through intermediaries. That is, either M cannot legally limit L_B's territory of sales, or it is too costly for M to enforce any such constraint. Suppose that L_B incurs an additional constant marginal cost $t \geq 0$ in selling the good in A. For instance, t could be the additional transportation

cost or tariff. Assume $t \leq \frac{1}{2}$ so that L_B's cost of selling the product to A is not too high. Assume that if L_B sells in Country A, it will compete with L_A in a Cournot fashion.

Let the quantities sold in A by L_A and L_B be q_{aA} and q_{aB}, respectively, and the quantity sold in B by L_B be q_{bB}. A subgame-perfect Nash equilibrium is a pair (q_{aA}, q_{aB}) that constitute a Nash equilibrium for any (w_i, T_i) for $i = A, B$, together with an optimal choice of q_{bB} by L_B for any (w_B, T_B) and an optimal choice of (w_i, T_i) for $i = A, B$ by M. Let w denote the vector (w_A, w_B) and T denote the vector (T_A, T_B).

We start our analysis of the model by considering equilibrium in Country A, taking as given any (w_i, T_i) that is accepted by L_i. The profits of L_A and L_B through sales in A are:

$$\pi_{aA} = q_{aA}\left[1 - (q_{aA} + q_{aB}) - w_A\right], \tag{1}$$

$$\pi_{aB} = q_{aA}\left[1 - (q_{aA} + q_{aB}) - w_B - t\right]. \tag{2}$$

The first-order conditions, which are also sufficient here, are:

$$1 - 2q_{aA} - q_{aB} - w_A = 0, \tag{3}$$

$$1 - q_{aA} - 2q_{aB} - w_B - t = 0, \tag{4}$$

provided $1/2 \geq w_B + t$.

Therefore, given any (w_i, T_i) that is accepted by L_i for $i = A, B$, there exists a unique Nash equilibrium in A, $(q_{aA}(w_A, w_B), q_{aB}(w_A, w_B))$, given by

$$q_{aA}(w) = \frac{1 - 2w_A + w_B + t}{3}, \tag{5}$$

$$q_{aB}(w) = \frac{1 + w_A - 2w_B - 2t}{3}, \text{ if } w_B \leq \frac{1}{2} - t; \tag{6}$$

$$q_{am}(w) = \frac{1 - w_A}{2}; \; q_{al}(w) = 0, \text{ if } \frac{1}{2} - t < w_B. \tag{7}$$

The equilibrium price in Country A, as a function of w_B, is

$$p_a(w) = \begin{cases} \frac{1+w_A+w_B+t}{3} & if \quad w_B \leq \frac{1}{2} - t \\ \frac{1+w_A}{2} & if \quad \frac{1}{2} - t < w_B. \end{cases} \tag{8}$$

When $\frac{1}{2} - t \geq w_B$,

$$\pi_{aA}(w) = \frac{(1 - 2w_A + w_B + t)^2}{9}, \tag{9}$$

$$\pi_{aB}(w) = \frac{(1 + w_A - 2(w_B + t))^2}{9}. \tag{10}$$

The industry profit generated through sales in Country A, $\pi_a(w)$, thus is

$$\begin{aligned}\pi_a(w) &= \frac{(1-2w_A+(w_B+t))^2}{9}+\\ &\quad \frac{(1+w_A-2(w_B+t))^2}{9}+\\ &\quad w_A\frac{1-2w_A+w_B+t}{3}+\\ &\quad w_B\frac{1+w_A-2w_B-2t}{3}. \end{aligned} \tag{11}$$

When $\frac{1}{2}-t \geq w_B$, we have

$$\pi_{aA}(w) = \frac{(1-w_A)^2}{4},\ \pi_{aB}(w) = 0 \tag{12}$$

and the industry profit is

$$\pi_a(w) = \frac{(1-w_A)^2}{4} + w_A\frac{1-w_A}{2}. \tag{13}$$

We next consider output and price in Country B, again taking as given any (w_B, T_B) that is accepted by L_B. Distributor L_B solves

$$\max_p \{S(1-bp_B)(p_B-w_B)\}. \tag{14}$$

The equilibrium (optimal) price and quantity in B thus are:

$$p_B(w) = \frac{1+bw_B}{2b};\ q_{bB}(w) = S\left(\frac{1-bw_B}{2}\right). \tag{15}$$

