An Empirical Investigation of Price Convergence in the European Union

by

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ABSTRACT

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This study examines the effectiveness of economic integration in the European Union (EU) by observing price convergence or divergence for individual goods and services among its member nations during 1970-1993. The convergence of prices for the same goods and services is used here to gauge the degree to which the economic objectives of integration are being achieved by the member nations of the EU. The convergence at aggregate price level is also examined. Price convergence between the nine 'late-joiner' and the 'original-six' countries is tested from 1960-1992. Price convergence for the original six members of the EU is also examined from 1958-2000 to determine the extent of economic integration.

This study expands similar research in this area by performing a longitudinal study of price movements before and after unification. It examines the impact of economic

integration in the context of the European Union for the new members by comparing the price movements before and after the admittance to the EU.

While price convergence is not observed for the entire period of 1970-1993 and for all commodities, it is observed during some of the periods. The convergence seems to be driven by the non-tradables, i.e., after unification, the non-tradables become more competitive and hence the decrease in dispersion in price differentials between a 'late-joiner' and the 'original-six' countries. The aggregate price levels even among the 'original-six' countries also do not exhibit convergence across time consistently, which leads to the conclusion that other economic, socio-political, geographical, regulatory, and institutional factors may have more influence on prices than just the economic integration alone. Besides, actual economic integration is a slow process and does not necessarily start immediately when a new member is admitted.

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Table of Contents

List of Tables

List of Charts

Chapter I

Introduction and Research Issue

1.1 Introduction

An objective of nations that integrate their economies is to improve their welfare. Welfare could relate to political, economic, and social welfare. Standard of living, economic efficiency, productivity, etc. may judge economic welfare. It is argued that economic integration should lead to price convergence through arbitrage and by the freer movement of capital, technology, and labor among member nations. Convergence of prices for the tradable goods is used here to gauge the degree to which the economic objectives of integration are being achieved by the nations of European Community. After economic integration, some of the non-tradable goods and services may also become more tradable than before. For example, some of the doctors or lawyers may want to move from country A to country B where the price of their respective services is higher.

Price disparities for the same goods and services among key markets implies sub-optimal economic activity and/or institutional barriers to price convergence. Freer trade should lessen and in some cases eliminate price disparities in traded goods. Accordingly, price convergence, if not uniform prices, is expected to be one of the main consequences of economic integration and should be specifically observable in the case of European

unification. However, price convergence can also be caused by income convergence, factor accumulation, or improved communication and technology[1] instead of market integration. It is difficult to link price convergence back to trade barriers. Unfortunately it is not a ceteris paribus world and all other factors are not constant. This clouds the linkage between price convergence and market integration considerably.

Market integration may also to lead to price divergence instead of convergence as pointed out by Knetter and Slaughter (2000). As more and more countries start specializing on one particular activity in a certain industry, prices may diverge[2]. The other important aspect that complicates the issue further is the assumption of homogeneity of products. The product for which price is compared in different countries is assumed to be exactly the same[3]. However, it is necessarily not true, since a particular product sold in different locations (countries and even within a country) may have different amounts of transportation, distribution, marketing, and retail costs associated with it. Hence, most of the time the assumption of identical good is violated.

My research is bound by all these limitations described above. Nonetheless, the test for price convergence or Law of One Price (LOP) is the accepted tool in the literature to gauge market integration. Therefore, I have used price convergence among the member nations of the European Union (EU) as a test of the economic integration within the EU

[1] Knetter and Slaughter (2000)
[2] Automobile industry as an example is used by Knetter and Slaughter (2000)
[3] Goldberg and Knetter (1997)

thus far. Increase in population mobility, more uniform tax structure among the member nations, etc. may be some of the other measures of economic integration.

The inception and development of the EU during the last few decades has provided researchers with opportunities to study the impact of gradual economic integration of disparate national economies, some of which have been there from the beginning of the EU's inception, while others have been admitted gradually. A comparison of the prices between the original and the subsequent member nations (late joiners), across time, tests the effectiveness of economic integration in a near control setting. The availability of detailed price data for several commodities and groups over the life of the EU makes it attractive to investigate the effectiveness of the union in achieving price convergence.

I evaluate the effectiveness of economic integration in the EU by examining price convergence or divergence among its member nations during 1970-1993. The selection of the time period is determined by the availability of data. Detailed commodity level data are available for the years 1970, 1975, 1985, 1990, 1993 and 1996. The 1996 data was published in the year 2000 and has not been included in this study. The original six members of the EU are Germany, France, Italy, Belgium, Netherlands, and Luxembourg. The United Kingdom, Denmark, Ireland, Greece, Spain, Portugal, Austria, Finland, and Sweden were admitted later. Price convergence between the nine 'late-joiners' and the 'original-six' is tested. While price convergence is not observed for all commodities during the selected period, it is observed for some of the time intervals for some of the countries. The aggregate price levels also do not show any convergence. Results

conform to earlier research by others. However, this study extends the research in this area by performing a longitudinal study of price movements before and after unification.

1.2 Research Issue

Trade theory suggests that prices for tradable goods in different members of an economic community should move towards greater uniformity after unification. However, price disparities do seem to persist. Prices of most commodities may differ within nations for geographical, institutional, and economic reasons[4].

Since the creation of the European Union there has been substantial research on different aspects of these economies – income (per capita GDP), growth of income, purchasing power parity, and other indices of economic welfare[5]. Earlier researchers have focused on the impact of economic integration on national output, income, and price levels (both aggregate and individual prices of goods and services), as well as the integration of economic policies. A major part of research on convergence is focused on convergence of income (per capita GDP). The research on price comparisons deals with the continued existence of price disparities among member nations of the EU for the same commodity and or industry.

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[4] For example, after the formation of the EU, to have uniform prices in power supply in Italy and France, a unified power-grid is required. But geographic constraint such as mountain ranges between the two countries make is impractical to have such a system.

[5] References are discussed in the literature review chapter.

Whereas a number of studies on price convergence have focused on post-unification price convergence or divergence during a particular year only, I examine the inter-temporal movements of prices and price levels before and after unification. Most researchers have observed significant price disparities even after unification, and tried to explain why prices, at the end of the period studied, are not the same for a particular commodity or group of commodities; absent are the tests to evaluate if price disparities have increased or decreased after unification. This is an important aspect to examine – it is quite likely that while initial price differentials were large and price convergence after economic integration may have reduced some of those differentials, but it might not have been sufficient. Therefore, observed price disparities after economic unification at any particular time is not sufficient to draw any conclusion about price convergence or divergence.

I examine the direction and extent of price disparities in the EU between 1970 and 1993, i.e., before and after unification, asking the question: Has economic integration resulted in significant price convergence or divergence?

1.3 Price Convergence

Convergence is defined as the movement of two or more price categories in two or more economies towards each other over a period of time. For example, if country A has a higher price level for a selected category of prices than country B, and the rate of increase of such prices in country B is faster than that of country A, then price convergence exists.

In other words, over time, price levels in country A and country B will converge. In other words, price convergence is measured by the movement of the price differentials between two countries across time. If convergence exists then these differentials would gradually reduce and become zero eventually.

1.4 Data

The analysis is based upon time series of the prices of individual commodities as well as aggregate price levels for individual member nations of the EU. Purchasing power parity (PPP) and exchange rate data are used to calculate price levels. These data are not available from any single source, nor are available data always complete.

Data for PPP and nominal expenditure for individual commodities are from International Comparison Project (ICP) and OECD. The ICP data set is available for 1970 and 1975. The OECD data set is for 1985, 1990, and 1993. The exchange rate data are from the Penn World Table (v. 5.6a) and IMF. The real GDP per capita data is from the Penn World Table covering the period of 1950 through 1992. I have used data set covering the period 1960 to 1992 since the EU was formed in the year1958, and the first set of 'late joiner' countries was admitted in 1973.

Based upon the aggregate price levels in the 'original-six' countries, a composite price index is calculated by averaging the price levels. Aggregate price level of any individual country out of the 'original six' is not used to calculate the price differential with any 'late-

joiner' country. Such a comparison would be more of a bilateral nature, and will be biased by country specific characteristics. For example, when comparing prices in the UK with each individual original member of the EU, it is possible that price levels are converging in case of France (because price levels in the UK and France have been similar historically) while diverging with respect to Italy. To avoid such distortions, use of a composite price index is more appropriate. To test for price convergence, the series of price differentials between price level of each of the 'late-joiners' country and the composite price index of 'original-six' are examined across time.

I have also examined the aggregate price level convergence for the original six members the EU. The data covers a period of 1958 through 2000. In this case the series of price differential was constructed with Germany as the reference country. Germany is chosen because of the size and stability of the economy.

1.5 Overview of Methodology and Test Design

The objective of the study is to examine the inter-temporal movement of price differentials. In other words, if the price dispersion is decreasing over time, then price convergence exists. In order to evaluate price dispersion over time, following three sets of tests are performed:

- Diminishing price disparity as measured by the standard deviation of price differentials, mean of absolute price differentials, and coefficient of variation of price differentials for individual goods and services[6].
- Regressing annualized growth rate of aggregate price levels on logarithm of initial price levels across countries, the sign of the coefficient determines convergence.
- Correlograms and unit root tests for convergence of price differentials in aggregate price level. A higher than critical value LB statistic[7] and the presence of a unit root confirm the divergence of price levels.

The study includes price movements for individual industries and commodities. Since, individual commodity prices are available only for 1970, 1975, 1985, 1990, and 1993 the usual time series analyses are not appropriate. Therefore, standard deviation, mean of absolute price differentials and coefficient of variation tests are used to determine the degree of convergence.

I test price convergence for the EU member nations in two periods, before and after unification. If the test results do not support price convergence, then the reasons for such disparities need to be examined.

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[6] Earlier researchers have used similar tests. The rationale, relevance and references for these tests are discussed in detail in Chapter II (literature review) and III (data and methodology for individual goods and services).

[7] LB statistic is discussed in Chapter IV.

1.5.1 Tests for Price Levels of Individual Goods and Services

The dispersion of price differentials of individual goods and services among the member nations is measured by three statistics -- the standard deviation, mean of absolute price differentials, and coefficient of variation of price differentials before and after unification. The price differential between each of 'late-joiner' country and the 'original-six' countries is calculated for a selected individual commodity. Individual goods and services are then grouped into various categories. Standard deviation, mean of absolute price differentials, and coefficient of variation are calculated for each of these categories and for all the goods and services combined across time. These dispersion statistics are then compared across time.

The dispersion statistics are calculated for the UK, Ireland, Denmark, Spain and Austria. Since the rest of the 'late-joiner' countries have only three data points: 1985, 1990 and 1993, it is difficult to draw any meaningful conclusion, and are not included in the analysis.

Convergence tests for Austria, Finland and Sweden also act as control, since these countries joined the EU in 1995, after the period covered in this study (1970-93). Comparing the results of these three countries with that of the UK, Ireland, Denmark, Greece, Spain and Portugal should indicate if unification has any observable effect on prices.

1.5.2 Tests for Convergence of Aggregate Price Levels

Price convergence is tested using time series aggregate price levels from1960 to 1992 for all members and for the original six members from 1958 to 2000. The annualized growth rate of price level is regressed on the log of initial price level and if the sign of the coefficient is negative then it implies convergence. For prices to converge, a country with initial lower price level has to grow faster than the country with higher price level to move towards more uniformity in prices. I have followed the same methodology as in Sala-I-Martin (1996) where the above-mentioned convergence is referred as beta (β) convergence[8].

The dispersion in price level is measured by the standard deviation of log of initial price levels and compared with the standard deviation at a later time. If this dispersion is decreasing over time then the prices are converging among the group of countries. Sala-I-Martin (1996) referred to this definition of convergence as sigma (σ) convergence.

Another approach to test for price convergence is to test the stationarity of the time series of price differentials. If the time series is stationary then it indicates price convergence. Correlograms are used to evaluate the stationarity of the time series of price differentials. In case of correlograms, I test the hypothesis that all the autocorrelation coefficients are simultaneously zero. Autocorrelation coefficient is defined as the ratio between

[8] Detailed explanation is in Chapter IV.

covariance at a certain lag and variance. If some of the autocorrelation coefficients are non-zero, it indicates that the series is non-stationary, which signifies non-convergence of prices. Unit root tests also convey similar results. The existence of unit root suggests that the time series of price differentials is not stationary, or it follows a random walk. Random walk would suggest that price differentials would wander more and more away from a predetermined value (value at the start of the time series) as more time is elapsed. In such cases of non-stationarity, the price levels will not converge. Lack of adequate data prevents me from performing unit root test, since the results will not convey any meaningful inference.

1.6 Why Prices May Not Converge

Price levels are affected by many economic, geographical, political, and institutional factors, which generate differences in the timing of price movement, as well as prices themselves. Further, the price levels of tradables, non-tradables, and services cannot be expected to move uniformly. Many services are considered non-tradables (e.g., hair-cut, legal services, medical services), until labor can move as freely as other tradable commodities. Factors such as per capita income, tax structure, resource base, share of services in a nation's output, openness to trade, protection of domestic production, differing levels of regulation for the same commodity, differences in technical know-how, and the nature of each nation's infrastructure will have a long-term influence on prices and price levels. Then there are shorter-term effects of monetary and fiscal policies and fluctuations in exchange rates. Consequently, each member of the EU is expected to

portray different degrees of convergence in prices and price levels as new nations join the EU. For example, if a non-member country has similar per capita income and as high degree of openness as the existing members, there may not be any noticeable movement in prices after joining the EU.

The time frame considered here runs from 1960's to 1990's, and the visible effect of economic integration on prices may not be clearly identifiable. If the speed of convergence towards a more common price is very slow then convergence may not be discernable when measured over a relatively short time period. Further, while unification was officially initiated in 1958, competition in some industries was substantial throughout Europe even prior to the formation of a regional economic bloc. For less integrated industries inter-country price differentials prevailed due to trade barriers, product standards, consumer tastes, and the prevalence of cartels and other restrictive practices. The history of European unification (see Appendix I) reveals that the actual removal of trade and other barriers has moved rather slowly. The possible reasons for lack of convergence are discussed at length in later chapters.

The rest of the paper is organized as follows: literature review is covered in Chapter II; data and methodology are detailed in Chapters III and IV. Price convergence of individual commodities and services is described in Chapter III; Chapter IV discusses price convergence of aggregate price levels. The findings of this study are summarized and analyzed in Chapter V.

Chapter II

Literature Review

From the perspective of my research the relevant existing literature may be classified into the following three broad areas:

- Research on market integration and price convergence, per se.
- Research on methodological issues relating to convergence tests.
- Research on income convergence and its relationship to price movements.

While much of economic literature focuses on prices, fewer papers deal with price convergence. In an ideal world the result of market integration would be a world where one price prevails, i.e., Law of One Price (LOOP) should hold. Therefore, the literature on market integration analyzes the behavior of prices in different markets. Especially interesting is the study of the impact on prices following certain specific events like the fall of the Soviet Union or the formation of trading blocs like NAFTA, the EU, etc. Removal of trade barriers and other economic and political regulations is supposed to lead to price convergence and ultimately to a single price for any particular commodity for all the markets involved. However, factors like imperfect information, transportation cost, non-tariff barriers, market specific peculiarities (different taste, climate, geography), etc. also affect prices. These effects may outweigh the effects of market integration on prices. Hence, there are studies dealing with the effect of institutional and geographical factors on prices within the same country, while others have tried to examine the 'border-

effect' (when prices are more dissimilar between two locations in two different countries than the prices between two locations within a country with same distance apart). The research on price convergence in the context of the EU is mostly cross-sectional in nature and concentrates on the reasons for convergence or divergence rather than the direction of movement of prices through time among the EU nations.

The research on the validity of Law of One Price (LOOP) tests for the variability of prices within a country or across the borders to see if the markets are integrated. It is to be noted that variability of prices measured across borders is related to traded goods and not non-traded goods. The research in this area has direct bearing on my research. While LOOP may not hold, decrease in price variability (dispersion) would still not rule out market integration. In general, price convergence would suggest market integration but it may not always be true. For example, technological developments, income variation, and other institutional factors may as well drive the price variability[9].

My research examines the impact of economic integration on prices by performing a longitudinal study of the impact on prices in the late joiner countries by comparing the price movements before and after admittance to the European Union. I also examine the price convergence among the original six members of the EU.

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[9] "...price equalization for a good would suggest that trade barriers for that good had been eliminated....One disadvantage of this approach is it does not link outcomes back to barriers. Without these links one cannot rule out that changes in outcomes are caused by forces other than declining barriers, such
.... footnote continues on next page

The body of literature on income convergence is much larger than that of price convergence[10]. Consequently, the research methodologies for measuring income convergence are much more refined and sophisticated than the studies on price convergence. Another reason for methodological sophistication in these studies may well be that the income data are more readily available and complete. The data on prices of individual goods and services are difficult to obtain. Nonetheless income convergence studies are quite useful for this research. Besides dealing with a more refined methodology, they also provide important input and a reference point for my research. It is an established fact that income level and price level are positively correlated. Thus, income convergence/divergence for a group of countries may indicate price convergence/divergence.

2.1 Market Integration and Price Convergence

2.1.1 Law of One Price (LOOP) and Market Integration

My research is somewhat similar to the following papers on LOOP and 'border effect'. While I do not specifically look into the dispersion of prices between pairs of cities with

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as economic growth....it might also be caused by convergence of country incomes--caused in turn by forces like technological convergence or factor accumulation." Knetter and Slaughter (2000)

[10] To mention, just a few income convergence studies: Sala-i-Martin (1996), Evans and Karras (1996a, 1996b), Hann (1995), Pritchett (1996), Bernard and Durlauf (1995), Fischer and Serra (1996), Ben-David (1996), and Cho (1994). Most of these papers are discussed later in this chapter.
For price convergence studies see, Parsley and Wei (1996), Richards and Tersman (1996), Hetzel (1995), Gaul (1993), Cristini (1995), Rogers, Hufbauer and Wada (2001), Bayoumi and Thomas (1995), O'Rourke, Taylor and Williamson (1996).

same distance between them, I examine the price dispersion among the countries across time to test the changing patterns of dispersion. The basic research question is - Is there systematic increase or decrease in the price dispersion. Examination of underlying causes of price dispersion may be subject of subsequent research.

There is a considerable amount of literature dealing with tests of Law of One Price across countries and within a country[11]. Generally these papers use validity of LOOP as an evidence for the level of market integration. The research also highlights the limitation of this linkage of LOOP and market integration due other mitigating factors, such as, economic development, technological changes, etc. Most of these papers measure the relative LOOP rather than absolute LOOP because of data limitations. Goldberg and Knetter (1997) do a comprehensive survey of this line of research[12]. The authors discuss reasons why most researchers use the relative version of LOOP. The three main reasons advanced for this approach are: cost (of information, transportation, and border-effect), violation of the identical goods assumption, and the fact that most of the available data on prices is in the form of price indices. The generally accepted basic argument is that the variability of relative price of a good between two markets over time is an evidence of market segmentation. According to their survey, the research on LOOP indicates that relative price of similar goods sold in different countries are systematically related to exchange rate fluctuations between these countries. The main weakness of this line of

[11] Engel and Rogers (1996), (1998), (2001), Goldberg and Knetter (1997), Parsley and Wei (1996), (2000), Crucini, Telmer and Zachariadis (2000)

[12] They categorize the literature on relationship between exchange rate and goods prices into three segments: a) law of one price; b) exchange rate and tariff pass-through; c) pricing to market.

research, as the authors clearly point out, is that the identical goods assumption is mostly violated since goods produced in different countries are not physically homogeneous and retail price at different locations include different amounts of transportation, distribution, and the associated retail costs. These cost components are non-tradables and may not obey the LOOP.

Knetter and Slaughter (2000) present a comprehensive description of methodologies for statistical measures of product market integration across time, countries and goods. They use both price and quantity data from the product market to measure the market integration. They conclude from the falling US tariffs and transportation costs over last 20 years, that the US product markets have become more integrated with the world markets. But as the natural and political trade barriers have been gradually disappearing with innovations in technology, less restrictive regulations, and regional arrangements between countries (e.g., the EU, NAFTA, etc.), many countries and regional blocs have increased their non-tariff barriers (e.g., aggressive use of antidumping laws) diluting the effect of removal of trade barriers. Furthermore, it is difficult to quantify the effects of non-tariff barriers, so that measuring product market integration becomes even more difficult. The authors use the price equalization of a particular good between countries as one of the measure of market integration. Overall they find little evidence of increased market integration between 1973 and 1991. Prices (both absolute and relative) among the European countries seem to converge suggesting a move towards a single market. However, there is no such indication between Europe and the US or the UK. From the quantity data the authors conclude that there was steady integration in the product

markets during the 1970s, but in 1980s integration had been much less: in fact initially the trend was reversed and then it started integrating again. My research results do not support price convergence for 1958 - 2000 for the original six nations of the EU. However, price convergence is noticed for 1958 - 1970 and 1979 - 1991.

Engel and Rogers (1996) find that while intercity distance and sticky nominal prices explain some variation in prices of the same goods in different cities, most of the 'border effect' is not explained by these factors. They consider prices of 14 different goods in 9 Canadian cities and 14 cities in the United States for their study. The price variation is larger between cities located in two different countries than cities located in the same country with the same distance apart. This is characterized as 'border effect' and the authors find that even after taking in to account nominal price stickiness, integration of labor markets, and trade barriers most of the 'border effect' remains unexplained. The authors update their 1996 research in their 1998 study with special emphasis on the US-Canada free trade agreement on market integration. They measure market integration with the study of prices of goods and services. Specifically they investigate the behavior of prices before January 1990, when the free trade agreement between Canada and the US went into effect, and afterwards. The authors conclude that nothing much has changed since their last study - "*the markets between the US and Canada are more segmented than can be explained by the physical distance between the locations*". In their 2001 paper, Engel and Rogers examine the variability in prices of similar goods across US cities. They find that price variability is larger for traded goods and conclude that non-traded goods have greater price stickiness so that the price variability is also less.

Consequently, though distance between cities (hence transportation costs) explain a large part of the variation in prices, nominal price stickiness seems to be even more important in explaining price variability.

Both of these papers (paper on NAFTA agreement between Canada and the US and between the US cities) are relevant to my research. NAFTA is a regional trading agreement to promote market integration similar to the EU, though the concept of EU is much stronger. Similarly, price dispersion between cities of the US can be used as a benchmark for most intense form of market integration. If the US cities exhibit some violations of LOOP, then member nations of the EU will definitely show much more violation of LOOP.

Another paper on 'border effect' is by Parsley and Wei (2000) who use prices of 27 traded goods across 96 cities in the US and Japan to show that a simple average of good level real exchange rates predicts nominal exchange rate quite well, suggesting sticky prices. When the US-Japan border is crossed, they find that cross-country volatility of relative prices are quite high and some of the factors explaining these market segmentation are distance, unit-shipping costs, and exchange rate volatility.

Similarly, Crucini, Telmer and Zachariadis (2000) also examine the average relative prices and dispersion around those averages using data from Eurostat (local currency prices of retail goods and services across European capital cities). They also find that averages of ratios of foreign to domestic prices are good predictors of nominal exchange

rates. They observe that the dispersion around the averages is high, which is explained by the characteristics of the particular good: measures of international tradability, non-traded inputs, competitive structure of the markets where goods are sold, geography, and product heterogeneity.

2.1.2 Price Convergence in Europe

A considerable amount of literature on price convergence deals with the price disparities in individual industries in the European Union and other groups of countries. For example, there are several papers dealing with the automobile industry[13], textile industry, domestic appliance industry, steel industry, etc.

There are several studies[14] regarding the price movements in the European nations. Some of the research is focused on the general price levels expressed in different forms: real interest rate, real exchange rate, inflation rate, etc. Other authors have concentrated on the price movements of individual industries or commodities[15]. Comparing prices of individual industries/commodities for different countries presents a special challenge since country specific peculiarities and regulations will influence some of these industries/commodities. The pharmaceutical sector in the EU is a prime example of such

[13] Salvadori (1991), Berg (1993), Goldberg and Verboven (2001)
[14] Bayoumi and Thomas (1995), Rogers, Hufbauer and Wada (2001), Rogers (2001)
[15] Boussemart and Bandt (1993), Flam and Nordstorm (1995), Bianchi and Forlai (1993)

peculiarities and regulations. In the following sections, I review the some of existing literature in these areas.

2.1.2.1 The EU Automobile Industry

Except for few papers, most of the papers discussed in this section try to establish cause(s) of price disparity at a particular point in time rather than testing the degree of price differential over time. For the EU, the expectation is to find price uniformity, due the removal of trade barriers and freer mobility of capital and labor. The time frame under consideration in these papers is quite short and not necessarily related to any particular event. The conclusions or results are mixed; most of the cross sectional studies find price disparity in the automobile industry whereas longitudinal study of Goldberg and Verboven (2001), which is discussed later, find price convergence.

Didier Salvadori (1991) looks at the strategies of the firms in the automobile industry and the effects of establishing a single market on these strategies. This paper examines the reasons for price disparities rather than looking into the possible changes in the price disparities over time. The paper documents price disparities for some models of automobiles exclusive of tax in the different EU countries for 1987 and 1988. According to the author, institutional factors like manufacturers' pricing policies and distributors' remittance practices contribute to these observed price differentials. This paper provides an excellent review of institutional and structural factors in the automobile industry of Europe.

Flam and Nordstorm (1995) examine the pre-tax car prices across European countries from 1989 to 1992. This is a cross-sectional study designed to measure the price differential for 43 models of cars in 11 countries. While they do list the results for all four years, the emphasis of the study is not to examine trends in price differential between 1989 and 1992, but to establish reasons for the price differentials. Some of the reasons advanced are market segmentation in Western Europe; government regulations – specifically the block exemption from the EU competition law granted to the car industry[16]. Furthermore, tastes, local high wages, and other market specific factors also contribute to the observed price differentials. The authors note that price differences (net of taxes) exceed 50% between the least and most expensive markets. Additionally, if a particular market is high priced, the high prices apply to all the models of cars to the same extent.

Similarly, Gaul (1993) investigates the sources of price differentials between markets using a model of oligopolistic interaction. The paper uses before tax transaction prices for June of 1986. This is a purely cross-sectional study and focuses on finding the causes of price differentials. The author concludes that value added tax (VAT) differentials and disparities in import restraints contribute to the observed price differentials. The author also finds that automobile firms segregate national markets in the EEC (now EU). In some of the EEC countries, preferences for domestic brands also account for the observed

[16] The issue is under consideration by the EU regulators. See discussion about the institutional factors affecting economic integration in Chapter V.

price differentials. An important contribution of the paper is that it establishes that the transportation cost is not a significant explanatory variable.

All of the above three papers are examining the causes of price disparity and they are cross sectional studies. It is possible to have price disparity at any point in time, and until a longitudinal (time series) study is performed, the existence of price convergence or divergence may not be evident.

Berg (1993) examines the European motorcar industry in the context of competition versus protectionism. He describes the challenges faced by the European auto industry from 1950s to 1980s and its response to these challenges. One of the common responses was to impose import quotas. However, each member nation of the EU sets its own quotas. Non-uniformity of the levels of protectionism is expected to contribute to price differentials. Formation of European Common Market in 1992 required adoption of uniform trade policies by the member nations. The paper highlights that existence of these kinds of regulations may contribute to the non-convergence of prices among the EU members.

Goldberg and Verboven (2001) study the European automobile market to investigate the relationship between market integration and price convergence in international markets. Their data set cover a period from 1970-2000, prices of 150 different models of automobiles per year in five distinct European countries. They find strong evidence of price convergence in both absolute and relative sense.

All these studies examine price convergence or validity of LOOP either on a cross-sectional basis or sometimes across time and not specifically test the changing pattern of price behavior around a particular event unlike Engel and Roger (1998), which I discussed earlier, where they examine the price behavior before and after the US-Canada free trade agreement. My study is more in line with this paper as far as the individual commodities, since it investigates the price behavior before and after the individual countries join the EU (late joiners). However, I also examine the aggregate level price convergence for original six member nations of the EU from 1958 -2000, though there is no before and after scenario in this case, since the EU started in 1958 with these six countries.

2.1.2.2 Examples from Other Industries in the EU

Winters (1995) provides example of another regulated industry – steel. Boussemart and Bandt (1993) examine the textile industry and the nature of regulations in that industry[17]. They point out that in certain sectors of the economy, notwithstanding the free trade policies, the governments may have to regulate some of the trade policies. Bianchi and Forlai (1993) characterize the European domestic appliance market as an oligopoly.

[17] "All governments had to intervene to help solve the problems of the textile industries, in order to limit the social impact of job losses...Furthermore, the countries had to take account of the reactions of the firms, which couldn't accept being sacrificed for external trade's sake. As a consequence, all EC countries have implemented adjustment policies: both trade and industrial policies....Within the EC, the process of formulating a common trading position has made the divergencies apparent...Here(Industrial policies) too,
.... footnote continues on next page

Rogers (2001) examines price convergence through the variation in inflation across the countries in the Euro area. The premise is that if initial price levels are different across these countries, then price convergence would suggests that inflation will be higher in countries where prices are initially low. This is exactly the same concept of convergence that is defined in Sala-i-Martin (1996), which is discussed later in the chapter. Rogers finds evidence of price level convergence during 1990 - 1999 in the Euro area. Convergence is more during the first half of 1990s and for traded goods. Even then deviations from the law of one price are large. He also finds a statistically significant negative relationship between 1999 price level and 2000 inflation rate confirming the hypothesis that countries with lower price levels have higher inflation rate. But he concludes that factors other than price convergence account for most of the cross- country variation in inflation.

In a similar paper, Rogers, Hufbauer and Wada (2001) find evidence of price level convergence in Europe between 1990 and 1999 in the Euro area. Convergence is observed in traded goods, especially in the first half of the decade. They do not find any evidence of convergence in the nontradables. Bayoumi and Thomas (1995) conclude that the goods and factors markets are more integrated in the US compared to the EU. Hence, relative price movements in response to any disturbance are much larger within the EU.

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the relative levels of intervention and the weights put on the various types of policy measures have led to divergencies within the EC." Boussemart and Bandt (1993) pp 222-223

The following two papers are mentioned more for the purpose of making a methodological point rather than examining any industry specific issues. The financial markets, by their very nature, are quite different from the goods and services markets because of much higher degree of integration.

Kleimeier and Sander (2000) examine the degree of integration in retail lending (interest rate) in the original six EU countries using cointegration methodology. They find integration before 1992 and a slower integration thereafter, which they conclude as a sign of convergence. Abbott and Chow (1993) investigate the equity markets of Belgium, Denmark, France, Germany, Italy, Netherlands and the UK. They test for stationarity and cointegration of the time series data (1959 – 1991) of stock price indices. They find that the nonstationary stock price indices series are cointegrated. The results are consistent with the fact that financial markets are much more integrated than the goods market.

The above reviewed papers clearly demonstrate that despite the formation of common market in the EU, a major number of industries are still regulated to a varying degree, and under such condition price convergence may not be observed.

2.1.2.3 EU and Parallel Trade

'Parallel trade[18]' is a common practice in the European Union, especially in the pharmaceutical industry [19] (Wall Street Journal, 1/3/97, 10/18/96). This is an example of price disparity in the EU nations caused by member nations' price controls and regulations. The continued existence of parallel trade reflects the arbitrage opportunities, which exist for the independent wholesalers since the prices of several drugs vary from nation to nation (within the EU). Incidentally, this is a perfectly lawful practice. The wholesalers buy drugs from cheaper EU states and resell in dearer markets. The EU antitrust authorities believe that the practice fosters competition and keeps the prices down and they support these parallel traders. But many of the pharmaceutical giants vehemently oppose this practice, and they want a single price for the drugs in all the EU nations. According to these companies, parallel trade is the result of price controls in many EU states. The EU member governments argue that this parallel trading keeps their health care bill under control. In fact some of the EU countries (e.g., Denmark, Germany, Netherlands) even encourage parallel trade.

[18] Buying and selling of products (in this case pharmaceutical drugs) to take advantage of price differentials in two countries. The opportunity arises when the same product is sold at different prices in different markets. The parallel trader is like an arbitrageur who takes advantage of price disparity.
[19] See Chapter V for more on issues relating to the pharmaceutical industry in the EU.

2.1.3 Price Convergence Outside the EU

Though Paula De Masi and Vincent Koen (1996) deal with the convergence of prices in Russia to the world level, the paper is of interest from a methodological point of view. They consider the movement of absolute and relative price levels in Russia after the price and exchange rate liberalization. The gap between domestic and international prices (retail) is measured by a price-basket of 19 staples. Both, the US and French price levels are considered as benchmark international price levels. Since the weights of main groups of items in the basket are quite different in Russia from what they are in France, a Paasche-type index is used for both Russian and French price levels based on Russian weights. A Laspeyres type index is also used with French weights. Analysis based on these two types of price indices shows that the gap between domestic and foreign prices has narrowed between 1992 and 1994.

Lipsey and Swedenborg (1996) find that among OECD countries food price levels vary over a wide range. The authors conclude that level of protection of agricultural products, the VAT rate on food, and general price level are primarily responsible for the observed disparities in food price levels in those countries. But in different countries, degree of influence of these factors are different, e.g., VAT has most influence on food prices in Denmark and Sweden, whereas, in Japan, Finland, Norway, and Switzerland, it is the agricultural protection level that has more influence. This paper also lends support to the findings of my research that prices are not converging in the EU.

2.1.4 Price Convergence in the US

Some of the papers, which can be listed under this sub-category, have already been discussed in the market integration and LOOP sub-section 2.1.1.1. I discuss here some other papers.

Parsley and Wei (1996) use quarterly prices of 51 final goods and services from 48 cities in the United States from 1975 to 1992 including tradable and non-tradable goods. Their argument for using US cities for their study to test convergence is that the trade barriers and exchange rate volatility affect the rate of convergence. They use New Orleans as the benchmark city. Impact of taxes and transportation costs on rate of convergence are also examined. The variability of price differential is defined as the standard deviation over time of the percentage price differences. They find that the perishable goods have on average the highest variability of the inter-city price differentials. They also examine the mean absolute price differential, which is defined as the mean absolute deviation of log of prices between cities. This is good measure of price differences and I have used this in my research. In their study, services emerge as having the highest mean average price differential. Parsley and Wei reject the random walk null hypothesis, for most of the categories of goods and services for at least some level of confidence in favor of mean zero AR(1) process, which implies convergence. To distinguish between tradables and nontradables speed of convergence was considered. They argue that, if log prices between cities is a zero-mean AR(1) process then the rate of convergence is positively

related to the absolute size of the estimated coefficient. This paper is quite relevant for my research, since I have adopted methodology similar to theirs.

Parsley and Popper (2000) examine the relationship between relative price dispersion and inflation in goods and equity markets and conclude that they are strongly and similarly related for the both the markets. The authors conclude that neither of the two existing explanations (imperfect information and menu costs) is sufficient to explain this relationship. The imperfect information approach may be an appropriate explanation for goods markets, but definitely not for the equity markets.

2.2 Methodological Issues

The literature reviewed in this section does not necessarily relate to price convergence but does provide a good direction for my study. There are mainly two distinct methodologies employed in the convergence research. Bernard and Durlauf (1996) examine the merits, limitations, and comparative suitability of these two approaches to test convergence.

i. Cross-sectional correlation between per capita income and its growth rate for a group of countries. A negative correlation suggests convergence, in the sense that the low per capita income countries are growing faster then the higher per capita countries in an effort to catch up with them. This is exactly the same as the sigma convergence of Sala-i-Martin (1996); i.e., countries j and k converge between dates t and t+T if the log per capita output disparity at t is expected to decrease in value over time.

ii. Long term differences in per capita output across countries is examined and the convergence is suggested when the long-run forecasts of the difference between any pair of countries converge to zero as the forecast horizon lengthens. In other words, countries j and k converge if the difference between long-term forecasts of log per capita output tends to zero. The output differences in the two economies cannot contain unit roots of time trends. Further, the output levels in the two economies must be cointegrated.

The authors show that the "time series tests are based on a stricter notion of convergence than cross-sectional tests." The cross-sectional tests assume that the data are generated by economies that are far away from a steady state, whereas time series based tests assume that the data are from a well-defined distribution. The authors illustrate how these two kinds of tests can lead to very different conclusions regarding convergence.

The methodology employed in my study to test for price convergence in the individual goods and services has been primarily influenced by the work of Parsley and Wei (1996) already discussed above and the work of Sala-i-Martin (1996) discussed below. As noted earlier, most of the literature on convergence is focused on testing the convergence of per capita GDP across economies. The papers on income convergence are relevant to my study for methodological issues.

Sala-i-Martin (1996) defines two types of convergence: beta convergence and sigma convergence. He defines, "there is absolute β-convergence if poor economies tend to

grow faster than rich ones"[20]. The annualized growth rate is regressed on the log of some pre-determined initial income level, the slope of the regression is beta (β). The sign of the beta should be negative for convergence. Beta is the estimated speed of convergence. If at time t+T the per capita GDP is to converge, then poor economy has to grow faster than the rich economy.

A sigma (σ) convergence is reached when dispersion in real per capita income for a group of countries decreases over time. This implies that the standard deviation of log (per capita GDP) at time t+T is smaller than at time t between the two economies. Thus, sigma convergence cannot exist without beta convergence; i.e. beta convergence is a necessary condition for sigma convergence. However, if the poorer economy grows at a very fast rate compared to the rich economy, it might be possible to reach a situation where initially poor economy's per capita GDP level is more than that of the initial rich economy. In that case though there is beta convergence, but there is no sigma convergence. In other words, beta convergence is not a sufficient condition for existence of sigma convergence.

According to the author "*sigma convergence relates to whether or not the cross-country distribution of world income shrinks over time. Beta convergence, on the other hand, relates to the mobility of different individual economies within the given distribution of*

[20] See page 1020 Sala-i-Martin (1996)

world income." The author finds that very few countries show beta convergence. This is because of the assumption that countries converge to the same steady state.

The author also defines a conditional beta convergence - where countries do not converge to the same steady state, but each to their own steady state and that depends on country specific technological and behavioral parameters. A detailed discussion of this approach is provided in Chapter III.

In the context of my research, the methodology of Sala-i-Martin can be translated in the following manner. When a country joins the EU, and if the joining country has lower prices compared to the incumbent members, prices in the joining country have to rise faster (higher inflation rate) than the price rise in the existing member countries to achieve beta convergence. In the context of sigma convergence, if the price dispersion as measured by standard deviation, tends to decrease over time after a country joins the EU, a sigma convergence occurs. I have also examined the price convergence (sigma convergence) for the original six countries of the EU.

A number of papers have used a similar approach or the same methodology in essence. Evans and Karras (1996) follow a similar approach and idea as that of Sala-i-Martin. The authors argue "conventional approach of convergence is valid only if economies have identical first-order autoregressive dynamic structures and all permanent cross-economy differences are completely controlled for." Goerlich and Mas (?) test for productivity and income convergence for the OECD countries using σ-convergence as defined by Sala-i-

Martin. Neven and Gouyete (1995) examine income convergence across regions in European Community from 1975-90 using three different tests, namely, σ, β, and Markov process. All the three tests produce the same results. They find that south of Europe converges in the early 1980s and stagnates after that, whereas the opposite holds true for north Europe regions.

Cho (1994) examines the conflicting results of convergence of per capita income obtained from neoclassical growth models and the new endogenous growth models. The author regresses the growth rate of per capita income on an initial log (per capita income) to determine the sign of the coefficient, which indicates convergence or divergence. The author finds that on an average, high-income countries grew faster than the low-income countries. There is convergence among the industrialized nations but not between the industrialized and the less developed countries.

Button and Pentecost (1995) measure the degree of convergence in the EU regional economies measured in terms of growth of per capita GDP since mid 1970s to 1980s. According to them convergence occurs when simple model specifications are used but not when more specified model is used which includes structural variables, country dummies and an ERM dummy. ERM dummy reflects the national membership in the Exchange Rate Mechanism. This paper also uses the sigma definition for convergence as suggested by Sala-i-Martin. For test of convergence, Button and Pentecost use the mean reversion method. In their model the per capita GDP data is measured relative to the EU average so that convergence is measured across the EU as a whole. Since they have used

the sigma convergence, essentially they test for a negative cross section correlation between a country's initial per capita output and subsequent growth for a fixed time period. The methodology for measuring convergence is essentially similar to other papers.

Some of these above papers are included not only for the methodological aspect, but also from the perspective of their findings. Though it will be discussed the next section in more detail, just to mention it here, there is positive relationship between income and prices. In other words, income convergence should indicate price convergence. So, the results of these papers are quite relevant for my research.

As mentioned earlier, the other major methodology used to test for convergence is to check for stationarity and cointegration of the time series of income (or price). Some of the research papers in the area of income convergence that have employed this methodology are discussed below.

Oxley and Greasley (1995) test for income convergence among Australia, the UK and the USA during 1870-1992. They argue in favor of time-series approach (unit root tests) for tests of convergence. Bernard and Durlauf (1995) use cointergration techniques to test for income convergence among 15 OECD countries from 1900-1987. They find no evidence of convergence but a only common trend.

The following papers discuss the relationship of trade and convergence. Ben-David (1996) finds that trading partner countries are more likely to exhibit income convergence as compared to randomly selected countries. Tybout and Westbrook (1995) conclude that trade liberalization in Mexico resulted in significant lowering of the average cost, especially for tradable goods producers. Relaxation in trade barriers, even unilateral, has direct positive impact on prices. Freund and McLaren (1998) document the length of the trade adjustment process, which takes about 12 years in the EU. According to them, the process started 4 years before joining the EU. The incumbents' share of the joining country's trade rose by 18%. The findings of this paper are significant, since it illustrates the adjustment process is slow. Therefore, it can be argued that the price convergence process (if any) also may be slow and may not be observable before a considerable length of time has passed after the accession.

2.3 Income Convergence and Relationship of Income and Prices

There is an extensive literature on the cross-country relationship between income and price levels (a few are discussed here). A significant positive relationship between income and price level would suggest that if there is income convergence across countries then prices should also show some signs of convergence.

The following papers discuss the relationship between income and price levels.

Richards and Tresman (1996) use data for 1990 from 73 countries participating in ICP project. The regression results confirm the findings of so many other studies, that the PPP-adjusted GDPs have a strong positive relationship with the price level. They also note that European countries in general have higher price levels and US has lower price levels than implied by their corresponding income levels. Kravis and Lipsey (1987) study also finds that the national price levels are strongly and positively correlated with the PPP-adjusted per capita GDP. Clague (1988) also find similar results. Other factors correlated with the price level are level of education and the proportion of GDP from agriculture and natural resources.

Goerlich and Mas (?) have reviewed several papers on income convergence. The papers reviewed by them cover various time periods from 1870 onwards, using various databases [Maddison (1982), Dollar-Wolff, Summers-Heston, EUROSTAT, etc.], analyzing different groups of countries. Goerlich and Mas surmised that income convergence was observed until the mid-1960s and stagnation and even divergence after that. Their own research on income convergence in the OECD and the EU countries covers the period of 1962-1993. They conclude that there was convergence until 1973, and stagnation or divergence after that. These findings lend support to the validity of the results of my research, because of the well-defined relationship between income and prices. Therefore, if income levels converge, then prices are also expected to converge. As mentioned by Knetter and Slaughter (2000), this clouds the measure of market integration, since evidence of price convergence may also indicate that economies (income or output) are converging instead of increased market integration.

My study heavily draws upon the earlier research in the area of market integration, LOOP, and price convergence. The distinguishing feature of my study is that it is a longitudinal study designed to test and discuss any recognizable changes in price movements before and after becoming a member of a regional bloc - the EU as well as the movements in prices among the original six members if the EU. The approach and findings of my study are detailed at length in the subsequent chapters.

The next chapter describes the data, methodology, and the tests for price convergence of individual goods and services in the EU.

Chapter III

Price Convergence of Individual Goods & Services:

Data, Methodology, and Tests

In this chapter, I examine price convergence for individual goods and services. I also describe the data and their appropriateness for the analysis. Subsequently, methodological issues are discussed and suitable tests for the analyses are formulated. The results are presented and analyzed in Chapter V.

3.1 Data

The detailed data for goods and services[21] spanning 1970-93 are primarily from the following sources:

- United Nations International Comparison Project (ICP): World Product and Income, International Comparisons of Real Gross Product, Kravis, Heston, and Summers, 1978 and 1982 publications. The ICP provides data for 1970 and 1975.

[21] The ICP and OECD data sets differentiate between commodities and services as follows:
"Services are defined as including categories in which expenditures are on goods that can not be stored. These include categories in which personal services are being engaged (for example, domestic services, teachers, and government employees), repairs of various kinds (footwear, auto), rents, public transport and communication, public entertainment, and restaurants and hotels. All other categories of GDP are regarded as commodities." ICP 1975 data published in 1982, page 193.
However, in this study the term commodity is used to represent all goods and services that are bought and sold in the market place.