Firm L_B's operating profit in B, excluding T, is $\pi_{bB}(w) = \frac{S}{b}\left(\frac{1-bw_B}{2}\right)^2$. We now turn to the equilibrium choice of (w_A, T_A) and (w_B, T_B) by M. In equilibrium, M can extract all the surplus from L_A and L_B by setting

$$T_A = T_A(w) \equiv \pi_{aA}(w) \tag{16}$$

$$T_B = T_B(w) \equiv \pi_{aB}(w) + \pi_{bB}(w) \tag{17}$$

Any contracts (w_A, T_A) and (w_B, T_B) are accepted by L_A and L_B in equilibrium. For notational purposes we define the following thresholds:

$$t_1 \equiv \frac{Sb}{4+5Sb} \tag{18}$$

$$t_2 \equiv \frac{3}{2}\left(\frac{Sb}{4+3Sb}\right) \tag{19}$$

The equilibrium choice of w_A and w_B therefore maximizes the joint industry profits in two countries and we have the following result:

Proposition 1 *The model has a unique subgame perfect Nash equilibrium. The equilibrium value of* w_A *and* w_B*,* w_A^* *and* w_B^**, are given by*

$$w^* = \begin{cases} w_A = \left(\frac{1-5t}{2} - \frac{2t}{Sb}\right), w_B = \frac{2t}{Sb} & if \quad t < t_1 \\ w_A = 0, w_B = 2\left(\frac{1+4t}{4+9Sb}\right) & if \quad t_1 \leq t < t_2 \\ w_A = 0, w_B = \frac{1}{2} - t & if \quad t \geq t_2 \end{cases}, \tag{20}$$

the equilibrium price in Country A is

$$p_A^* = \begin{cases} \frac{1}{2} - \frac{1}{2}t & if \quad t < t_1 \\ \frac{2+4t+3Sb(1+t)}{4+9Sb} & if \quad t_1 \leq t < t_2 \\ \frac{1}{2} & if \quad t \geq t_2 \end{cases}, \tag{21}$$

and the equilibrium price in Country B is

$$p_B^* = \begin{cases} \frac{S+2t}{2Sb} & if \quad t < t_1 \\ \frac{4+9Sb+2b+8tb}{2(4+9Sb)b} & if \quad t_1 \leq t < t_2 \\ \frac{1}{4} + \frac{1}{2b} - \frac{t}{2} & if \quad t \geq t_2 \end{cases}. \tag{22}$$

Since $q_{aB}(w^*) = \frac{3Sb(1-2t)-8t}{4+9Sb} > 0$ if and only if $t < t_2$, we have

Proposition 2 *Parallel importing occurs in country A if and only if $t < t_2$.*

Now, the retail price difference between market A and B, $\Delta p^* \equiv p_A^* - p_B^*$, is

$$\Delta p^* = \begin{cases} \frac{1}{2} - \frac{1}{2}t - \frac{S+2t}{2Sb} & if \quad t < t_1 \\ \frac{2+4t+3Sb(1+t)}{4+9Sb} - \frac{4+9Sb+2b+8tb}{2(4+9Sb)b} & if \quad t_1 \leq t < t_2 \\ \frac{1}{2} - \left(\frac{1}{4} + \frac{1}{2b} - \frac{t}{2}\right) & if \quad t \geq t_2 \end{cases} \tag{23}$$