- Purchasing Power Parities and Real Expenditures, OECD, 1985[22], 1990, and 1993. The 1996 data were released in 2000 by OECD and are not included in this research.

The exchange rate and real GDP per capita data are from Penn World Table (PWT) version 5.6a compiled by Summers and Heston. This table covers 1950 – 1992. Information for 1993 exchange rate was obtained from International Financial Statistics published by the International Monetary Fund (IMF), as quoted in Statistical Abstract of US Department of Commerce.

Price data for the fifteen member nations of the EU[23] used here, cover original six members, France, Germany, Italy, Belgium, Netherlands, and Luxembourg, who joined to form the union in 1958; the United Kingdom, Ireland, and Denmark admitted in 1973; Greece admitted in 1981; Spain and Portugal admitted in 1986; Austria, Finland, and Sweden admitted in 1995.

Detailed data are not available for all the countries for all the years. For 1970, data are available only for the five original member nations, France, Germany, Italy, Belgium, and the Netherlands. The 1970 data are available for only other country included in this research, the United Kingdom. The 1975 data source has information on the UK, as well as Denmark, Ireland, Spain, Luxembourg, and Austria. For the years 1985 through 1993, data are available for all 15 members of the EU.

[22] 1980 data from the benchmark studies provided by the PWT are not compatible with the data set I have used. Hence, 1980 data is not included in my study.

If the data were available for all the years without any gaps, more sophisticated statistical tests could be employed. The small sample size of the available data set coupled with data gaps, rule out the applicability of parametric as well as non-parametric tests, and this study is forced to rely on descriptive and summary statistics only.

3.1.1 The UN ICP and OECD Data

The United Nations' ICP data are based on price surveys of identical sets of goods and services in various countries. Overall purchasing power parities (PPPs) and price parities for individual goods and services are calculated. Further these goods and services have been grouped into distinct categories covering all of the GDP. Estimates of each country's expenditure on these individual goods and services have been used as weights for these calculations by the publishers of the data.

OECD continued with similar research as the United Nations' ICP project to publish similar data sets for OECD countries. The last ICP data set is for year 1975. OECD produced the next data set for 1985.

Both ICP and OECD data sets define purchasing power parity (PPP) as the value of $1 worth of goods or services or GDP in local currency. The comparative price levels are the ratio of PPPs and exchange rates.

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[23] For an overview of the evolution of the EU please see the Appendix I

The UN and OECD, the publishers of these data have occasionally changed some definitions of categories of goods and services and regrouped categories from 1970 to 1993 publications. For example, in 1970 each type of fresh meat was categorized as a separate group and all types of frozen meat were put into the single category of ***frozen and chilled meat***. By 1975, fresh and frozen meat of each type was classified separately and there was no separate category for frozen meat. Similar regroupings have taken place in some other commodities as well.

Some categories from the past have been further divided into more detailed sub-categories, e.g., the ***household utensil*** category of the 1970 and 1975 data sets were sub-divided into three separate categories of ***glassware & tableware***, ***cutlery & silverware***, and ***motor-less kitchen & domestic utensils***, in later years.

Quite a number of new categories of goods and services, not previous listed, are also included in the data sets of later years. Examples include, motor-less garden appliances, jewelry, watches and repair, and entertainment goods.

The degree of tradability is not the same for all commodities. For example, investment (capital) goods are more easily tradable than perishable food. Thus it is possible to confirm if the prices of traded commodities are more likely to converge than lesser-traded and non-traded commodities.

3.1.2 Penn World Table (PWT) and OECD Data

The data source compiled by Summers and Heston, combines information from International Comparison Projects and SNA data of national accounts[24] to provide quantity and price time-series covering Gross Domestic Product (GDP) and some additional variables. This data set is known as PWT data. PWT version 5.6a used in this study spans 1950-92.

OECD data for aggregate price level cover the period from 1970 – 2000. I have used PWT data from 1950 – 1992 and 1993 – 2000 data is from OECD.

PWT and OECD data used here are aggregate price level data. Though I have examined price convergence at an aggregate price level in the next chapter, it is much more appropriate to test price convergence from individual commodity prices. The aggregate price level includes both tradables and non-tradable (not in the same proportion), and imported goods. If the prices of tradables are converging but the share of non-tradables are higher in the output, the resulting movement in aggregate prices will not reflect this convergence, until and unless non-tradable prices are also converging. On the other hand, every commodity has some non-tradable price component (sales and marketing expenses, service component, etc.). Depending on size of the non-tradable component in the

[24] SNA data – System of National Accounts

product, price behavior may vary from commodity to commodity. Hence, measuring price convergence from an individual commodity perspective is much more relevant.

3.2 Methodology

My research examines the price convergence for individual commodities among the late-joiner of the EU. Price convergence implies that the price differentials should shrink over time.

The dispersion of price differentials across time are calculated and analyzed to determine if the price differentials increased or decreased over the period of time during which different countries join the EU. The standard deviation, coefficient of variation, and absolute mean of the price differentials over time are used as measure of price dispersion. The price differentials between countries are defined as X, the difference of log of price of commodity k at time t between countries i and j:

$$X_{ij,k,t} = \ln (P_{i,k,t} / P_{j,k,t})$$

For each of the nine late-joiners of the EU this price differential is calculated with respect to each of the six original members individually. For example, for UK the price differential is calculated with respect to Germany, Italy, France, Belgium, Netherlands,

and the Luxembourg, individually[25]. These price differentials are calculated for each selected category of goods and services. Thus for UK there are 288 observations[26] of price differentials for each of the five years – 1970, 1975, 1985, 1990, and 1993. The three dispersion statistics examined in this study, standard deviation, coefficient of variation, and absolute mean of price differentials, are calculated for each of these five sets of 288 observations of price differentials. Coefficient of variation is more appropriate measure of dispersion when the means of the sample data significantly differ from each other. These three statistics are the accepted measure of dispersion in the literature.

The pattern of changes in standard deviation over the five time periods is analyzed to identify the existence or lack of price convergence. A systematic reduction in the standard deviations would imply that the price differentials are more closely clustered suggesting that the prices in the group of countries under examination are moving closer. Changes in dispersion of price differentials, as measured by the standard deviation, for the late-joiners would be indicative of price convergence and suggested economic integration in the EU.

The variances of price differential from year to year are compared to test if variance from one year is statistically different from the other. The usual method for such comparison is

[25] The UK here represents the benchmark country a-la Parsley and Wei (1996). This procedure is repeated for all the late joiners.

[26] Six original countries and 48 categories (6x48 = 288) for each of the five years for which the data are available. For further description of these categories please see Appendix II

to calculate the F statistic and measure it against the critical value for a specific level of confidence. The F-test is appropriate and meaningful when the sample distributions are normal. In case the distribution is not exactly normal, but not too dissimilar from normal distribution, and the two sample sizes are the same, F statistics can still be used for such a comparison of the variances[27].

In this study, though the distribution is not strictly normal, it is similar to normal and the numbers of observation are large and same across different years. Thus, F-test for comparison of variances of price differentials is valid. The variances are compared for the three categories of goods and services - ***All***, ***Tradables***, ***Non-tradables***. The results are presented and discussed in Chapter V.

The price differentials can be in either direction and the mean of these differentials does not provide full impact of their magnitude. Therefore, the mean of absolute price differentials $|\ln (P_{i,k,t} / P_{j,k,t})|$ are also calculated, irrespective of sign(+/-). The patterns of changes in these means of absolute price differentials over time are analyzed to determine price convergence or divergence. A reduction in the mean absolute price differential over time for the late-joiners would be consistent with price convergence and economic integration within the EU, at least with respect to market prices.

[27] See Berenson and Levine (1996) p.493

The coefficient of variation is also calculated to provide a relative measure of variation. Standard deviation measures the scatter of observations and the mean absolute price differential measures the magnitude of the differentials. However, the two samples may have same standard deviation but different means. In such a situation, coefficient of variation is a better dispersion statistic. It measures the scatter in observations relative to the sample mean. It is calculated by dividing the standard deviation with the mean of the sample. The coefficient of variation is particularly useful when the observations have different units of measurement or they are significantly apart (different sample means).

Overall data used in this study, span more than 150 categories of goods and services for the period, 1970 - 1993. The number of categories is not constant across different compilations by ICP and OECD. The 1970 ICP data cover 153 categories of commodities and services, while the 1993 OECD data set has 202 categories due to the ongoing revisions to provide greater details by the publishers of the data. For this research, 48 different categories of goods and services[28] have been selected for analysis for the years 1970-93. The selection is based on the following two criteria regarding the degree of tradability and the homogeneity of category definitions over the time period covered in the study:

1. The commodities examined here present varying degrees of tradability. Consequently, some commodities have a high degree of tradability and some others may have little or no tradability. One of the criteria used here was to

[28] See Appendix II for a list of these 48 categories.

ensure that the categories selected for this analysis exhibit some degree of variability in terms of their tradability so that the differences in their price convergence can be captured.

2. The second criterion was that the homogeneity in the definition of the categories of goods and services, by the publishers of the data UN and OECD, across time must be apparent.

Of these 48 groups of commodities a further selection has been made to differentiate between tradables and non-tradables[29]. Specifically the 'services' and construction are placed in the non-tradables category. The dispersion statistics (standard deviation, absolute mean, and coefficient of variation) of the price differentials are analyzed over the time. Non tradables are expected to exhibit greater price differentials, as well dispersion because of less competition and arbitrage opportunities. The results are presented in Chapter V.

Tradables are further subdivided into groups of similar commodities[30]. For example, eggs and butter are in one group of *perishables* and refrigerators and freezers in c*onsumer durables*. These groupings are made to determine if the degree of tradability is reflected in price differentials and dispersions. For example, perishables are expected to exhibit similar patterns as non-tradables as opposed to durable goods. The dispersion statistics (standard deviation, absolute mean, and coefficient of variation) of the price differentials for these sub-groups are also analyzed and the results are presented in Chapter V.

[29] See Appendix II for the list.
[30] See Appendix II for the list.

Of the nine late-joiners of the EU, the price movement analysis has been performed only for the UK, Ireland, Denmark, Spain, and Austria. Since data for the remaining five late-joiners are available only for the last three periods, 1985, 1990, and 1993, too short a period to draw any meaningful conclusions, they were excluded from this analysis.

Austria, Finland and Sweden act as control countries. They were admitted to the EU in 1995, outside the period of analysis for this study. While these countries were not members of the EU for the period of the study, they did have comparable level of industrialization and income. If the price differentials for these countries and their dispersion statistics also display a similar pattern over time, as that of the late-joiners of the EU, then it cannot be said with any reasonable confidence that the prices converged due to economic integration or due to some other reasons.

The results for price convergence of individual goods and services are presented and analyzed in Chapter V. The next chapter describes the data, methodology, and tests for price convergence at the aggregate price level.

Chapter IV

Price Convergence at the Aggregate Price Level: Data, Methodology, and Tests

In this chapter, I examine price convergence for national aggregate price levels. I also describe the data their appropriateness for this analysis. Subsequently, methodological issues are discussed and suitable tests for the analyses are formulated. The results are presented and analyzed in Chapter V.

4.1 Data

The national aggregate price level data are from Penn World Table (PWT) version 5.6a compiled by Summers and Heston. This data are available as a continuous time series from 1950 and ends at 1992. This data set has been complied from information provided by ICP project and Systems of National Accounts[31]. The price levels for all the countries are estimated with respect to the United States price level as 100. The data for the period of 1993 – 2000 are from OECD. The exchange rate data for this period is from International Financial Statistics published by the International Monetary Fund (IMF), as quoted in the Statistical Abstract of US Department of Commerce.

4.2 Methodology

Price convergence exists if the differentials, between the aggregate price levels of specific categories of commodities across a cross-section of countries, significantly reduce over time. For example, initially if the country A has a higher price level and country B has a lower price level, then country B's price level has to grow faster than that of country A to narrow the gap in price levels between them. In order for price convergence to occur, the growth rate in price levels has to be higher for lower price level country. If the spread between the prices of countries A and B narrows significantly over time, i.e., converge then we may well have evidence of economic integration and increased competitiveness between the two nations.

4.2.1 Beta Convergence

The following definitions of beta and sigma convergence, as measures of price convergence, have been adopted from Sala-i-Martin (1996). This issue has been discussed at length in the literature review section, Chapter II.

Let the annualized growth rate of price levels in country i between time t and t+T be defined as

$$X = (\ln[(P_{i,\,t+T})/(P_{i,\,t})])/T.$$

[31] The data are more fully described in Chapter III.

where $P_{i, t+T}$ is the aggregate price level at time t+T and $P_{i, t}$ is the aggregate price level at time t. Let $\ln(P_{i, t})$ be the logarithm of price level at time t for country i, and when the following equation is estimated

$$X = \alpha + \beta \ln(P_{i, t}) + \varepsilon_{i, t}$$

and if $\beta < 0$ then it indicates price convergence. For convergence to occur, the initial price level and growth rate of price level must have a negative relationship. In other words, if $\ln(P_{i, t})$ becomes smaller then value of X should become higher. This condition is satisfied when $\beta < 0$, i.e., the slope of the equation is negative. β represents the speed of convergence. Thus, if estimation of β is negative then convergence exits. In the literature, this type of convergence analysis is defined as **beta-convergence**.

The beta convergence test is performed for the late joiners and for the original member nations of the EU and the results are presented in Chapter V.

4.2.2 Sigma Convergence[32]

If the dispersion in price level for a group of economies reduces over time then also the convergence is said to exist. The dispersion is measured by the standard deviation of logarithm of price levels across countries.

Thus, if

$$\sigma_{t+T} < \sigma_t$$

[32] A-la Sala-i-Martin (1996)

where σ_t is the standard deviation of $\ln(P_{i,t})$ across i, then price convergence exists. This definition of convergence is characterized as **sigma-convergence** in the literature.

The sigma convergence test is performed for the late joiners and the six original member nations of the EU and the results are presented in chapter V.

The beta- and sigma-convergence are related. If the price levels of two economies become similar over time, it means that the price level in cheaper (with lower price levels) economy is growing faster than the dearer (higher price levels) economy. If this phenomenon takes place then only the initial dispersion in price levels would go down across time. In other words, the dispersion in price levels across countries is falling over time. Therefore, for sigma-convergence to occur, beta-convergence is a necessary condition. But it is not a sufficient condition, since if cheaper economy continues to grow faster than the dearer economy, a time will come when the price level positions will be reversed, i.e., the cheaper economy now have become dearer economy and vice versa. The dispersion of price levels as measured by the standard deviation goes down initially, becomes zero, and then starts to increase again. So the existence of beta-convergence does not always imply existence of sigma-convergence.

4.2.3 Correlograms and LB Statistics

A series that diverges will exhibit nonstationarity. Stationarity of time series of price differentials implies that the price differentials will not wander away from zero

indefinitely. A stationary series has constant mean and variance over time and covariance depends on the lag between time periods and not on actual time at which the covariance is calculated.

One of the tests for stationarity of a time series is based on correlograms. If the autocorrelation coefficients at different lags are significantly different from zero then the series is nonstationary. The joint hypothesis that all autocorrelation coefficients are zero is tested by LB-statistic (Q-statistics), which is a Chi-square distribution with *m* degrees of freedom where *m* is the lag length. If the computed LB-statistic is exceeds the critical value from the Chi-square table, then at least some of the autocorrelation functions are nonzero, meaning the series is nonstationary.

A composite price index for the original six countries is constructed. It is the average of the price levels in these countries. The price differentials between the late joiners and this composite index are calculated over time. For example, for the UK, let P_{UK} and P_c be the UK price level and composite price level, respectively. Price differential at time t for the UK is defined as:

$$Y_t = \ln(P_c/P_{UK})_t$$

The LB-statistics at different lags for the resulting time series is calculated and computed value of the LB-statistics is compared with the critical value from the Chi-square table for a particular degree of freedom (*m*, the lag length). If the computed value is greater than the critical value then some of the autocorrelation coefficients are non-zero and the series

for price differentials is non-stationary or will wander farther and farther away from some pre-determined value.

For the group of original six countries data covers 1958 to 2000. The EU was formed in 1958. The price differentials between Germany and the other original five member nations are calculated. Germany is used as a benchmark, being a more stable economy. The correlograms for these series of price differentials are examined to test for the stationarity of the series. A stationary price differential series would indicate that price differentials are converging.

The nonstationarity of a series can be also be confirmed by the presence of a unit root. However, data set is not large enough to arrive at any meaningful conclusion. Hence the tests results are not included.

The correlograms and LB statistic for stationarity i.e., convergence of price differentials for the late joiners and original six countries are calculated and the results are presented in the next chapter.

Chapter V

Results and Analysis

5.1 Price Convergence for Individual Goods and Services

The detailed results for standard deviations and absolute means of the price differentials for 48 commodities for the UK, Ireland, Denmark, Spain, and Austria are presented in tables 1 through 5 and charts 1 through 10. Coefficients of variation and standard deviations of price differentials are presented in tables 6 through 8 and charts 11 and 12.

A brief summary of these results for Spain and the UK is presented in the next sections. The results for the UK and Spain are highlighted here since meaningful data are available for these two countries both before and after joining the EU. For Ireland and Denmark the data is available only for the period after joining the EU. Although data for Austria is available, it joined EU in 1995, outside the period covered in this analysis. Hence Austria is considered as a benchmark country against which the dispersions of price differentials of 'late joiners' are compared.

5.1.1 Mean of Absolute Price Differentials

Although price dispersion analysis has been performed for all the eight groupings[33] of tradables and the two categories of non-tradables, the summary results are presented here only for the three broader categories of ***Tradables***, ***Non-tradables***, and ***All*** - which includes both the tradables and the non-tradables. Detailed results for ten groupings (eight tradables and two non-tradables) are presented in tables and graphs mentioned earlier. The following table shows the means of absolute price differentials over time. The mean of absolute price differential represents the changes in magnitude of price differential though the years. If prices were moving towards each other in different countries then eventually the mean would become very small or zero. In fact, when the mean of absolute price differential is zero, there is perfect price convergence. The following table summarizes the results for Spain, the UK, and Austria. Results for Austria is included to highlight the difference in patterns of mean absolute price differential across time between members and non-members of the EU.

The means of absolute price differentials for non-tradables are greater than those of tradables. This indicates that markets for tradables are more integrated than markets for non-tradables. The trends in the means are similar for the UK and Austria for all the three different categories - ***All, Tradables*** and ***Non-tradables***. The magnitude of price differentials decreased from 1970 to 1990 and then shows a slight increasing trend. For

[33] Appendix II describes the details of the groupings.

Spain the magnitude of price differential decreased over time from 1975 to 1993, though from 1990 to 1993 the decrease was very small.

Price Dispersion of Spain and the UK As Measured by Mean of Absolute Price Differentials						
	All		Tradables		Non-Tradables	
Year	Spain	Austria	Spain	Austria	Spain	Austria
1975	0.495	0.363	0.405	0.297	0.676	0.495
1985	0.399	0.240	0.271	0.214	0.650	0.299
1990	0.277	0.203	0.277	0.189	0.300	0.236
1993	0.265	0.224	0.254	0.211	0.306	0.253
	UK	Austria	UK	Austria	UK	Austria
1970	0.488		0.491		0.535	
1975	0.396	0.363	0.328	0.297	1.531	0.495
1985	0.262	0.240	0.253	0.214	0.267	0.299
1990	0.260	0.203	0.268	0.189	0.261	0.236
1993	0.314	0.224	0.289	0.211	0.389	0.253

The similar trends in tradables and non-tradables suggest that the effects of factors other than removal of trade barriers are more prevalent here. Some of these factors may be convergence of real GDP, less industrialized countries becoming more industrialized, etc. For example, if Spain's industrial development and productivity were increasing to be more in line with Germany, then even without economic integration or without removal of trade barriers, the prices in these two countries would be more aligned with each other, be it a tradable or non-tradable commodity.

Since Austria shows the same trends as that of the UK and Spain, and even if the trend shows price convergence from 1970 through 1990, it cannot be said with any degree of confidence that the observed convergence is due to the economic integration in the EU. Actually, Austria's means of absolute price differentials were smaller than either those of

the UK or Spain, suggesting that prices were more similar between Austria and the six original members, even though Austria had not been admitted to the EU during the period covered in this study.

5.1.2 Standard Deviation Results

The following table displays the standard deviation of price differentials for the UK and Spain and the results are compared with those of Austria. The following table corresponds to charts 11 and 12.

Price Dispersion of Spain and the UK
As Measured by Standard Deviation of Price Differentials

	All		Tradables		Non-Tradables	
Year	**Spain**	Austria	**Spain**	Austria	**Spain**	Austria
1975	0.512	0.478	0.391	0.380	0.686	0.601
1985	0.504	0.318	0.338	0.262	0.623	0.394
1990	0.334	0.271	0.337	0.248	0.334	0.315
1993	0.327	0.268	0.329	0.251	0.334	0.312
	UK	Austria	**UK**	Austria	**UK**	Austria
1970	0.616		0.578		0.690	
1975	0.692	0.478	0.397	0.380	1.040	0.601
1985	0.364	0.318	0.326	0.262	0.389	0.394
1990	0.342	0.271	0.321	0.248	0.381	0.315
1993	0.380	0.268	0.367	0.251	0.399	0.312

For all the countries there is one result that stands out - the price dispersions in tradables are much less than those in non-tradables. This is to be expected. The other result, which is readily observable, is that if there is any price convergence, it is being driven by the movement of prices in non-tradables rather than tradables.

For Spain, the results for ***All*** commodities indicate a reduction in price dispersions from 1985 to 1990. Between 1990 and 1993 there is no significant change. There is a marked drop in standard deviation of ***Non-tradables*** in Spain between the years 1985 and 1990, whereas the standard deviation of price differentials more or less remains the same in ***Tradables*** during the same time period. Spain joined the EU in 1986 and all the impact (if any) of this admission seems to have gone to the ***Non-tradables***. The table also reveals that this effect in 1985-90 is primarily driven by the reduction in price dispersions of ***Non-tradables*** during that period. In fact, in 1993 there is no significant difference between the price dispersion in tradables and ***Non-tradable***. There is no significant change in the dispersion of price differentials for ***Tradables*** for all the three countries during the period of study.