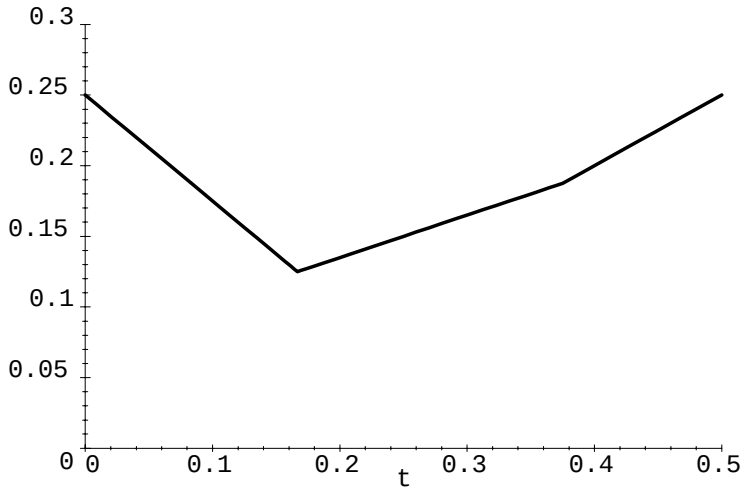
which is decreasing in the trade cost t if $t < t_1$ and increasing in the trade cost if $t_1 \leq t$. We thus have for low and intermediate trade costs that:

Corollary 1 *When $t < t_2$. There is parallel importing from country B to country A in equilibrium; and the difference in retail prices between market A and B is a decreasing function in t if $t < t_1$, and an increasing function in t if $t \geq t_1$.*

Correspondingly, for high trade costs we have:

Corollary 2 *When $t \geq t_2$. There is no parallel importing from country B to country A in equilibrium; and the difference in retail prices between market A and B is an (strictly) increasing function in t if $t \geq t_2$, and constant if $t \geq \frac{1}{2}$.*

The following figure shows the retail price differences in the two countries:



Parallel imports reduce the profits of the manufacturer (or the joint industry profits in two countries), not only because they create competition in the country receiving parallel imports, but also because they incur additional transaction (transportation) costs and prevent the manufacturer from achieving efficient vertical pricing. When the manufacturer is unable effectively to impose territorial constraint, it can still reduce or eliminate parallel imports by raising the wholesale price to the independent agent, but this leads to a less-profitable retail price in the country where parallel imports originate. In equilibrium, the manufacturer balances the needs to exercise optimal vertical price control and to limit parallel imports.

The equilibrium combined industry profit in two countries, which is the same as the profit of the manufacturer in our model, is

$$\Pi^* = \begin{cases} \frac{Sb+5Sbt^2-2tSb+4t^2+S^2}{4Sb} & ,t < t_1 \\ \frac{8Sb^2+20Sb^2t^2-8tSb^2+9S^2b+16bt^2+4b+4S}{4b(4+9Sb)} & t \in (t_1, t_2) \\ \frac{4b+4S-Sb^2+4tSb^2-4Sb^2t^2}{16b} & t \geq t_2 \end{cases} , \tag{24}$$

Since

$$\frac{\partial \Pi^*}{\partial t} = \begin{cases} \frac{1}{2}\left(\frac{(5Sb+4)}{Sb}t - 1\right) < 0 & if \quad t < t_1 \\ \left(\left(\frac{5Sb+4}{Sb}\right)t - 1\right)\frac{2Sb}{4+9Sb} > 0 & if \quad t_1 \leq t < t_2 \\ \frac{1}{4}Sb\,(1-2t) > 0 & if \quad \frac{1}{2} > t \geq t_2 \end{cases} \tag{25}$$

and we have the following result

Corollary 3 *The combined industry profit in two countries decreases in the trade cost t when $t < t_1$, increases in t when $t > t_1$, and has two global maxima at $t = 0$ and $t \geq \frac{1}{2}$.*

It is interesting that industry profits are not monotonic in t. An increase in t reduces competition in A for any given w, but increases the cost of parallel trade from A to B

and we, therefore, have a minimum at intermediate trade costs.