While this result seems to be consistent with the hypothesis of economic integration leading to price convergence for the late-joiners of the EU, interesting enough, Austria exhibits similar trends despite not being a member of the EU. Further, the price dispersions for Austria are lower than that of Spain - even after joining the EU. Thus, it seems that the effect of other factors such as the level of industrialization, trade, income, and host of other socio-political issues may be more important determinants of price convergence than the impact of joining a regional trading bloc - the EU. The lack of any significant change in the price dispersions in ***Tradables*** suggests that the trade barriers between Spain and the original six members of the EU were perhaps not very high even before joining the EU.

The price dispersions for the UK show trends similar to that of Spain. The UK joined the EU in 1973 and subsequently for later years, there is a drop in price dispersion in non-tradables. However, there seems to be a sharp increase in the price dispersion in 1975, which is primarily driven by the abnormally low prices for nursing services. While price of nursing services was decreasing between 1970 and 1975 in the European countries, the prices in the UK as recorded in the ICP data are 0.004 pounds for $1 worth of nursing services. For both the UK and Ireland, the price of nursing services (as recorded by ICP data) seems to be very low compared to the other European countries, though the trend in prices of nursing services seems to be same in these countries as well. Like Spain, there is hardly any difference between the price dispersion of ***Tradables*** and ***Non-tradables*** in the UK from 1985 onwards. As mentioned earlier, the same trend in price dispersion is observed in both group of commodities in Austria as well. As expected the price dispersion in ***Non-tradables*** is little higher than in ***Tradables***.

Overall, the results of standard deviation and mean absolute price differentials exhibit nearly the same trends through time.

5.1.3 F-Tests to Compare the Variances from Year to Year

The statistical significance of price dispersion results is tested by F statistics. Though the distribution is not exactly normal, it is close to normal and the number of observations is large enough to make the F-test applicable. The F-test determines if the observed

variances are statistically different from year to year. A summary of results of the F-test analysis for the variances of price differentials is presented below.

Comparison of Variances of Price Differentials From Year to Year									
	All			Tradables			Non-Tradables		
	ESP	AUT	UK	ESP	AUT	UK	ESP	AUT	UK
1970-75			N			Y			Y
1975-85	N	Y	Y	Y	Y	Y	N	Y	Y
1985-90	Y	Y	N	N	N	N	Y	Y	N
1990-93	N	N	N	N	N	N	N	N	N

'N' = Variances of price differentials are not statistically different at 95% confidence level between the years under consideration.
'Y' = Variances of price differentials are statistically different at 95% confidence level between the years under consideration.
ESP = Spain, AUT = Austria, UK = The United Kingdom

The overall results are mixed and do not support any particular trend for any country for any category. The variances of price differentials between 1990 and 1993 are statistically same for all countries at 95% confidence level. It appears that only between 1975 and 1985, the variances are statistically different for the ***Tradables*** category. After 1985, the variances in price differentials are statistically same from year to year for all the countries. The results for Spain and the UK are same as that of the control country - Austria. This suggests that the economic integration and subsequent changes in trade policies between the original six countries and the UK and Spain did not have any significant effect on the prices.

5.1.4 Coefficient of Variation

The following table summarizes the coefficients of variation of price differentials for the UK, Spain, and Austria. The corresponding graphs are displayed in charts 13 and 14.

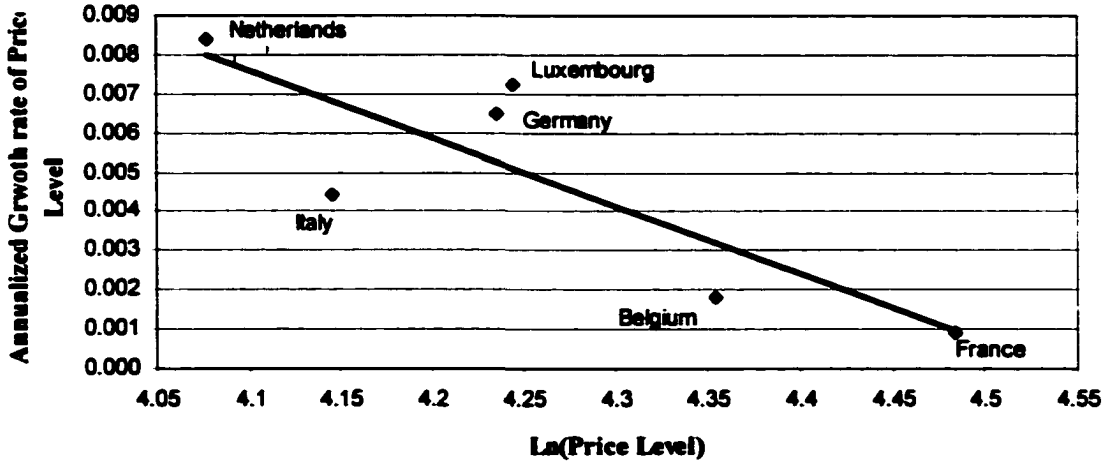
Price Dispersion of Spain and the UK As Measured by Coefficient of Variation of Price Differentials						
	All		**Tradables**		**Non-Tradables**	
Year	**Spain**	Austria	**Spain**	Austria	**Spain**	Austria
1975	1.344	7.134	1.174	2.603	1.441	-6.604
1985	2.558	-3.212	5.452	-1.970	1.251	12.313
1990	7.106	-4.371	37.444	-4.509	2.511	-35.000
1993	2.748	-2.393	2.964	-2.461	2.049	-4.216
	UK	Austria	**UK**	Austria	**UK**	Austria
1970	6.286		6.964		5.349	
1975	2.932	7.134	2.701	2.603	2.512	-6.604
1985	-15.826	-3.212	20.375	-1.970	-29.923	12.313
1990	5.607	-4.371	4.338	-4.509	4.281	-35.000
1993	2.021	-2.393	2.447	-2.461	1.376	-4.216

No consistent patterns are discernable in the results of coefficients of variation. The coefficients of variation for ***Non-tradables*** in Spain are nearly invariant across time. The same is true for the category of ***Tradables*** in Austria. Rest of the results for coefficients of variation do not show any particular trend indicating that means of the price differentials across time vary considerably. This suggests that the price differentials between these countries and the original six changed significantly over time but with no specific direction.

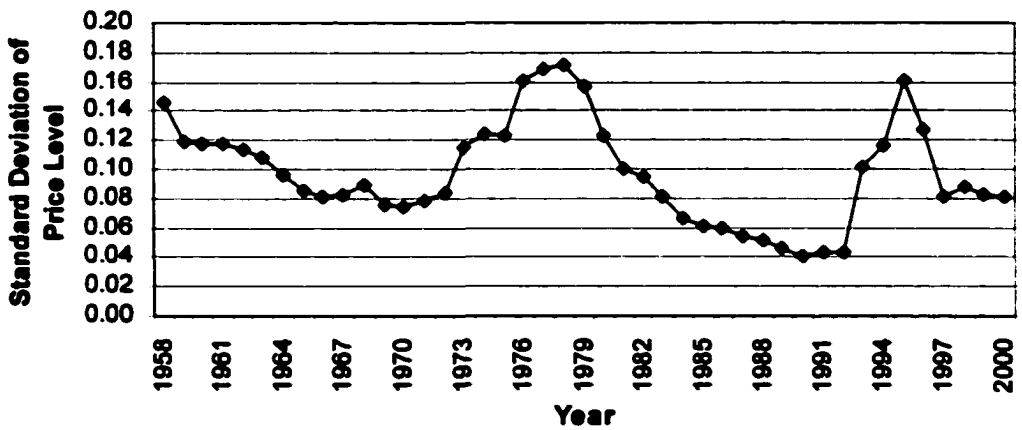
5.2 Price Convergence for Aggregate Price Level

5.2.1 For the Original Six Members of the EU

Annualized growth of aggregate price level for the original six countries from 1958 to 2000 is plotted against initial aggregate price level of 1958. According to the concept of price convergence, countries with initial lower price levels are expected to have a higher annualized growth level of prices to converge with countries with a higher initial price level, and hence a negative relationship between initial price level and annualized growth rate of price level. Germany and Netherlands are the outliers, i.e., though these countries started with a higher price level in 1958, they also had a higher growth rate of prices. No regression was run with only six data points for six countries. Though the trend line shows a negative relationship, the results are not significant.



The standard deviation of price levels for these six countries are also plotted over time and it does not show any consistent pattern. If there was price convergence, the standard deviation of prices across time is expected to decrease. Here there are periods of dispersion and periods of convergence. In conclusion, the overall result is mixed, and there is no consistent price convergence among the original six members of the EU between 1958 and 2000.



5.2.2 Regression Results, the Beta Convergence for All Members of the EU

The average growth rate of aggregate price levels between 1960 and 1992 is regressed on the log of price levels of 1960 for all countries. For price convergence to exist, countries with low initial price levels should demonstrate higher average growth rate of prices as compared to countries with high initial price levels. In other words, the slope should be negative. The slope represents β as described in the Chapter IV under the discussion of

Beta Convergence. While the graph 15 shows a downward sloping trend (both straight-line and non-linear fits[34]) suggesting price convergence, the regression results, which are presented in table 9, are not statistically significant. The t-statistic for β is insignificant. However, the intercept is significant indicating that other factors explain most of the growth in prices.

5.2.3 Tests for Sigma Convergence

The test is discussed in detail in Chapter IV where methodology was described. The standard deviation of log of price levels for each late joiner country and original six countries are calculated across time. The results are plotted in the graphs 16 and 17. The graphs show that the movement of standard deviation of log prices through time is similar for all the countries. The trend does not exhibit any significant reduction in standard deviation after joining the EU. The standard deviation for the post-unification period is not necessarily less than the pre-unification period, indicating lack of σ convergence. Between 1978 and 1993 there is some indication of reduction in standard deviation of log prices.

[34] Since straight-line fit is nearly as good as the non-linear fit, non-linear regression was not performed.

5.2.4 Plots of Price Differentials

The series of price differentials between individual late-joiners and the average price level of the original six countries are presented in charts 18 through 20. The graphs clearly demonstrate that except for Sweden there is a distinct upward or downward trend signifying possible non-stationarity of the series.

5.2.5 Correlogram Results

Tables 10 through 12 summarize the results of correlograms of price differential between composite price index of original six countries and individual aggregate price level of late-joiners. There are 33 observations and results for 25 lags are shown.

For all the countries, the joint hypothesis that all the autocorrelation coefficients are simultaneously zero can be rejected. At least some of the autocorrelation coefficients are not zero. In every case the LB (or Q) statistics is too large compared to the chi-square critical values. The p-values give the probability of getting a critical chi-square value as large as that of the computed LB statistics. In most cases p-values are very small or approximately zero, implying that the probability of obtaining such high chi-square values by chance, are nearly zero and the corresponding series is non-stationary. Since the price differential series is non-stationary it can be surmised that the price differential is never going to be zero. In other words, the series would wander away farther and

farther from some pre-determined level. This shows that aggregate price levels are not converging at least in a bilateral sense of late-joiner versus the original six countries.

The data cover a period from 1960 to 1992, and there are total 33 observations. The observations have not been divided into two groups of pre and post-joining the EU. For the three countries, the UK, Denmark, and Ireland, it would have left only 12 observations for pre-joining period, too small a number to draw any meaningful conclusions from correlograms. Similarly, for other countries as well, such grouping would have left too small a number of observations in pre or post-joining periods. Lack of such groupings would not allow comparison between pre and post-admittance trends. However, the correlograms still help in identifying the overall trend in movements of price differentials.

5.3 Towards Explaining the Non-Convergence of Prices

The picture that emerges from the preceding analysis is that the price levels in these countries, on an average, are not converging. There are various reasons for this lack of expected price convergence as a consequence of economic integration among the EU countries.

Some of these reasons can be traced to: violation of identical good assumption[35], differences in income levels, tastes, country-specific regulations such as different tax system, infrastructure, and other non-tariff barriers (laws against dumping).

The member nations of the EU also do not necessarily have well synchronized phases of business cycles (there are lags in the business cycle between the member countries), which in itself is indicative of fragmented economies.

Another important factor for the non-observance of price convergence might be that the data set are too small and not enough time has passed since the formation and implementation of major regulations of the EU. The concept of the single European market to promote free movement of goods, persons, services and capital came into force only in 1993. Even if this concept were to be fully adopted, there would always be the question of localized personal preferences in consumption or relocation. People, even though not prohibited in moving from one country to another, might still prefer not to move elsewhere (another country) even if there are significant wage differences.

Output and inputs of some of the industries are difficult to trade, e.g., power and utilities. Further, some industries, especially agriculture sector, are protected in most of the countries and the form of protection is not yet uniform among the EU member nations. Industries like pharmaceuticals and chemical are heavily regulated. Services are

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[35] "Goods produced in different countries are unlikely to be physically homogeneous. And prices of goods sold in different location s will have different amounts of transportation, distribution, and retail "value-
.... footnote continues on next page

gradually becoming a bigger component of GDP and most of these services may not be tradable even though there are no restrictions on trade.

According to classical theory, after the unification of Europe, owners of resources from a low wage country would prefer to move their resources to a high wage country and businesses would like to cut cost by moving to a low wage country. But these movements may not be feasible due to geographical, political, or simple economic reasons.

For example, it may not possible to distribute utilities (electricity) from a lower cost country to a higher cost country if there are physical impediments (mountain ranges) between the countries. Cost of overcoming such obstacles may prove to be exorbitantly high to venture into such project. Some countries have strict laws and regulations for foreign companies to make it quite unprofitable to move the business to that country even if resources are cheaper there. A country with low technical know-how and infrastructure is expected to have low income and wages. In such cases, businesses from a technically superior country will not rush to relocate to those countries even if there are no barriers to such a movement. It is especially true for those industries, which require highly skilled labor and a high level of technical infrastructure. Building adequate infrastructure and training of labor is time consuming and expensive. Under these circumstances, there may not be any observable change in the domestic income as well as prices. Most of these

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added" underlying them." Goldberg and Knetter (1997) pp. 1248

factors mentioned here have a long-run effect on prices, and these effects may be very small or insignificant in the short-run.

5.3.1 Institutional Factors in the European Union and Prices

The study does not find significant evidence in favor of price convergence in the European Union. As mentioned earlier, there are several explanations – economic, political, and institutional. In a perfectly competitive economy and in the absence of trade barriers, prices are expected to be uniform through arbitrage and freer movement of capital, technology, and labor. But the EU still has significant trade barriers. A small sampling of such instances of frictions, arising out of institutional factors, is reproduced below:

Gas Market: Apparently the EU gas market is not a competitive and unified market.

> "The paper highlights the fact that the EU's gas directive is not sufficient for the introduction of competition into Europe's gas markets."[36]
>
> "New EU gas policies will take effect to facilitate *competition*, bring down energy prices and improve environmental conditions. ... once fundamental market reforms are enacted and private investment ensues, the rules amongst countries coalesce. Basically, Western Europe would become one market." [37]

[36] Ellis, Bowitz; Roland (2000)
[37] Silverstien (2000)

Double Taxation: Apparently the current tax structure, among the EU nations, results in double taxation and is not conducive to cross border migration of labor.

> "The growing economic integration within the European Union and worldwide, together with a substantial number of businesses, workers and private individuals becoming involved in cross-border activities has resulted in many persons being subject to taxation in more than one country. The Confederation Fiscale Europeenne believes that bilateral measures are no longer sufficient remedy to protect taxpayers from double taxation and do not effectively remove the tax barriers which in many ways distort the functioning of the Single Market. It appears that certain tax barriers should be addressed not by bilateral but by multilateral agreements to be concluded by Member States." [38]

Financial markets: The EU financial markets and specially the retail lending markets are not yet fully integrated. The evidence for market integration has weakened for the post 1992 period. "As European lending rates are not yet fully integrated, the *still segmented financial markets* pose a challenge for a unified monetary policy." [39]

Chemical Industry: It seems that the EU member countries have myriad set of rules and regulation for specific chemicals due to environmental considerations. Unilaterally imposed curbs are seen as "erecting *unnecessary trade barriers* in what is supposed to be a single market. .... Progress in reducing trade barriers within the EU is being offset by problems caused by local legislation and national

[38] Anonymous (1998)
[39] Kleimeier, Sander (2000)

government guidelines. Denmark, for example, has drawn up its own list undesirable chemicals." [40]

Automobile Industry: The retail automobile industry in the EU remains highly fragmented - allowing dealers to charge different prices for the same car in different countries. "Sharp variations in car prices across Europe may soon spark a monumental battle between carmakers and regulators. The regulators want to undo a 15-year-old loophole that car companies won in European Union antitrust rules. It gives them control of most dealerships, supposedly to assure top quality maintenance. But it also lets them *vary prices country by country.*" [41]

Price Cartels: It is suggested that the EU has often allowed price fixing in major industries. Existence of such price collusion indicates the weakness of competitive markets, so essential for integration and price convergence. Recent efforts to implement the anti-trust laws are aimed at such price fixing. "While the 15 countries in the European Union have had a long history of tolerating price-fixing, that attitude is quickly changing. Since early last year, the EU's competition police have cracked down on cartels in the shipping, automobile, steel-pipe, and cement industries, among others. The shift has been prompted in large part by the move to a single currency and a unified market." [42]

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[40] Milmo (2000)
[41] Tierney, Echikson, Schmidt (2000)
[42] Echikson (2000)

Pharmaceutical Industry: The price differentials in pharmaceutical industry have long been acknowledged in the pharmaceutical industry in Europe. Price differentials in pharmaceuticals are even supported and advocated by the politicians as one of the means to for achieving "welfare maximization rate" of research and development.[43]

Thus the overall view is that the EU goods and factor markets have lower market integration resulting in the observed price differentials. Price variability in the context of the EU has been well accepted and documented[44].

The findings of this study are in conformity with the earlier research in this field. However, this study does add a new dimension by trying to examine the relationship of price differentials before and after joining the EU. While the results are not surprising, the study does provide another way of examining economic integration and price differentials in the context of the EU.

5.4 Conclusions

The overall results for the individual as well as aggregate price level, show no price convergence driven by the economic integration among the EU member nations. Lack of demonstrable convergence of price differentials among the late joiners and the original

[43] Gopal (1997)

six does not necessarily indicate that there is no economic integration achieved by the EU. As pointed out by Knetter and Slaughter (2000), these results of price convergence do not connect back to the trade barriers. Lack of this link prevents one from claming that price convergence is the result of economic integration. It can also be caused by income convergence among the countries, since income levels and price levels have a positive relationship.

The study does make a successful attempt at trying to examine the pre and post unification price movements. The study also points to the fact that the effect of other economic, geographic, and socio-political factors may be stronger than the effect of economic integration on the price movements. The next step will be to examine the quantity data, again as mentioned by Knetter and Slaughter (2000), since changes in price will definitely change the allocation of production and consumption.

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[44] Bayoumi, Thomas (1995)

Appendix I

The European Union: A Brief Background

A brief chronological description of the formation and evolution of European Union is presented here which shows gradual removal of trade restrictions over the years.

Though economic integration among European countries was always present to some degree, more organized integration took place after the Second World War in 1948 with the formation of Organization for European Economic Cooperation (OEEC). This organization was formed to liberalize trade, coordinate national policies, and cooperate in manufacturing and energy industry among the member countries. Other factors stimulating economic integration among the EU members are the technical progress that enables member countries to exchange technical knowledge, know-how, and capital without any hindrance. Shared political idealism, institutional development, and economic linkages further promote integration.

In 1958, France, Germany, Benelux, and Italy formed European Economic Community (EEC) by Treaty of Rome. The main purpose of the treaty was to establish a common market to promote harmonious and balanced growth of economic activities, which were expected to bring the member states closer to each other and rapidly raise their standards of living. The Treaty also affirms the rights of the citizens of member nations to move, work, and reside freely within the territory of the member states.

In 1961, first steps were taken to abolish quotas and customs duties progressively within EEC. In the same year, the first regulation on free movement of workers from member states within the Community came into force.

In 1968, customs union enters into force. Remaining duties in intra-Community trade were abolished and a common external tariff replaced national customs duties.

In 1973, the United Kingdom, Denmark and Ireland joined EEC, which was known by that time as European Community (EC).

In 1975, the council adopted a European Unit of Account (EUA) based on a composite basket of the Community currencies.

In 1977, the common external tariff was extended to Denmark, Ireland and the United Kingdom.

The European Monetary System (EMS) came into force in 1979. The eight member (excluding UK) states were required to maintain their exchange rates within certain fluctuation margins and the European Currency Unit (ECU) was created. ECU has since been renamed as European Union (EU).

Greece joined the EU membership in 1981.

In 1985 the first European passports were issued in most of the member states. Spain and Portugal joined the Union in 1986.

In 1987, the Single European Act came into force. This act defined the internal market as an area without internal frontiers in which the free movement of goods, persons, services and capitals is ensured. The first phase of Economic and Monetary Union (EMU) started with removal of most of the restrictions on capital movements, increased coordination of individual economic policies and more intensive cooperation between central banks.

In 1993, the Single European Market establishing the free movement of goods, persons, services and capitals was established.

Austria, Finland, and Sweden joined the union in 1995. Membership for several other European countries are currently under consideration.

Appendix II

Categorization of Commodities

The 48 different commodities are categorized into tradables and non-tradables. The tradables are further grouped into eight categories and the non-tradables into two categories. See chapter III for further discussion.

TRADABLES: (I - VIII):

I. PERISHABLES
Eggs and egg products
Butter
Potatoes and other tuber vegetables

II. COFFEE, TEAS, JAMS, CONDIMENTS
Coffee and instant coffee
Tea and other infusions
Jams, jellies, honey, and syrups
Salt, spices, sauces, and condiments

III. ALCOHOL AND TOBACCO
Spirits and liqueurs
Beer
Cigarettes
Other tobacco products

IV. CLOTHING, FOOTWEAR
Men's clothing
Ladies' clothing
Children's clothing
Men's footwear
Ladies' footwear
Children's and infant's footwear

V. CONSUMER DURABLES
Furniture and fixtures
Refrigerators and freezers
Washing machines, dryers, dishwashers
Heaters and air-conditioners

VI. PHARMACEUTICALS
Drugs and medical preparations
Therapeutic appliances

VII. AUTOMOBILES, AIRCRAFT, MACHINE TOOLS
Passenger vehicles
Motorcycles and bicycles
Tires, tubes, parts, accessories
Aircraft and other aeronautical equipment
Ships, boats
Metalworking machinery
Instruments

VIII. UTILITIES
Electricity
Town gas and natural gas

NON-TRADABLES: (I - II):	
I. CONSTRUCTION	**II. SERVICES**
One-family dwellings	Long distance by air and sea
Multi-family dwellings	Postal services
Industrial buildings	Telephone, telegraph, telex services
Agricultural buildings	Clothing rental and repair
Roads, streets and highways	Repairs to footwear
	Domestic services
	Services of dentists
	Services of nurses
	Maintenance and repair services of auto
	Hairdressers, beauty parlors, etc.
	Hotels and other lodging places

Table 1

Dispersion of Price Differential between the UK and Original Six EU Members

Categories	1970		1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):										
I. Perishables	0.310	0.433	0.247	0.530	-0.075	0.256	-0.064	0.298	-0.092	0.449
II. Coffee, Teas, Jams, Condiments	0.598	0.587	0.465	0.484	0.264	0.295	0.187	0.389	0.430	0.390
III. Alcohol and Tobacco	-0.747	0.375	-0.391	0.258	-0.399	0.354	-0.331	0.147	-0.207	0.196
IV.Clothing, Footwear	0.273	0.216	0.269	0.270	0.232	0.157	0.428	0.130	0.543	0.186
V. Consumer Durables	-0.409	0.510	0.095	0.211	-0.028	0.164	0.262	0.114	0.121	0.163
VI. Pharmaceuticals	0.421	0.297	0.471	0.218	0.107	0.312	0.061	0.294	-0.055	0.310
VII. Automobiles, Aircraft, Machine To	0.181	0.393	0.022	0.175	-0.115	0.238	-0.092	0.158	0.073	0.229
VIII. Utilities	0.111	0.425	0.285	0.255	0.305	0.121	0.079	0.143	0.030	0.208
All Tradables	0.083	0.578	0.147	0.397	0.016	0.326	0.074	0.321	0.150	0.367
Non-Tradables: (I - II):										
I. Construction	0.160	0.455	-0.050	0.189	-0.092	0.109	-0.026	0.172	0.323	0.281
II. Services	0.115	0.777	0.624	1.191	0.017	0.447	0.141	0.436	0.275	0.444
All Non-Tradables	0.129	0.690	0.414	1.040	-0.013	0.389	0.089	0.381	0.290	0.399
All 48 Commodities	0.098	0.616	0.236	0.692	-0.023	0.364	0.061	0.342	0.188	0.380

Absolute Price Differential

Categories	1970		1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):										
I. Perishables	0.424	0.313	0.518	0.247	0.200	0.171	0.229	0.194	0.287	0.351
II. Coffee, Teas, Jams, Condiments	0.714	0.429	0.546	0.386	0.303	0.252	0.318	0.287	0.452	0.362
III. Alcohol and Tobacco	0.747	0.375	0.392	0.256	0.463	0.261	0.331	0.147	0.236	0.159
IV.Clothing, Footwear	0.289	0.193	0.318	0.209	0.250	0.125	0.428	0.130	0.543	0.186
V. Consumer Durables	0.541	0.359	0.192	0.125	0.136	0.092	0.262	0.113	0.166	0.115
VI. Pharmaceuticals	0.429	0.284	0.476	0.207	0.268	0.177	0.204	0.202	0.205	0.232
VII. Automobiles, Aircraft, Machine To	0.338	0.288	0.134	0.112	0.176	0.196	0.150	0.104	0.140	0.194
VIII. Utilities	0.316	0.288	0.321	0.204	0.305	0.121	0.121	0.106	0.160	0.127
All Tradables	0.491	0.364	0.328	0.266	0.253	0.206	0.268	0.190	0.289	0.272
Non-Tradables: (I - II):										
I. Construction	0.418	0.227	0.152	0.120	0.120	0.076	0.143	0.095	0.343	0.255
II. Services	0.589	0.514	0.703	1.146	0.320	0.310	0.314	0.332	0.410	0.321
All Non-Tradables	0.535	0.450	0.531	0.984	0.267	0.282	0.261	0.291	0.389	0.303
All 48 Commodities	0.488	0.388	0.396	0.614	0.262	0.253	0.260	0.229	0.314	0.285

Table 2

Dispersion of Price Differential between Ireland and Original Six EU Members

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.247	0.260	-0.169	0.400	-0.101	0.279	-0.150	0.407
II. Coffee, Teas, Jams, Condiments	0.504	0.490	0.073	0.361	0.065	0.498	0.046	0.263
III. Alcohol and Tobacco	-0.343	0.192	-0.700	0.236	-0.616	0.265	-0.385	0.143
IV.Clothing, Footwear	0.145	0.219	0.176	0.172	0.300	0.199	0.287	0.141
V. Consumer Durables	0.121	0.270	-0.065	0.123	0.046	0.108	0.179	0.159
VI. Pharmaceuticals	0.190	0.270	-0.040	0.355	-0.059	0.363	-0.019	0.389
VII. Automobiles, Aircraft, Machine Tools	0.048	0.220	-0.118	0.231	-0.019	0.201	0.063	0.292
VIII. Utilities	0.109	0.363	-0.110	0.276	-0.171	0.374	-0.055	0.380
All Tradables	0.115	0.357	-0.104	0.362	-0.035	0.382	0.029	0.329
Non-Tradables: (I - II):								
I. Construction	0.114	0.201	0.241	0.217	0.175	0.195	0.408	0.258
II. Services	0.499	1.152	0.049	0.386	0.068	0.346	0.152	0.348
All Non-Tradables	0.379	0.976	0.108	0.353	0.101	0.310	0.232	0.343
All 48 Commodities	0.203	0.645	-0.069	0.372	-0.009	0.364	0.074	0.353

Absolute Price Differential

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.283	0.219	0.331	0.272	0.238	0.169	0.318	0.287
II. Coffee, Teas, Jams, Condiments	0.585	0.384	0.280	0.233	0.372	0.329	0.209	0.161
III. Alcohol and Tobacco	0.343	0.192	0.7	0.236	0.616	0.265	0.385	0.143
IV.Clothing, Footwear	0.215	0.147	0.205	0.135	0.305	0.191	0.289	0.135
V. Consumer Durables	0.277	0.090	0.106	0.088	0.093	0.070	0.194	0.141
VI. Pharmaceuticals	0.227	0.237	0.314	0.143	0.281	0.222	0.308	0.220
VII. Automobiles, Aircraft, Machine Tools	0.185	0.125	0.150	0.203	0.158	0.123	0.208	0.213
VIII. Utilities	0.313	0.195	0.246	0.152	0.336	0.221	0.341	0.146
All Tradables	0.292	0.235	0.275	0.257	0.288	0.252	0.269	0.192
Non-Tradables: (I - II):								
I. Construction	0.196	0.118	0.266	0.183	0.210	0.155	0.416	0.243
II. Services	0.838	0.931	0.299	0.246	0.284	0.207	0.307	0.221
All Non-Tradables	0.638	0.829	0.289	0.227	0.261	0.194	0.341	0.232
All 48 Commodities	0.407	0.539	0.279	0.256	0.275	0.238	0.291	0.212

Table 3

Dispersion of Price Differential between Denmark and Original Six EU Members

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	-0.007	0.784	-0.311	0.302	-0.435	0.349	-0.466	0.544
II. Coffee, Teas, Jams, Condiments	-0.175	0.228	-0.047	0.199	-0.005	0.252	-0.222	0.215
III. Alcohol and Tobacco	-0.476	0.417	-0.561	0.318	-0.538	0.301	-0.373	0.405
IV.Clothing, Footwear	-0.103	0.215	-0.125	0.173	-0.095	0.184	-0.025	0.128
V. Consumer Durables	-0.047	0.189	-0.203	0.179	-0.248	0.148	-0.096	0.188
VI. Pharmaceuticals	-0.241	0.265	0.101	0.701	-0.093	0.626	-0.050	0.575
VII. Automobiles, Aircraft, Machine Tools	-0.265	0.304	-0.306	0.239	-0.310	0.245	-0.088	0.426
VIII. Utilities	-0.089	0.324	-0.197	0.316	-0.496	0.380	-0.545	0.465
All Tradables	-0.186	0.387	-0.233	0.338	-0.262	0.337	-0.191	0.398
Non-Tradables: (I - II):								
I. Construction	-0.142	0.205	-0.183	0.123	-0.270	0.175	-0.176	0.235
II. Services	-0.057	0.348	-0.285	0.470	-0.247	0.407	-0.243	0.400
All Non-Tradables	-0.084	0.312	-0.253	0.397	-0.254	0.351	-0.222	0.357
All 48 Commodities	-0.152	0.366	-0.256	0.343	-0.272	0.323	-0.217	0.369

Absolute Price Differential

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.641	0.424	0.318	0.293	0.450	0.329	0.491	0.520
II. Coffee, Teas, Jams, Condiments	0.237	0.158	0.148	0.138	0.180	0.172	0.249	0.182
III. Alcohol and Tobacco	0.533	0.402	0.566	0.309	0.542	0.293	0.439	0.328
IV.Clothing, Footwear	0.185	0.148	0.174	0.122	0.185	0.090	0.106	0.075
V. Consumer Durables	0.164	0.100	0.212	0.167	0.248	0.148	0.145	0.152
VI. Pharmaceuticals	0.247	0.259	0.606	0.317	0.530	0.308	0.469	0.307
VII. Automobiles, Aircraft, Machine Tools	0.321	0.243	0.306	0.239	0.337	0.205	0.319	0.292
VIII. Utilities	0.266	0.191	0.304	0.205	0.508	0.361	0.570	0.432
All Tradables	0.314	0.293	0.311	0.269	0.337	0.262	0.305	0.320
Non-Tradables: (I - II):								
I. Construction	0.186	0.165	0.187	0.118	0.283	0.152	0.241	0.164
II. Services	0.279	0.213	0.436	0.332	0.404	0.250	0.407	0.228
All Non-Tradables	0.250	0.203	0.358	0.305	0.366	0.230	0.355	0.223
All 48 Commodities	0.293	0.267	0.322	0.282	0.340	0.251	0.314	0.290

Table 4

Dispersion of Price Differential between Spain and Original Six EU Members

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.181	0.178	0.091	0.257	-0.118	0.392	-0.113	0.393
II. Coffee, Teas, Jams, Condiments	0.290	0.316	0.104	0.215	0.035	0.288	-0.127	0.403
III. Alcohol and Tobacco	0.832	0.185	0.130	0.434	0.091	0.349	0.273	0.201
IV.Clothing, Footwear	0.447	0.434	0.233	0.173	0.172	0.332	0.271	0.230
V. Consumer Durables	-0.080	0.409	-0.262	0.304	-0.060	0.163	0.126	0.215
VI. Pharmaceuticals	0.411	0.203	0.497	0.314	0.468	0.314	0.577	0.331
VII. Automobiles, Aircraft, Machine Tools	0.274	0.256	-0.157	0.238	-0.160	0.256	0.043	0.193
VIII. Utilities	0.258	0.245	0.269	0.133	-0.226	0.150	-0.135	0.195
All Tradables	0.333	0.391	0.062	0.338	0.009	0.337	0.111	0.329
Non-Tradables: (I - II):								
I. Construction	0.230	0.358	0.556	0.265	0.222	0.268	0.232	0.305
II. Services	0.588	0.768	0.417	0.730	0.093	0.355	0.132	0.343
All Non-Tradables	0.476	0.686	0.498	0.623	0.133	0.334	0.163	0.334
All 48 Commodities	0.381	0.512	0.197	0.504	0.047	0.334	0.119	0.327

Absolute Price Differential

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.203	0.151	0.204	0.175	0.337	0.219	0.336	0.220
II. Coffee, Teas, Jams, Condiments	0.337	0.262	0.200	0.130	0.215	0.190	0.291	0.301
III. Alcohol and Tobacco	0.832	0.185	0.353	0.276	0.308	0.176	0.288	0.178
IV.Clothing, Footwear	0.502	0.366	0.247	0.152	0.325	0.180	0.287	0.208
V. Consumer Durables	0.306	0.276	0.327	0.229	0.139	0.101	0.182	0.168
VI. Pharmaceuticals	0.412	0.199	0.501	0.308	0.468	0.314	0.577	0.331
VII. Automobiles, Aircraft, Machine Tools	0.290	0.239	0.217	0.183	0.265	0.140	0.128	0.150
VIII. Utilities	0.292	0.200	0.269	0.133	0.226	0.149	0.155	0.177
All Tradables	0.405	0.315	0.271	0.211	0.277	0.192	0.254	0.236
Non-Tradables: (I - II):								
I. Construction	0.320	0.278	0.556	0.265	0.303	0.167	0.317	0.212
II. Services	0.837	0.479	0.693	0.521	0.299	0.209	0.300	0.210
All Non-Tradables	0.676	0.488	0.650	0.459	0.300	0.196	0.306	0.209
All 48 Commodities	0.495	0.401	0.399	0.365	0.277	0.192	0.265	0.225

Table 5

Dispersion of Price Differential between Austria and Original Six EU Members

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.098	0.136	-0.342	0.219	-0.319	0.263	-0.243	0.301
II. Coffee, Teas, Jams, Condiments	-0.069	0.314	-0.211	0.246	-0.225	0.262	-0.303	0.227
III. Alcohol and Tobacco	0.529	0.592	-0.198	0.395	-0.042	0.181	-0.024	0.192
IV.Clothing, Footwear	0.277	0.185	-0.068	0.145	0.148	0.183	0.036	0.148
V. Consumer Durables	0.002	0.343	-0.007	0.180	-0.084	0.167	-0.160	0.167
VI. Pharmaceuticals	-0.055	0.313	-0.238	0.357	-0.230	0.296	-0.246	0.328
VII. Automobiles, Aircraft, Machine Tools	0.105	0.345	-0.125	0.201	0.038	0.164	-0.024	0.256
VIII. Utilities	0.129	0.260	0.094	0.201	-0.041	0.138	-0.078	0.195
All Tradables	0.146	0.380	-0.133	0.262	-0.055	0.248	-0.102	0.251
Non-Tradables: (I - II):								
I. Construction	-0.390	0.553	0.072	0.182	-0.057	0.200	-0.031	0.239
II. Services	0.045	0.575	0.013	0.460	-0.039	0.353	-0.094	0.341
All Non-Tradables	-0.091	0.601	0.032	0.394	-0.009	0.315	-0.074	0.312
All 48 Commodities	0.067	0.478	-0.099	0.318	-0.062	0.271	-0.112	0.268

Absolute Price Differential

Categories	1975		1985		1990		1993	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tradables: (I - VIII):								
I. Perishables	0.144	0.082	0.344	0.215	0.332	0.246	0.326	0.200
II. Coffee, Teas, Jams, Condiments	0.252	0.194	0.256	0 196	0.273	0.209	0.311	0.215
III. Alcohol and Tobacco	0.599	0.518	0.359	0.250	0.141	0.117	0.150	0.119
IV.Clothing, Footwear	0.290	0.161	0.123	0.102	0.166	0.166	0.121	0.090
V. Consumer Durables	0.311	0.130	0.149	0.097	0.155	0.101	0.182	0.141
VI. Pharmaceuticals	0.243	0.191	0.312	0.289	0.332	0.158	0.363	0.174
VII. Automobiles, Aircraft, Machine Tools	0.240	0.267	0.149	0.184	0.126	0.109	0.209	0.147
VIII. Utilities	0.249	0.135	0.173	0.132	0.118	0.075	0.140	0.152
All Tradables	0.297	0.279	0.214	0.202	0.189	0.169	0.211	0.170
Non-Tradables: (I - II):								
I. Construction	0.601	0.300	0.160	0.109	0.165	0.124	0.191	0.142
II. Services	0.448	0.360	0.363	0.279	0.268	0.230	0.281	0.211
All Non-Tradables	0.495	0.348	0.299	0.257	0.236	0.208	0.253	0.196
All 48 Commodities	0.363	0.317	0.240	0.230	0.203	0.190	0.224	0.185

Table 6

Dispersion of Price Differential between the UK and Original Six EU Members

Categories	1970		1975		1985		1990		1993	
	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var
Tradables: (I - VIII):										
I. Perishables	0.433	1.397	0.530	2.146	0.256	-3.413	0.298	-4.656	0.449	-4.880
II. Coffee, Teas, Jams, Condiments	0.587	0.982	0.484	1.041	0.295	1.117	0.389	2.080	0.390	0.907
III. Alcohol and Tobacco	0.375	-0.502	0.258	-0.660	0.354	-0.887	0.147	-0.444	0.196	-0.947
IV.Clothing, Footwear	0.216	0.791	0.270	1.004	0.157	0.677	0.130	0.304	0.186	0.343
V. Consumer Durables	0.510	-1.247	0.211	2.221	0.164	-5.857	0.114	0.435	0.163	1.347
VI. Pharmaceuticals	0.297	0.705	0.218	0.463	0.312	2.916	0.294	294.000	0.310	-5.636
VII. Automobiles, Aircraft, Machine To	0.393	2.171	0.175	7.955	0.238	-2.070	0.158	-1.717	0.229	3.137
VIII. Utilities	0.425	3.829	0.255	0.895	0.121	0.397	0.143	1.810	0.208	6.933
All Tradables	0.578	6.964	0.397	2.701	0.326	20.375	0.321	4.338	0.367	2.447
Non-Tradables: (I - II):										
I. Construction	0.455	2.844	0.189	-3.780	0.109	-1.185	0.172	-6.615	0.281	0.870
II. Services	0.777	6.757	1.191	1.909	0.447	26.294	0.436	3.092	0.444	1.615
All Non-Tradables	0.690	5.349	1.040	2.512	0.389	-29.923	0.381	4.281	0.399	1.376
All 48 Commodities	0.616	6.286	0.692	2.932	0.364	-15.826	0.342	5.607	0.380	2.021

Table 7

Dispersion of Price Differential between Ireland and Original Six EU Members

Categories	1975		1985		1990		1993	
	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var
Tradables: (I - VIII):								
I. Perishables	0.260	1.053	0.400	-2.367	0.279	-2.762	0.407	-2.713
II. Coffee, Teas, Jams, Condiments	0.490	0.972	0.361	4.945	0.498	7.662	0.263	5.717
III. Alcohol and Tobacco	0.192	-0.560	0.236	-0.337	0.265	-0.430	0.143	-0.371
IV.Clothing, Footwear	0.219	1.510	0.172	0.977	0.199	0.663	0.141	0.491
V. Consumer Durables	0.270	2.231	0.123	-1.892	0.108	2.348	0.159	0.888
VI. Pharmaceuticals	0.270	1.421	0.355	-8.875	0.363	-6.153	0.389	-20.474
VII. Automobiles, Aircraft, Machine Tools	0.220	4.583	0.231	-1.958	0.201	-10.579	0.292	4.635
VIII. Utilities	0.363	3.330	0.276	-2.509	0.374	-2.187	0.380	-6.909
All Tradables	0.357	3.104	0.362	-3.481	0.382	-10.914	0.329	11.345
Non-Tradables: (I - II):								
I. Construction	0.201	1.763	0.217	0.900	0.195	1.114	0.258	0.632
II. Services	1.152	2.309	0.386	7.878	0.346	5.088	0.348	2.289
All Non-Tradables	0.976	2.575	0.353	3.269	0.310	3.069	0.343	1.478
All 48 Commodities	0.645	3.177	0.372	-5.391	0.364	-40.444	0.353	4.770

Dispersion of Price Differential between Denmark and Original Six EU Members

Categories	1975		1985		1990		1993	
	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var
Tradables: (I - VIII):								
I. Perishables	0.784	-112.000	0.302	-0.971	0.349	-0.802	0.544	-1.167
II. Coffee, Teas, Jams, Condiments	0.228	-1.303	0.199	-4.234	0.252	-50.400	0.215	-0.968
III. Alcohol and Tobacco	0.417	-0.876	0.318	-0.567	0.301	-0.559	0.405	-1.086
IV.Clothing, Footwear	0.215	-2.087	0.173	-1.384	0.184	-1.937	0.128	-5.120
V. Consumer Durables	0.189	-4.021	0.179	-0.882	0.148	-0.597	0.188	-1.958
VI. Pharmaceuticals	0.265	-1.100	0.701	6.941	0.626	-6.731	0.575	-11.500
VII. Automobiles, Aircraft, Machine Tools	0.304	-1.147	0.239	-0.781	0.245	-0.790	0.426	-4.841
VIII. Utilities	0.324	-3.640	0.316	-1.604	0.380	-0.766	0.465	-0.853
All Tradables	0.387	-2.081	0.338	-1.451	0.337	-1.286	0.398	-2.084
Non-Tradables: (I - II):								
I. Construction	0.205	-1.444	0.123	-0.672	0.175	-0.648	0.235	-1.335
II. Services	0.348	-6.105	0.470	-1.649	0.407	-1.648	0.400	-1.646
All Non-Tradables	0.312	-3.714	0.397	-1.569	0.351	-1.382	0.357	-1.608
All 48 Commodities	0.366	-2.408	0.343	-1.340	0.323	-1.188	0.369	-1.700

Table 8

Dispersion of Price Differential between Spain and Original Six EU Members

Categories	1975		1985		1990		1993	
	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var
Tradables: (I - VIII):								
I. Perishables	0.178	0.983	0.257	2.824	0.392	-3.322	0.393	-3.478
II. Coffee, Teas, Jams, Condiments	0.316	1.090	0.215	2.067	0.288	8.229	0.403	-3.173
III. Alcohol and Tobacco	0.185	0.222	0.434	3.338	0.349	3.835	0.201	0.736
IV.Clothing, Footwear	0.434	0.971	0.173	0.742	0.332	1.930	0.230	0.849
V. Consumer Durables	0.409	-5.113	0.304	-1.160	0.163	-2.717	0.215	1.706
VI. Pharmaceuticals	0.203	0.494	0.314	0.632	0.314	0.671	0.331	0.574
VII. Automobiles, Aircraft, Machine Tools	0.256	0.934	0.238	-1.516	0.256	-1.600	0.193	4.488
VIII. Utilities	0.245	0.950	0.133	0.494	0.150	-0.664	0.195	-1.444
All Tradables	0.391	1.174	0.338	5.452	0.337	37.444	0.329	2.964
Non-Tradables: (I - II):								
I. Construction	0.358	1.557	0.265	0.477	0.268	1.207	0.305	1.315
II. Services	0.768	1.306	0.730	1.751	0.355	3.817	0.343	2.598
All Non-Tradables	0.686	1.441	0.623	1.251	0.334	2.511	0.334	2.049
All 48 Commodities	0.512	1.344	0.504	2.558	0.334	7.106	0.327	2.748