Next, the consumer surplus in each market is, respectively:

$$C_A = \frac{1}{2}\left(1 - p_A^*\right)^2, \tag{26}$$

$$C_B = \frac{S}{2b}\left(1 - bp_B^*\right)^2. \tag{27}$$

More precisely, consumer surplus in market A is

$$C_A^* = \begin{cases} \frac{1}{2}\left(\frac{1}{2} + \frac{1}{2}t\right)^2 & if \quad t < t_1 \\ \frac{1}{2}\left(1 - \left(\frac{2+4t+3Sb(1+t)}{4+9Sb}\right)\right)^2 & if \quad t_1 \leq t < t_2 \\ \frac{1}{8} & if \quad t \geq t_2 \end{cases} \tag{28}$$

and, since

$$\frac{\partial C_A^*}{\partial t} = \begin{cases} \frac{1}{4} + \frac{1}{4}t > 0 & if \quad t < t_1 \\ -\frac{(2(1-2t)+3Sb(2-t))(4+3Sb)}{(4+9Sb)^2} < 0 & if \quad t_1 \leq t < t_2 \\ 0 & if \quad t \geq t_2 \end{cases} \tag{29}$$

and noting that $C_A^*(0) = C_A^*\left(\frac{1}{2}\right) = \frac{1}{8}$ we have:

Corollary 4 *Consumer surplus in market A increases in t if $t < t_1$, decreases in t if $t > t_1$ and its global maximum is at $t = t_1$.*

The consumer surplus in market B is

$$C_B^* = \begin{cases} \frac{S}{2b}\left(1 - b\left(\frac{S+2t}{2Sb}\right)\right)^2 & if \quad t < t_1 \\ \frac{S}{2b}\left(1 - b\left(\frac{4+9Sb+2b+8tb}{2(4+9Sb)b}\right)\right)^2 & if \quad t_1 \leq t < t_2 \\ \frac{S}{2b}\left(1 - b\left(\frac{1}{4} + \frac{1}{2b} - \frac{t}{2}\right)\right)^2 & if \quad t \geq t_2 \end{cases} \tag{30}$$

and, since

$$\frac{\partial C_B^*}{\partial t} = \begin{cases} -\frac{1}{2}\frac{S-2t}{Sb} < 0 & if \quad t < t_1 \\ -\frac{2(4+9Sb-2b(1+4t))S}{(4+9Sb)^2} < 0 & if \quad t_1 \leq t < t_2 \\ \frac{1}{8}S\left(2 - b\left(1 - 2t\right)\right) > 0 & if \quad t \geq t_2 \end{cases} \tag{31}$$

and noting that $C_B^*(0) = C_B^*\left(\frac{1}{2}\right) = \frac{1}{8}\left(\frac{S}{b}\right)$ we have:

Corollary 5 *Consumer surplus in market B decreases in t if $t < t_2$, increases in t if $t > t_2$ and its global maxima is at $t = 0$ and $t \geq \frac{1}{2}$. Consumer surplus in market B is at its lowest level at $t = t_2$.*

The combined consumer surplus in market A and B is $\sum C^* \equiv C_A^* + C_B^*$. We have

$$\frac{\partial\left(\sum C^*\right)}{\partial t} = \begin{cases} \frac{S(b-2)+(Sb+4)t}{4Sb} > 0 & if \quad t < t_1 \\ \frac{-Sb(2-t)-2(S+1)+4t}{4+9Sb} < 0 & if \quad t_1 \leq t < t_2 \\ \frac{1}{8}S\left(2 - b\left(1 - 2t\right)\right) > 0 & if \quad t \geq t_2 \end{cases} \tag{32}$$

if and only if

$$b > b^* \equiv \frac{2\left(5S - 3 + \sqrt{9 + 14S + 25S^2}\right)}{11S} \qquad (33)$$

which gives the following result

Corollary 6 *Combined consumer surplus in market A and B has its unique global minimum at* $t = t_2$. *If* $b > b^*$ *it has its unique global maximum at* $t = t_1$ *and if* $b < b^*$ *it has its global maxima at* $t = 0$ *and* $t = \frac{1}{2}$.