Dispersion of Price Differential between Austria and Original Six EU Members

Categories	1975		1985		1990		1993	
	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var	SD	Co. of Var
Tradables: (I - VIII):								
I. Perishables	0.136	1.388	0.219	-0.640	0.263	-0.824	0.301	-1.239
II. Coffee, Teas, Jams, Condiments	0.314	-4.551	0.246	-1.166	0.262	-1.164	0.227	-0.749
III. Alcohol and Tobacco	0.592	1.119	0.395	-1.995	0.181	-4.310	0.192	-8.000
IV.Clothing, Footwear	0.185	0.668	0.145	-2.132	0.183	1.236	0.148	4.111
V. Consumer Durables	0.343	171.500	0.180	-25.714	0.167	-1.988	0.167	-1.044
VI. Pharmaceuticals	0.313	-5.691	0.357	-1.500	0.296	-1.287	0.328	-1.333
VII. Automobiles, Aircraft, Machine Tools	0.345	3.286	0.201	-1.608	0.164	4.316	0.256	-10.667
VIII. Utilities	0.260	2.016	0.201	2.138	0.138	-3.366	0.195	-2.500
All Tradables	0.380	2.603	0.262	-1.970	0.248	-4.509	0.251	-2.461
Non-Tradables: (I - II):								
I. Construction	0.553	-1.418	0.182	2.528	0.200	-3.509	0.239	-7.710
II. Services	0.575	12.778	0.460	35.385	0.353	-9.051	0.341	-3.628
All Non-Tradables	0.601	-6.604	0.394	12.313	0.315	-35.000	0.312	-4.216
All 48 Commodities	0.478	7.134	0.318	-3.212	0.271	-4.371	0.268	-2.393

Table 9

Regression Results

Regression Statistics	
Multiple R	0.447590344
R Square	0.200337116
Adjusted R Square	0.138824586
Standard Error	0.006997764
Observations	15

ANOVA

	df	SS	MS	F
Regression	1	0.000159484	0.000159484	3.25685055
Residual	13	0.000636593	4.89687E-05	
Total	14	0.000796077		

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.100053404	0.044767236	2.234969431	0.04359985
Log(Price Level)	-0.019364168	0.010730005	-1.804674639	0.09433109

Table 10

Correlogram Results for Aggregate Price Differential between Denmark, Ireland, the UK and Original Six Members of the EU from 1960 to 1992

	Denmark				Ireland				UK			
Lag	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob
1	0.883	0.883	28.17	0.000	0.860	0.860	26.67	0.000	0.826	0.826	24.64	0.000
2	0.779	-0.008	50.75	0.000	0.654	-0.324	42.62	0.000	0.572	-0.349	36.83	0.000
3	0.678	-0.039	68.43	0.000	0.431	-0.148	49.78	0.000	0.357	0.028	41.73	0.000
4	0.557	-0.149	80.79	0.000	0.230	-0.051	51.88	0.000	0.169	-0.137	42.86	0.000
5	0.416	-0.181	87.92	0.000	0.053	-0.092	52.00	0.000	0.007	-0.072	42.87	0.000
6	0.312	0.061	92.07	0.000	-0.143	-0.298	52.87	0.000	-0.137	-0.136	43.67	0.000
7	0.231	0.056	94.45	0.000	-0.276	0.106	56.27	0.000	-0.222	0.044	45.86	0.000
8	0.190	0.155	96.12	0.000	-0.357	-0.046	62.17	0.000	-0.240	0.005	48.51	0.000
9	0.109	-0.237	96.69	0.000	-0.357	0.098	68.29	0.000	-0.205	0.053	50.54	0.000
10	0.027	-0.165	96.73	0.000	-0.361	-0.269	74.84	0.000	-0.217	-0.264	52.90	0.000
11	-0.020	0.045	96.75	0.000	-0.395	-0.185	83.05	0.000	-0.296	-0.214	57.49	0.000
12	-0.076	-0.045	97.07	0.000	-0.411	-0.050	92.32	0.000	-0.371	-0.105	65.05	0.000
13	-0.164	-0.113	98.62	0.000	-0.383	0.076	100.81	0.000	-0.355	0.167	72.31	0.000
14	-0.214	0.038	101.41	0.000	-0.317	-0.097	106.90	0.000	-0.289	-0.026	77.39	0.000
15	-0.244	0.002	105.22	0.000	-0.256	-0.041	111.10	0.000	-0.260	-0.157	81.73	0.000
16	-0.260	0.003	109.81	0.000	-0.207	-0.083	114.01	0.000	-0.217	0.024	84.94	0.000
17	-0.262	0.045	114.78	0.000	-0.131	0.101	115.25	0.000	-0.130	0.031	86.15	0.000
18	-0.269	-0.088	120.36	0.000	-0.033	-0.075	115.34	0.000	-0.012	0.003	86.17	0.000
19	-0.271	-0.112	126.42	0.000	0.068	-0.030	115.71	0.000	0.087	-0.030	86.79	0.000
20	-0.252	0.044	132.07	0.000	0.110	-0.187	116.80	0.000	0.126	-0.037	88.19	0.000
21	-0.284	-0.160	139.83	0.000	0.135	0.163	118.56	0.000	0.126	0.025	89.72	0.000
22	-0.300	0.023	149.26	0.000	0.144	-0.157	120.75	0.000	0.099	-0.156	90.74	0.000
23	-0.308	-0.064	160.23	0.000	0.127	-0.149	122.61	0.000	0.056	-0.176	91.11	0.000
24	-0.308	0.032	172.38	0.000	0.116	-0.003	124.33	0.000	0.032	0.094	91.24	0.000
25	-0.301	0.018	185.46	0.000	0.087	0.125	125.42	0.000	-0.002	0.005	91.24	0.000

Table 11

Correlogram Results for Aggregate Price Differential between Greece, Portugal, Spain and Original Six Members of the EU from 1960 to 1992

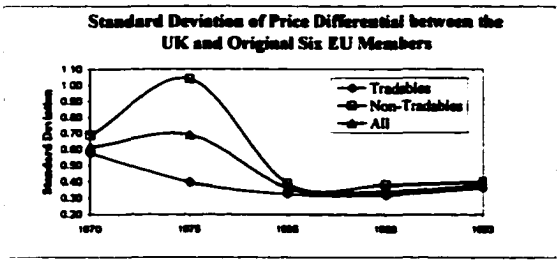
	Greece				Portugal				Spain			
Lag	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob
1	0.870	0.870	26.58	0.000	0.866	0.866	25.60	0.000	0.826	0.826	24.63	0.000
2	0.753	-0.020	47.13	0.000	0.699	-0.207	42.85	0.000	0.653	-0.093	40.50	0.000
3	0.650	-0.005	62.96	0.000	0.572	0.083	54.80	0.000	0.509	-0.012	50.46	0.000
4	0.535	-0.108	74.06	0.000	0.524	0.208	65.20	0.000	0.392	-0.011	56.57	0.000
5	0.446	0.035	82.07	0.000	0.492	-0.028	74.74	0.000	0.351	0.162	61.66	0.000
6	0.357	-0.060	87.41	0.000	0.438	-0.066	82.59	0.000	0.336	0.046	66.48	0.000
7	0.298	0.069	91.27	0.000	0.355	-0.062	87.96	0.000	0.330	0.044	71.33	0.000
8	0.258	0.030	94.29	0.000	0.222	-0.252	90.16	0.000	0.306	-0.037	75.66	0.000
9	0.177	-0.187	95.77	0.000	0.115	0.023	90.78	0.000	0.253	-0.054	78.73	0.000
10	0.112	-0.013	96.39	0.000	0.004	-0.222	90.78	0.000	0.211	0.035	80.98	0.000
11	0.040	-0.091	96.47	0.000	-0.101	-0.152	91.31	0.000	0.077	-0.323	81.28	0.000
12	-0.041	-0.076	96.56	0.000	-0.194	-0.031	93.33	0.000	-0.017	0.039	81.30	0.000
13	-0.067	0.142	96.82	0.000	-0.252	-0.002	96.93	0.000	-0.099	-0.125	81.87	0.000
14	-0.091	-0.009	97.32	0.000	-0.284	0.009	101.79	0.000	-0.161	-0.016	83.44	0.000
15	-0.169	-0.295	99.15	0.000	-0.317	0.005	108.23	0.000	-0.140	0.105	84.70	0.000
16	-0.223	-0.029	102.53	0.000	-0.379	-0.162	118.02	0.000	-0.172	-0.223	86.70	0.000
17	-0.277	-0.035	108.11	0.000	-0.445	0.011	132.46	0.000	-0.225	-0.079	90.34	0.000
18	-0.304	0.049	115.30	0.000	-0.453	0.135	148.64	0.000	-0.294	-0.126	97.01	0.000
19	-0.330	-0.027	124.42	0.000	-0.405	0.068	162.60	0.000	-0.363	0.007	107.86	0.000
20	-0.370	-0.087	136.82	0.000	-0.323	0.119	172.31	0.000	-0.370	0.042	120.05	0.000
21	-0.358	0.022	149.48	0.000	-0.269	-0.016	179.71	0.000	-0.348	0.114	131.69	0.000
22	-0.342	-0.010	162.21	0.000	-0.255	-0.080	187.13	0.000	-0.306	-0.041	141.54	0.000
23	-0.364	-0.138	178.24	0.000	-0.259	-0.016	195.73	0.000	-0.261	0.052	149.43	0.000
24	-0.370	-0.032	196.83	0.000	-0.212	0.099	202.29	0.000	-0.238	0.011	156.71	0.000
25	-0.379	0.017	219.14	0.000	-0.173	-0.279	207.39	0.000	-0.205	-0.028	162.76	0.000

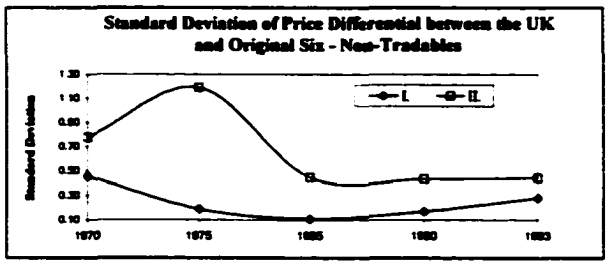
Table 12

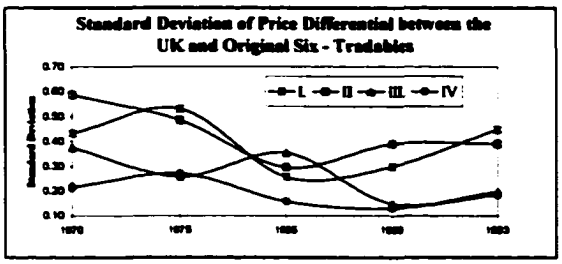
Correlogram Results for Aggregate Price Differential between Austria, Sweden, Finland and Original Six Members of the EU from 1960 to 1992

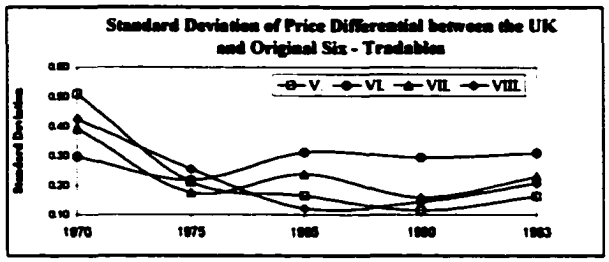
	Austria				Sweden				Finland			
Lag	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob	Auto-correlation	Partial Autocorrelation	Q-Stat	Prob
1	0.924	0.924	30.80	0.000	0.547	0.547	10.79	0.001	0.793	0.793	22.69	0.000
2	0.853	-0.002	57.92	0.000	0.055	-0.348	10.90	0.004	0.523	-0.285	32.89	0.000
3	0.789	0.006	81.88	0.000	0.092	0.393	11.23	0.011	0.310	0.008	36.58	0.000
4	0.703	-0.181	101.56	0.000	0.328	0.131	15.53	0.004	0.208	0.113	38.30	0.000
5	0.593	-0.227	116.07	0.000	0.280	-0.050	18.77	0.002	0.191	0.077	39.81	0.000
6	0.481	-0.123	125.96	0.000	-0.010	-0.138	18.77	0.005	0.146	-0.140	40.72	0.000
7	0.368	-0.094	131.97	0.000	-0.042	0.160	18.85	0.009	0.108	0.069	41.24	0.000
8	0.285	0.187	135.73	0.000	0.092	-0.115	19.25	0.014	0.029	-0.134	41.28	0.000
9	0.194	-0.062	137.53	0.000	0.149	0.111	20.31	0.016	-0.088	-0.158	41.65	0.000
10	0.092	-0.118	137.96	0.000	-0.001	-0.150	20.31	0.026	-0.244	-0.231	44.64	0.000
11	0.000	-0.107	137.96	0.000	-0.209	-0.159	22.62	0.020	-0.381	-0.097	52.26	0.000
12	-0.058	0.096	138.14	0.000	-0.226	-0.096	25.42	0.013	-0.402	0.056	61.16	0.000
13	-0.120	-0.047	138.98	0.000	-0.162	-0.110	26.93	0.013	-0.340	0.019	67.83	0.000
14	-0.179	-0.013	140.93	0.000	-0.048	0.171	27.07	0.019	-0.258	-0.023	71.86	0.000
15	-0.225	0.001	144.19	0.000	-0.090	-0.137	27.58	0.024	-0.258	-0.162	76.14	0.000
16	-0.289	-0.302	149.88	0.000	-0.246	-0.089	31.71	0.011	-0.327	-0.118	83.38	0.000
17	-0.337	-0.040	158.09	0.000	-0.317	-0.178	38.96	0.002	-0.321	0.172	90.84	0.000
18	-0.370	0.009	168.64	0.000	-0.269	-0.084	44.51	0.000	-0.287	-0.087	97.17	0.000
19	-0.422	-0.076	183.31	0.000	-0.129	0.057	45.88	0.001	-0.195	0.068	100.30	0.000
20	-0.450	0.095	201.29	0.000	-0.091	0.105	46.62	0.001	-0.123	-0.080	101.64	0.000
21	-0.452	0.087	220.93	0.000	-0.076	0.146	47.18	0.001	-0.070	-0.032	102.11	0.000
22	-0.456	-0.045	242.76	0.000	-0.028	0.001	47.26	0.001	0.009	0.051	102.12	0.000
23	-0.436	0.071	264.69	0.000	0.020	-0.027	47.31	0.002	0.064	0.026	102.60	0.000
24	-0.404	0.029	285.65	0.000	0.017	-0.124	47.35	0.003	0.107	0.024	104.06	0.000
25	-0.362	0.067	304.58	0.000	-0.053	0.026	47.76	0.004	0.085	-0.120	105.10	0.000

Chart 1



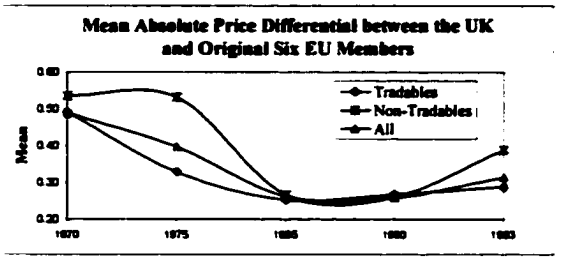


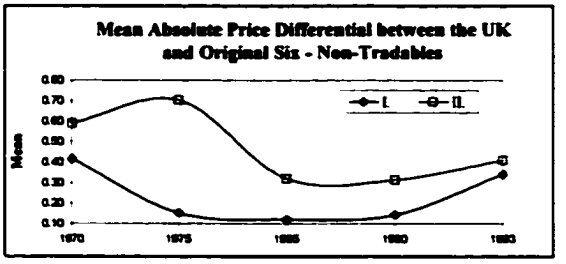


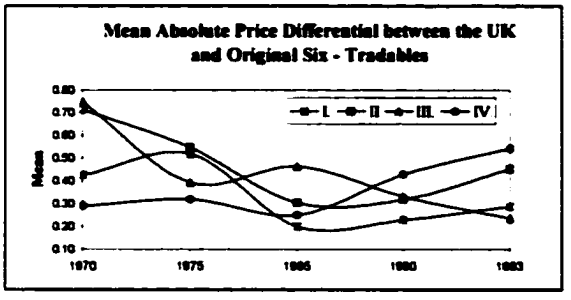


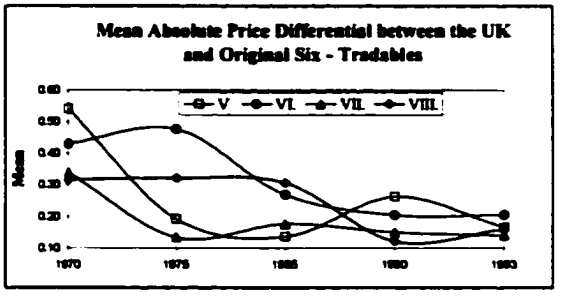
Note: Tradables: I.Perishables; II. Coffee, Tea; III. Alcohol and Cigarettes; IV. Clothing and Footwear; V. Consumer Durables; VI. Pharmaceuticals; VII. Automobiles, Aircraft, machine Tools; VIII. Utilities; Non-Tradables: I. Construction; II. Services;

Chart 2









Note: Tradables: I.Perishables; II. Coffee, Tea; III. Alcohol and Cigarettes; IV. Clothing and Footwear; V. Consumer Durables; VI. Pharmaceuticals; VII. Automobiles, Aircraft, machine Tools; VIII. Utilities; Non-Tradables: I. Construction; II. Services;

Chart 3

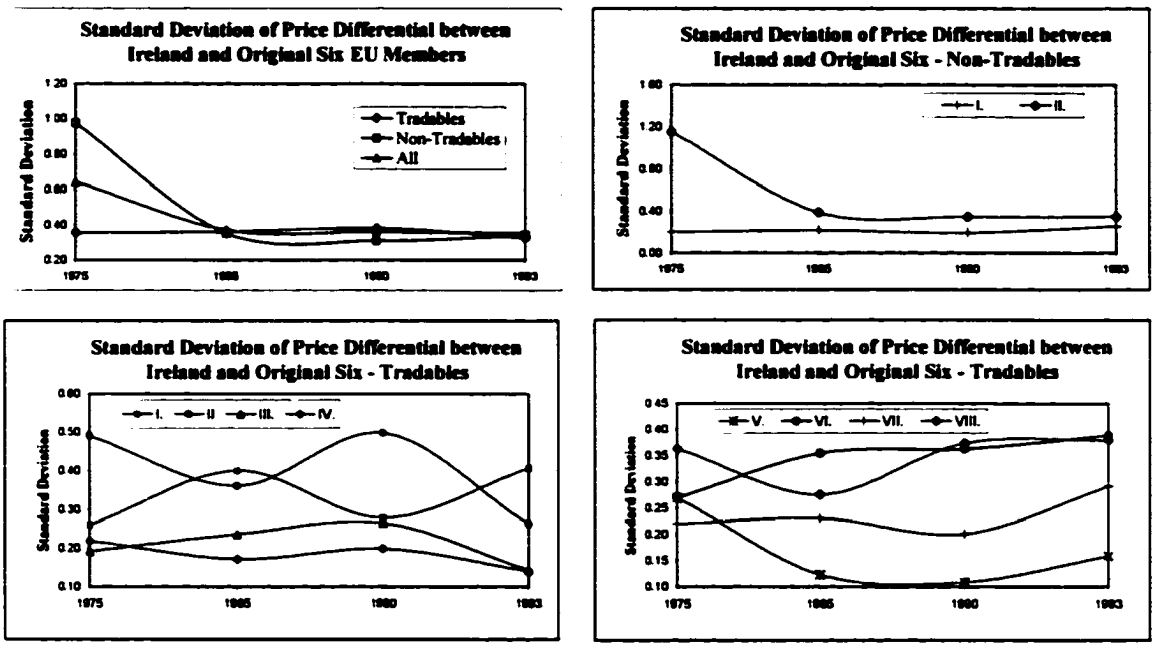


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Chart 4

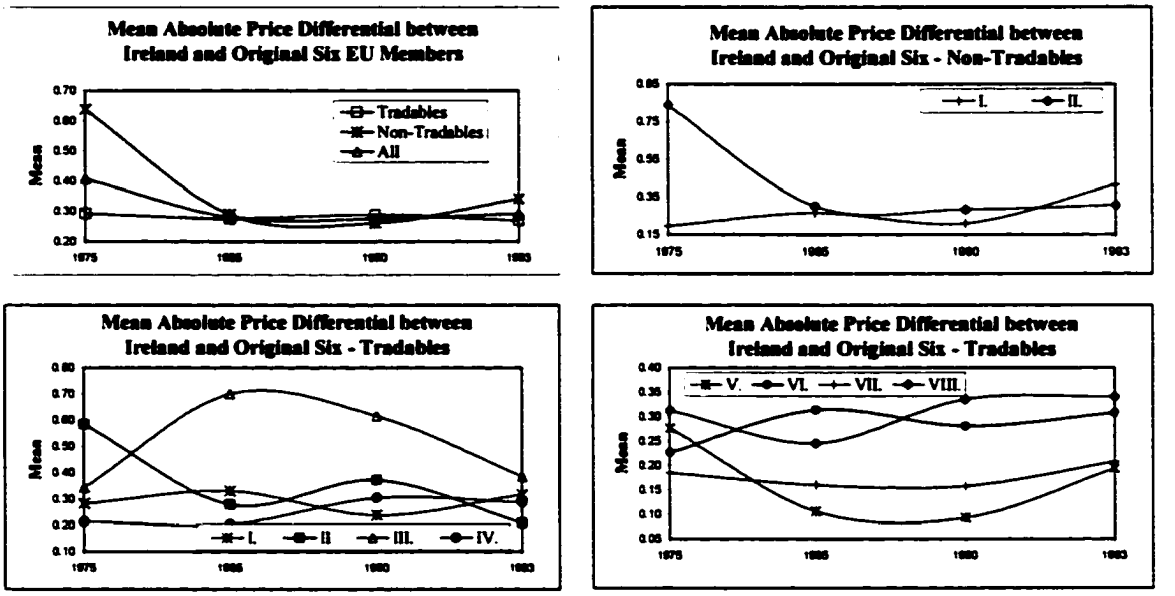

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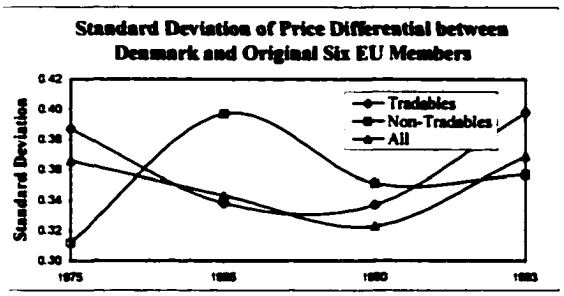
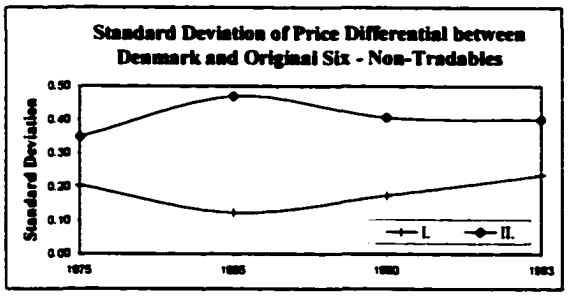
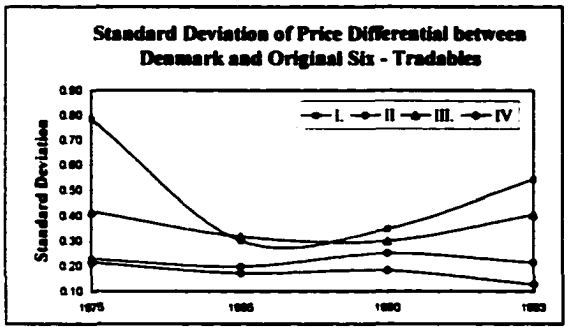
Chart 5







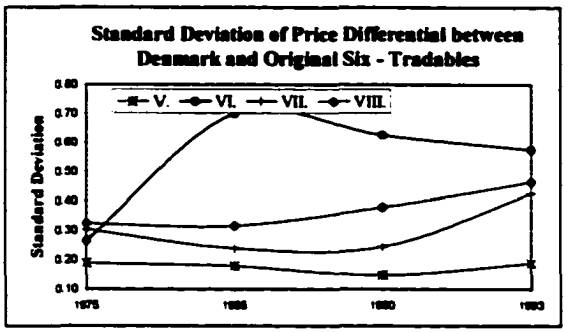


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Chart 6

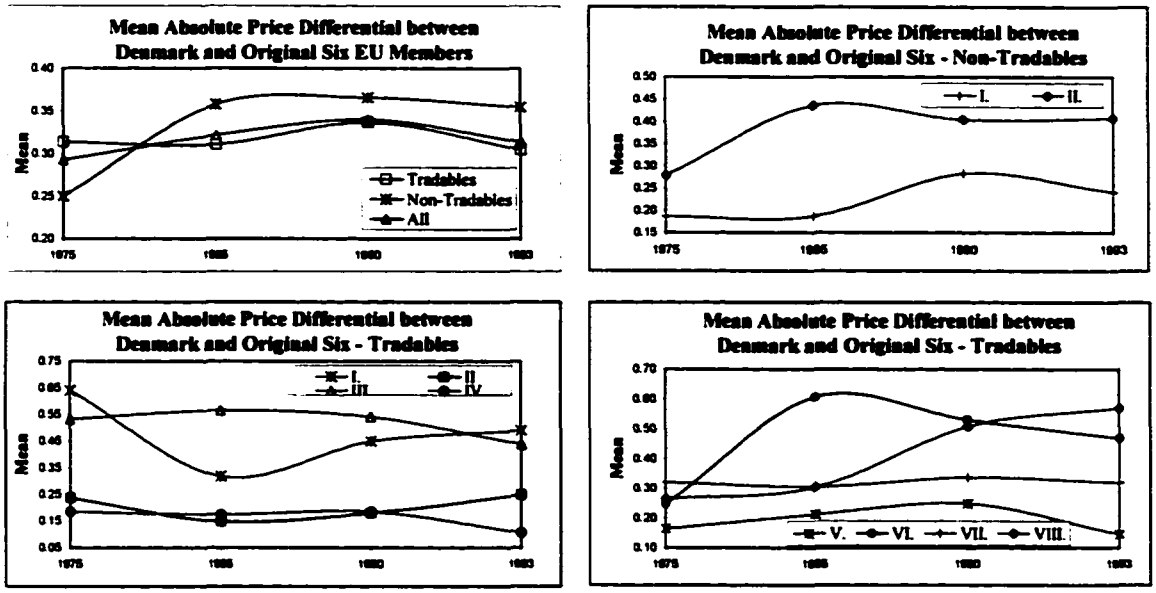

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Chart 7

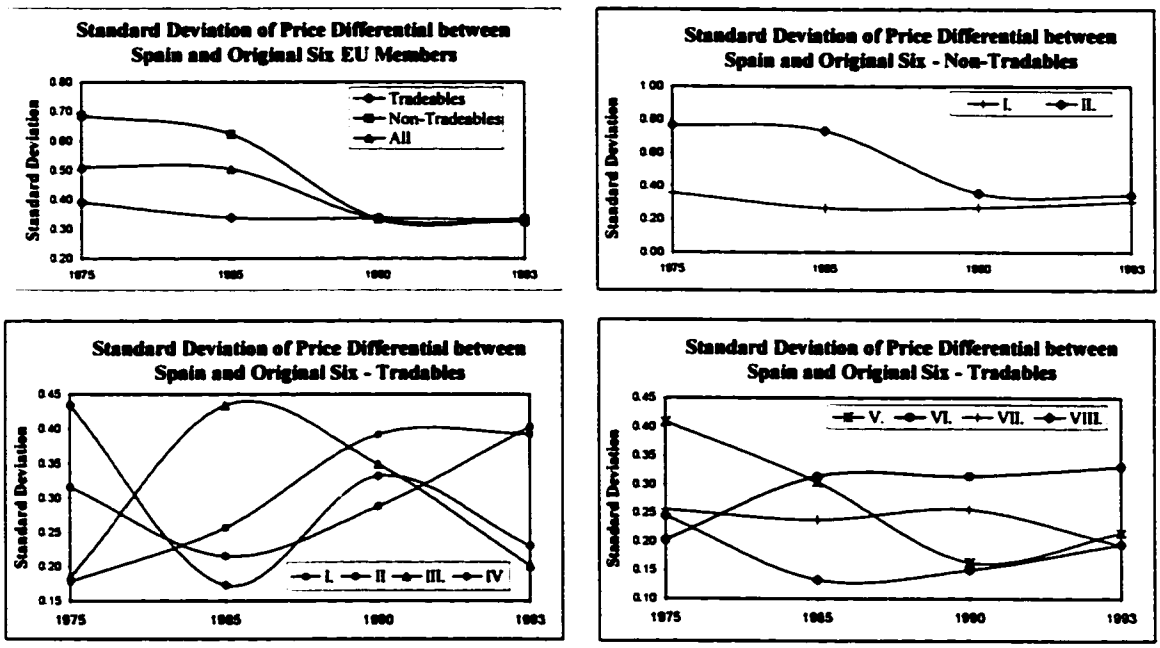

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Chart 8

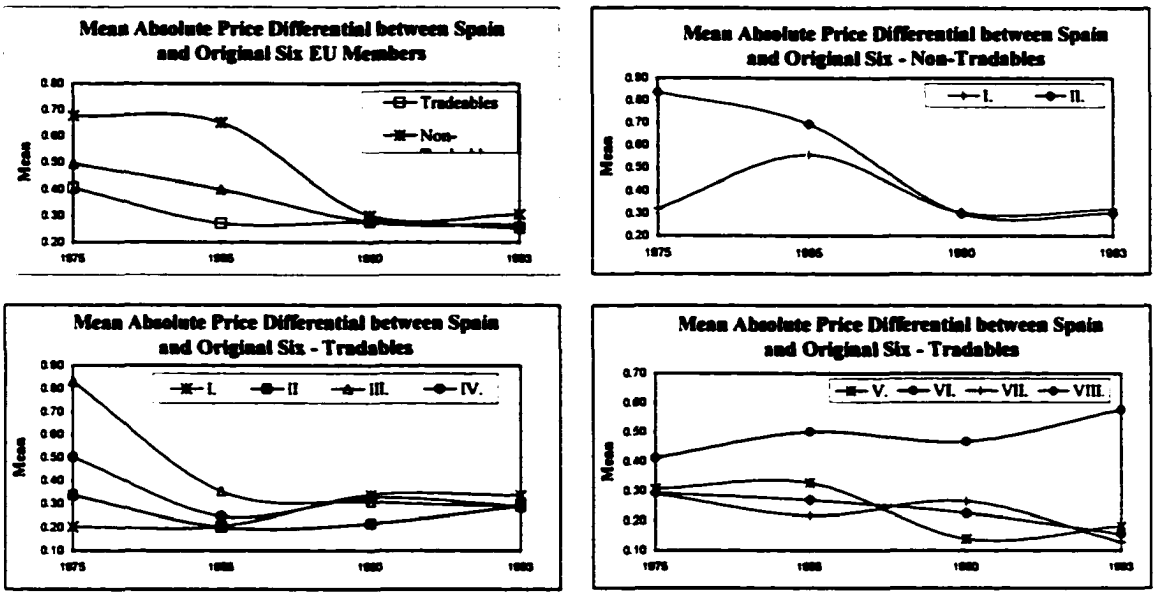

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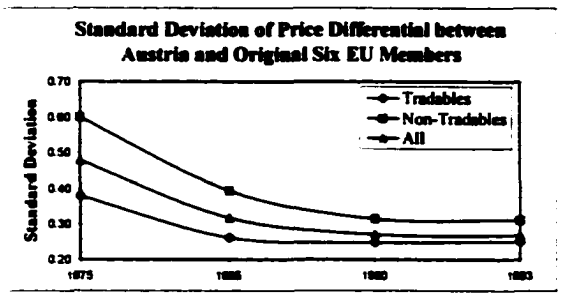
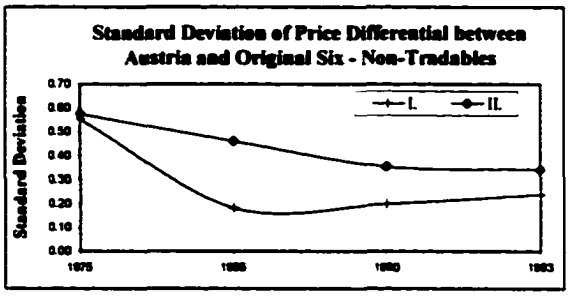
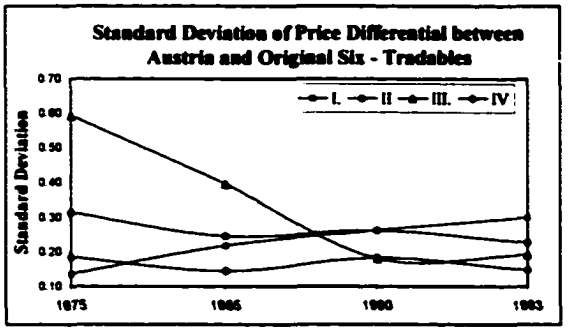
Chart 9







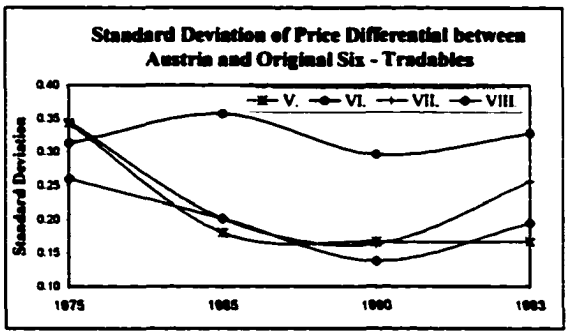


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Chart 10

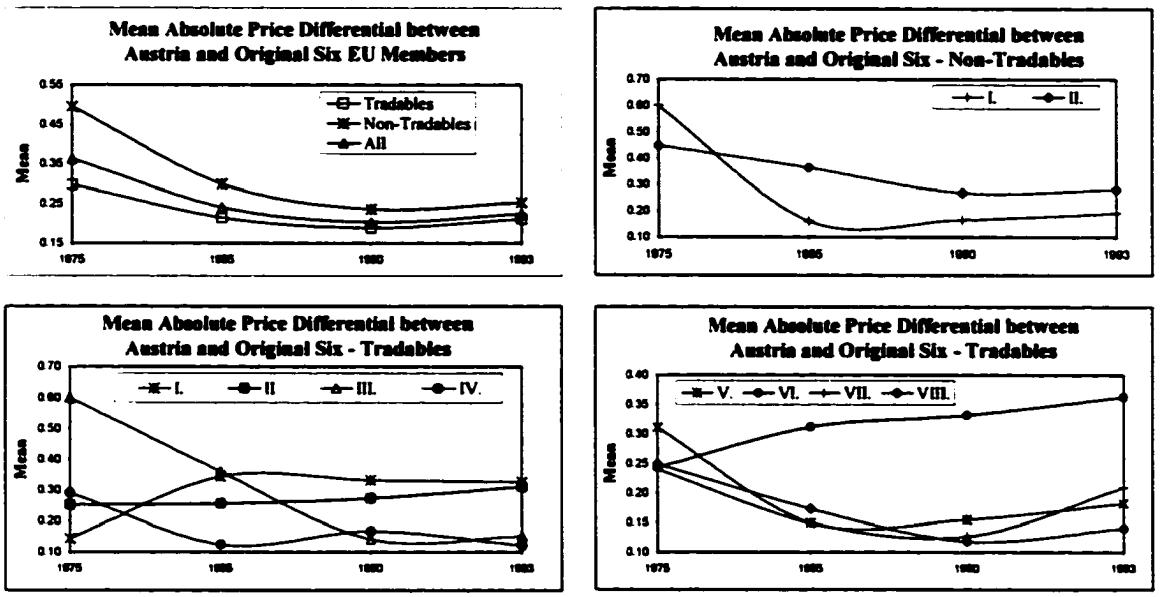

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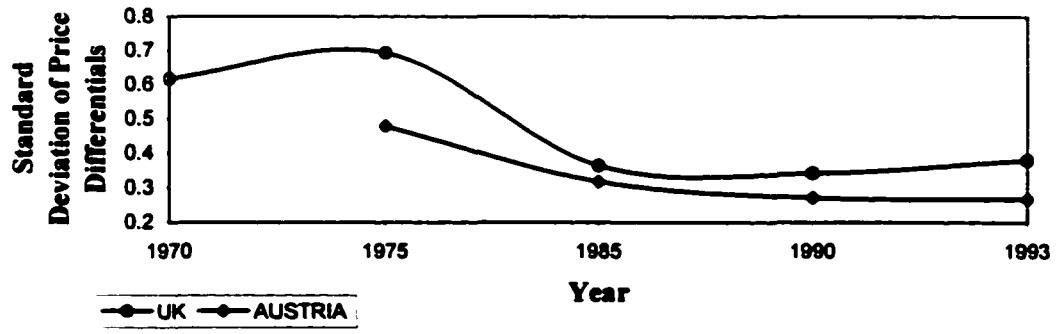
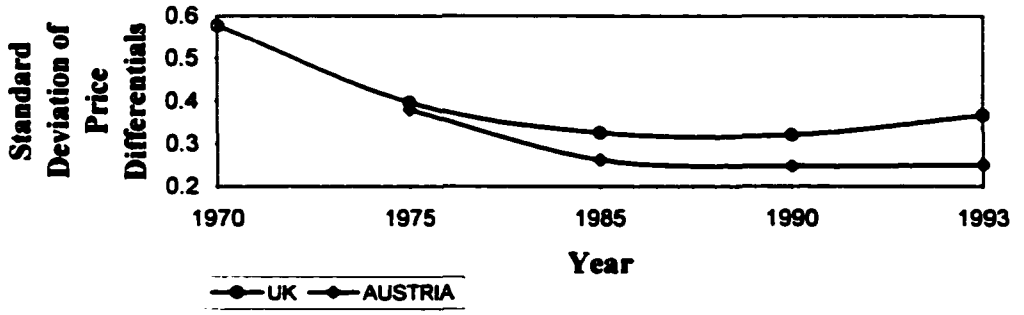
Chart 11

Price Dispersion of the UK Compared to Austria for All Commodities



Price Dispersion of the UK Compared to Austria for Tradables



Price Dispersion of the UK Compared to Austria for Non-Tradables

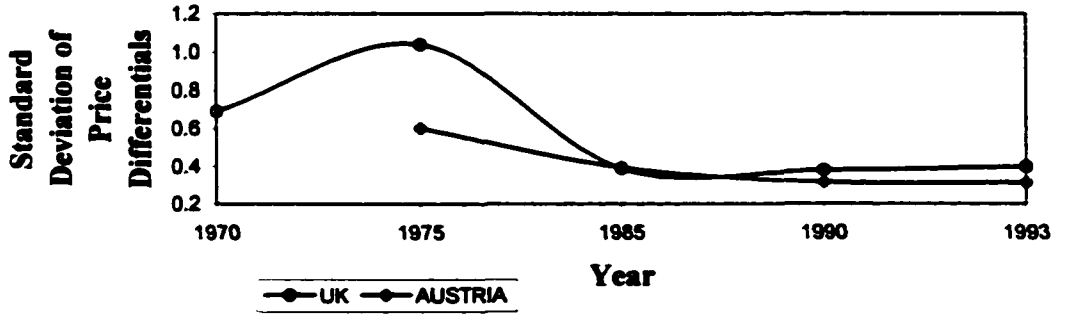
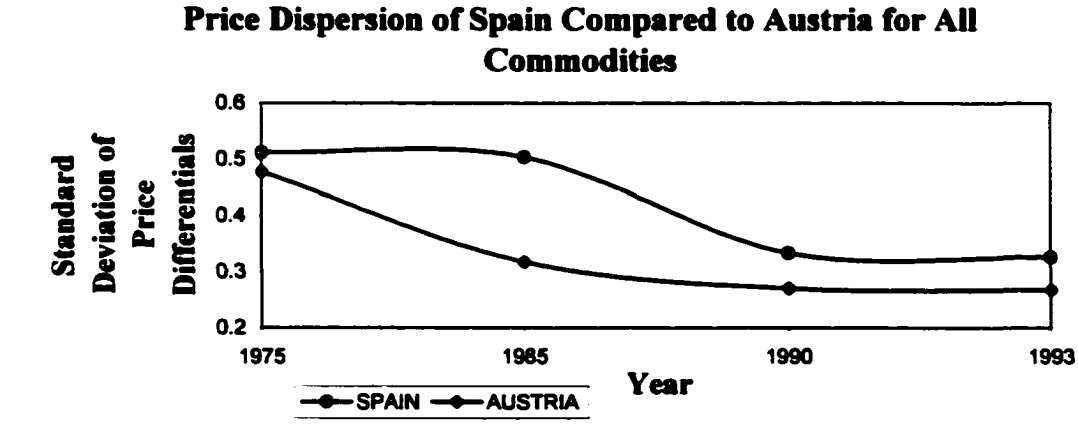
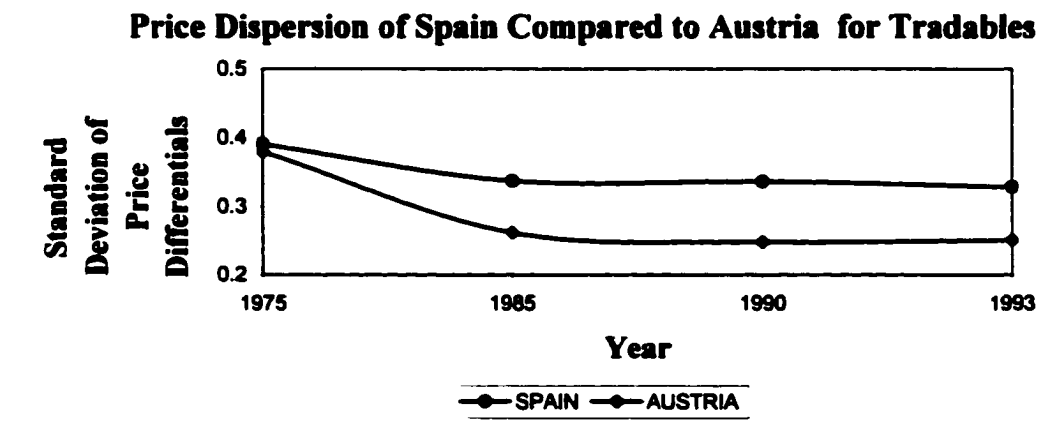


Chart 12





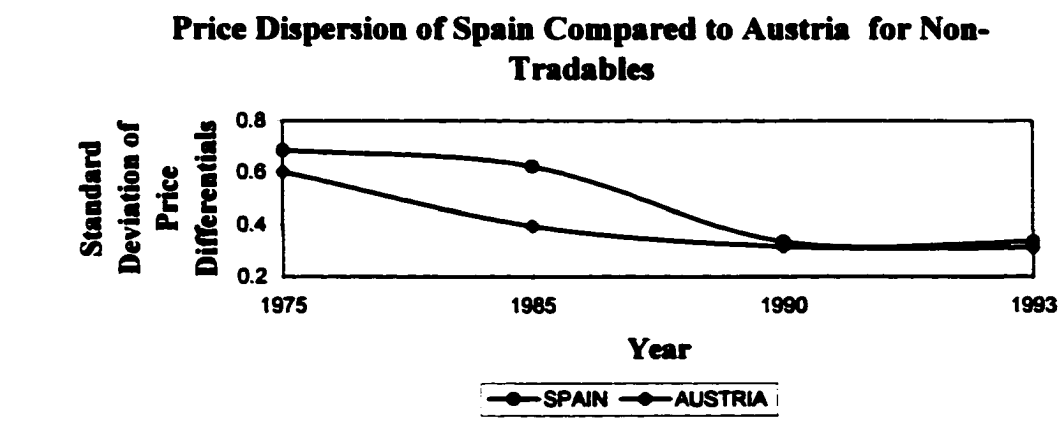
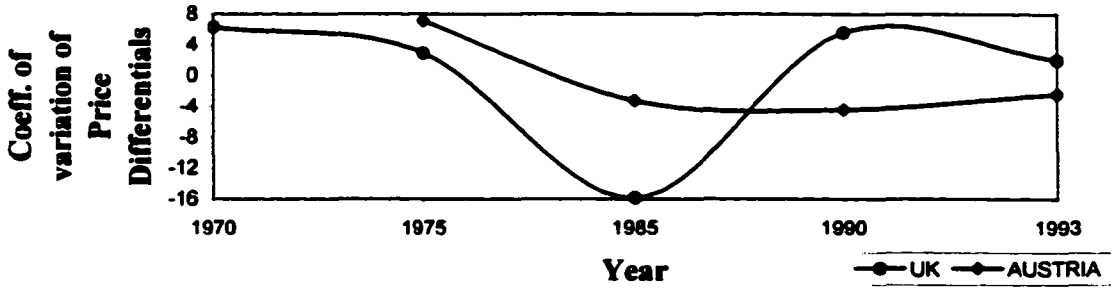
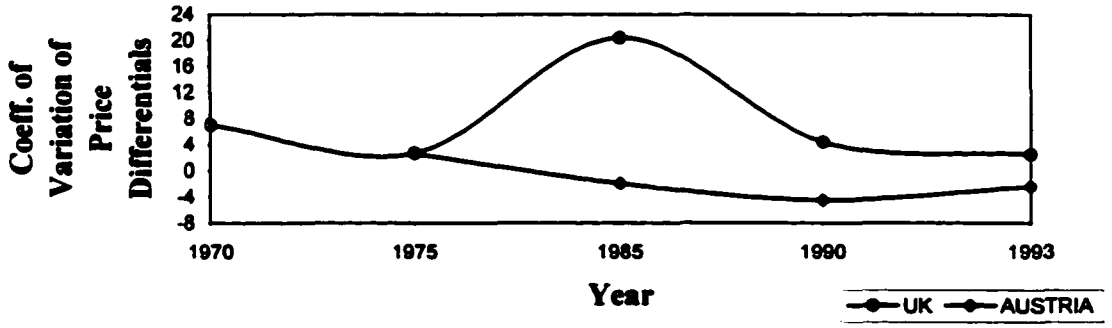


Chart 13

Price Dispersion of the UK Compared to Austria for All Commodities



Price Dispersion of the UK Compared to Austria for Tradables



Price Dispersion of the UK Compared to Austria for Non-Tradables

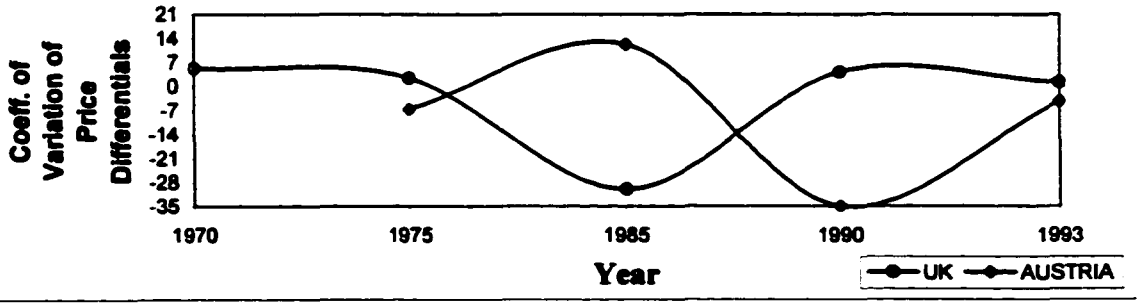
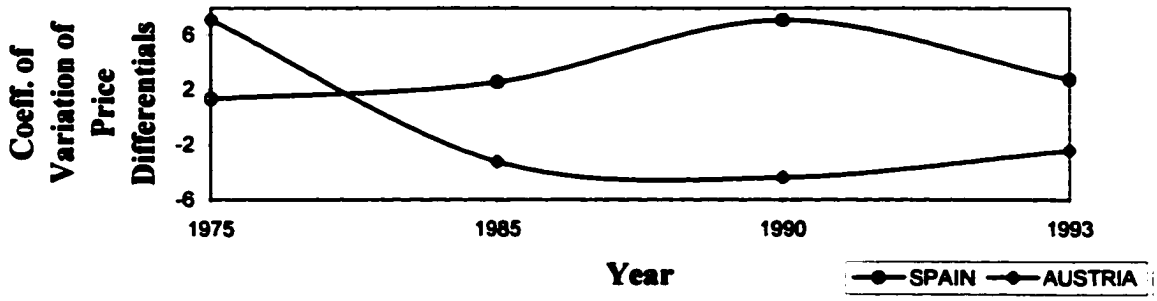
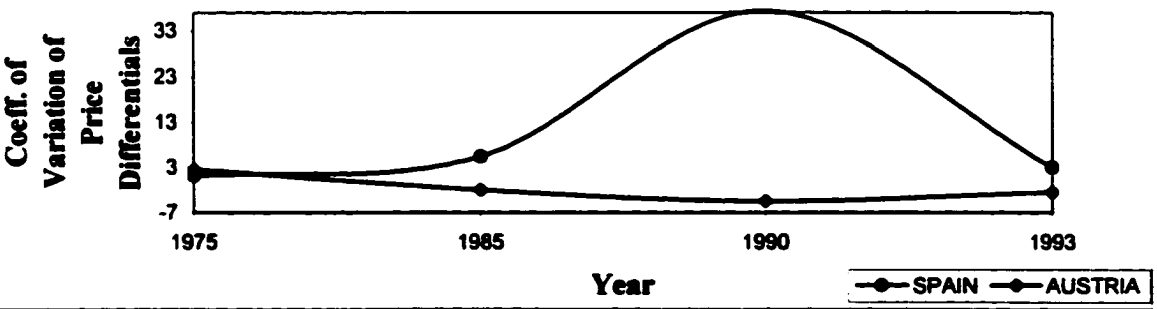


Chart 14

Price Dispersion of Spain Compared to Austria for All Commodities



Price Dispersion of Spain Compared to Austria for Tradables



Price Dispersion of the Spain Compared to Austria for Non-Tradables

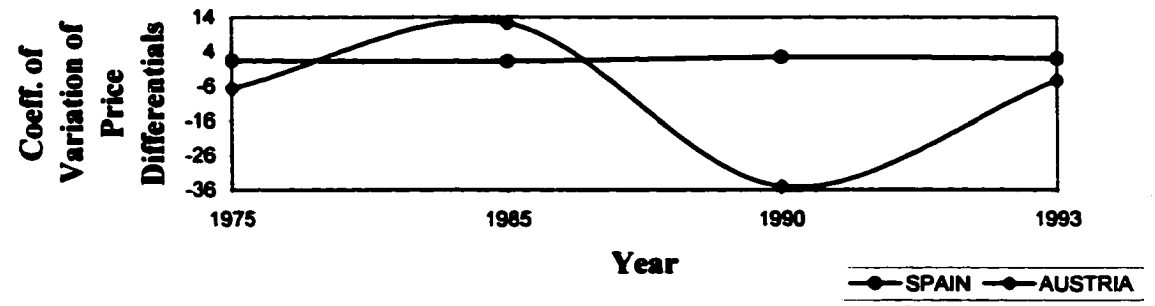


Chart 15

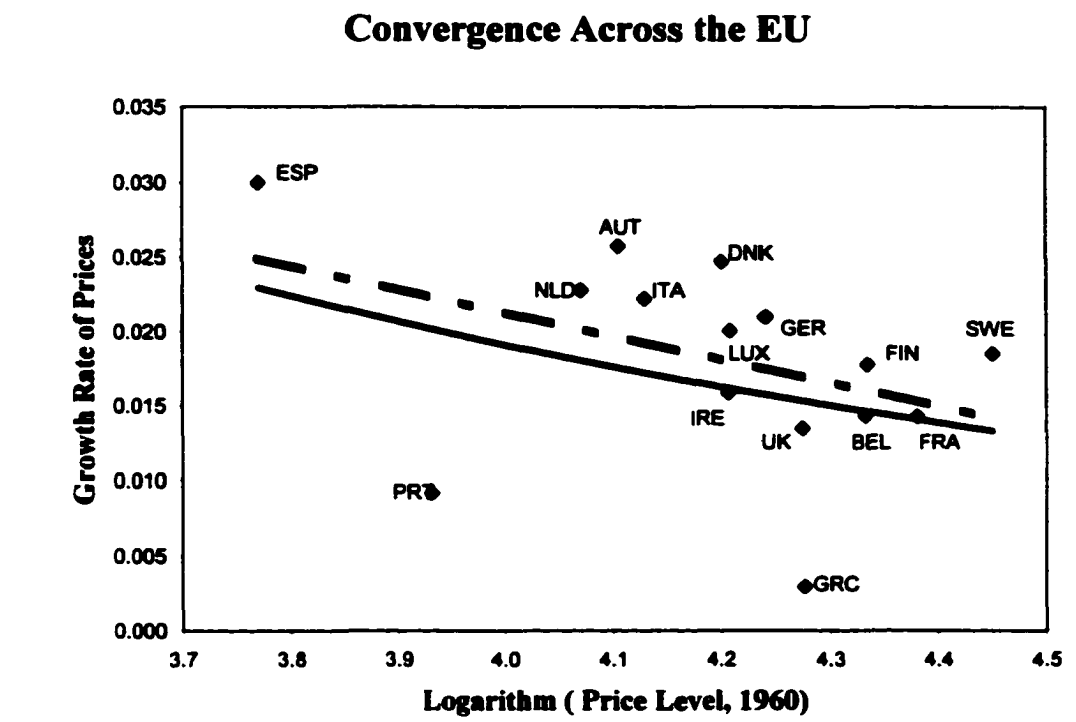
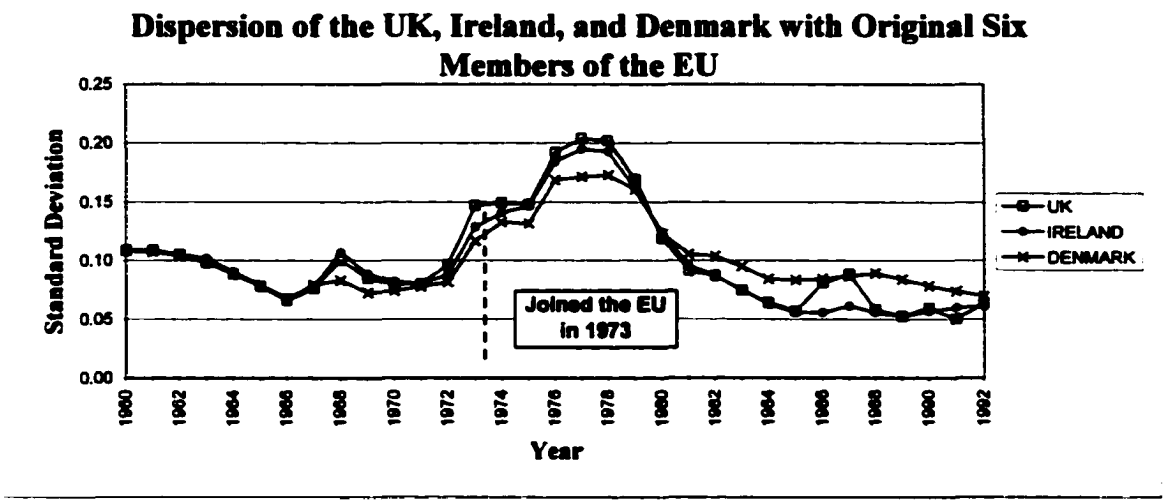


Chart 16



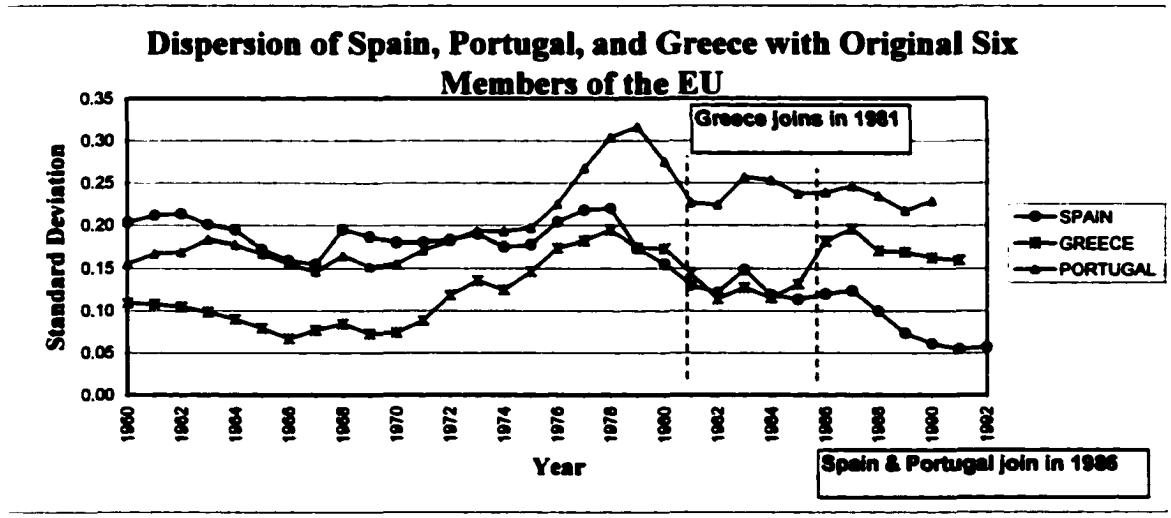


Chart 17

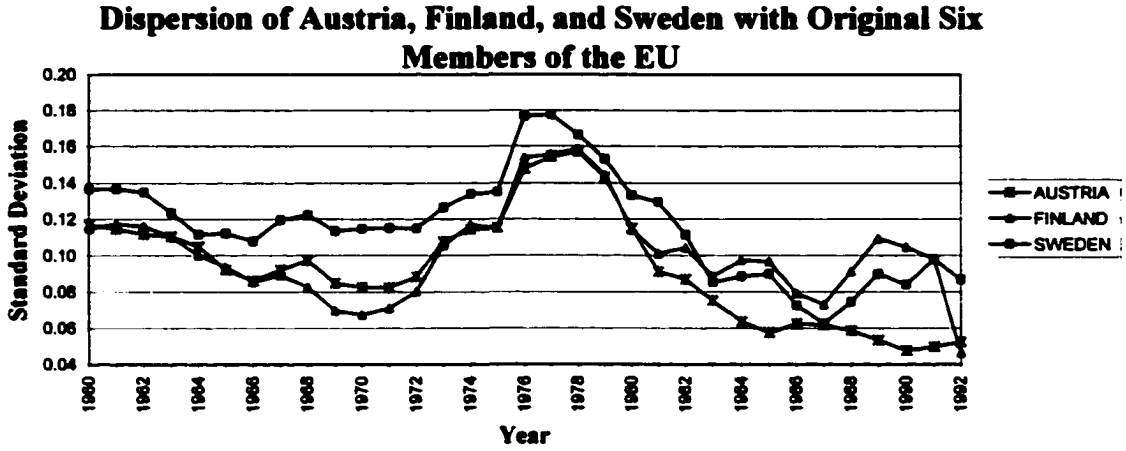
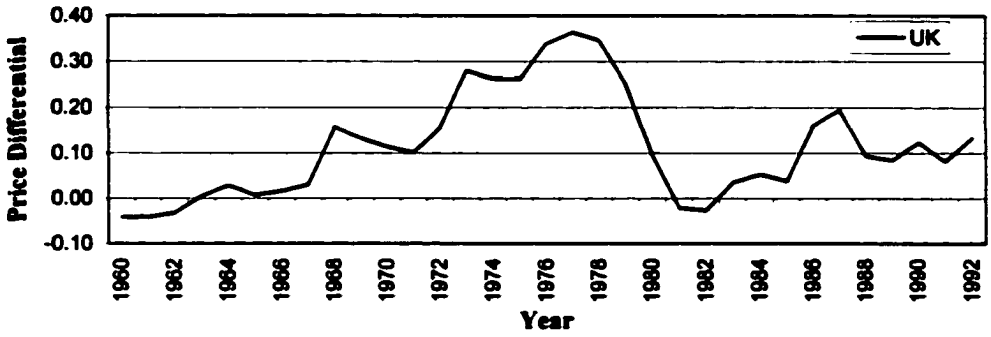
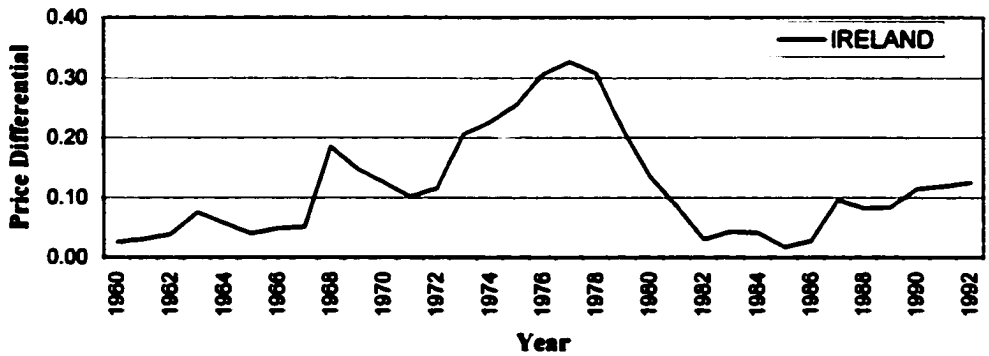


Chart 18

Price Differential of the UK With Average Price Level of Original Six Countries



Price Differential of Ireland With Average Price Level of Original Six Countries



Price Differential of Portugal With Average Price Level of Original Six Countries

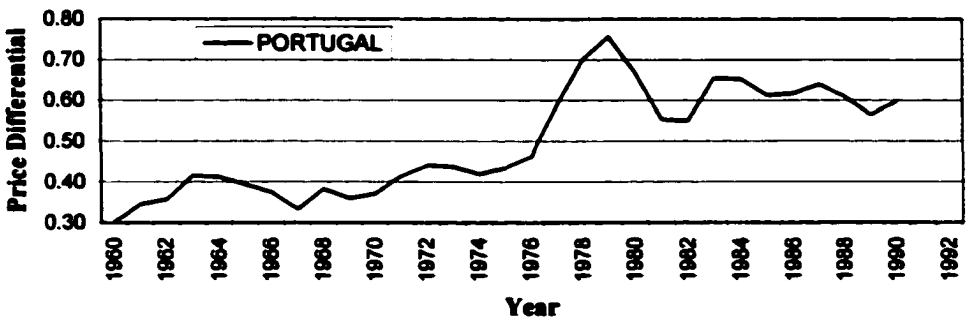
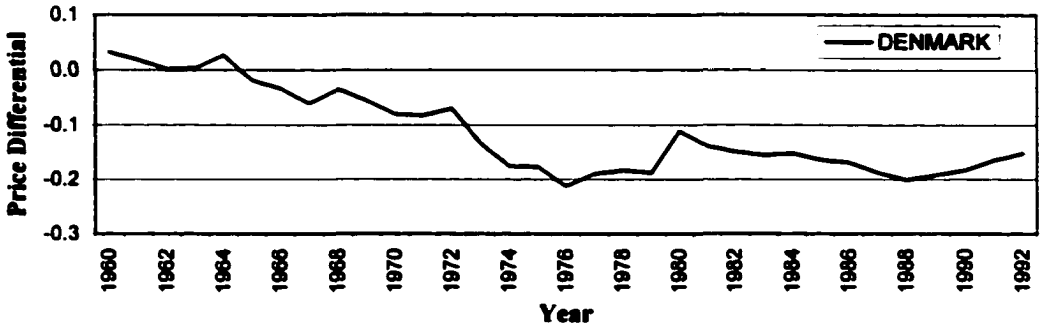
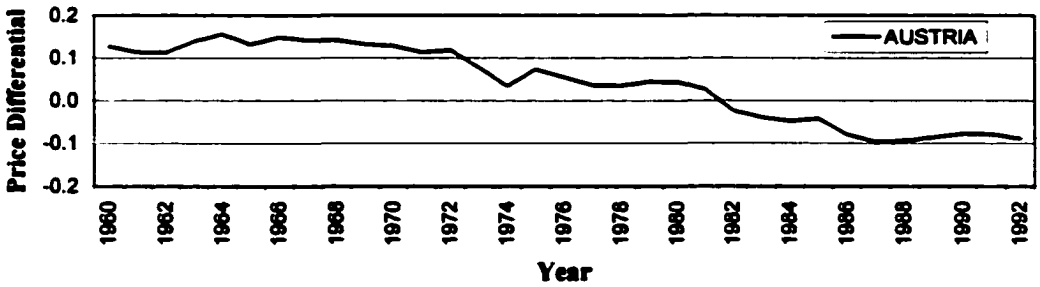


Chart 19

Price Differential of Denmark With Average Price Level of Original Six Countries



Price Differential of Austria With Average Price Level of Original Six Countries



Price Differential of Sweden With Average Price Level of Original Six Countries

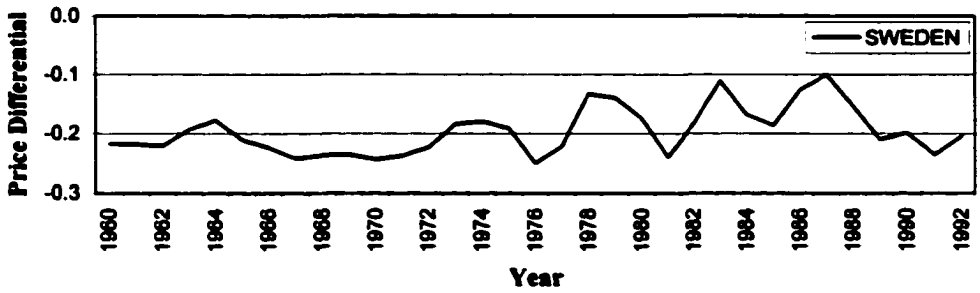
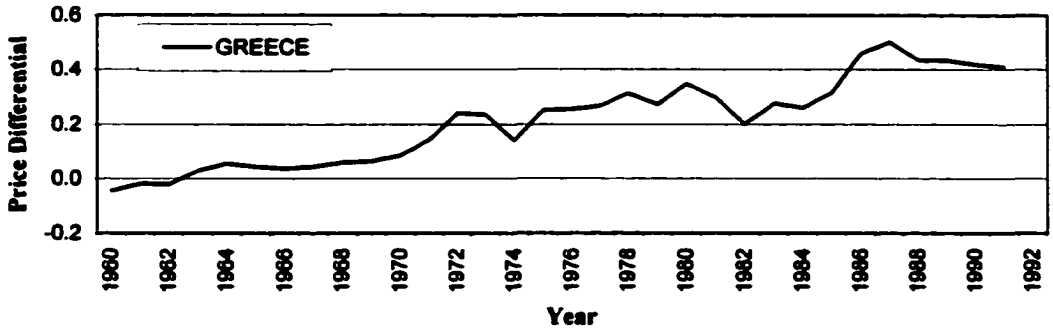
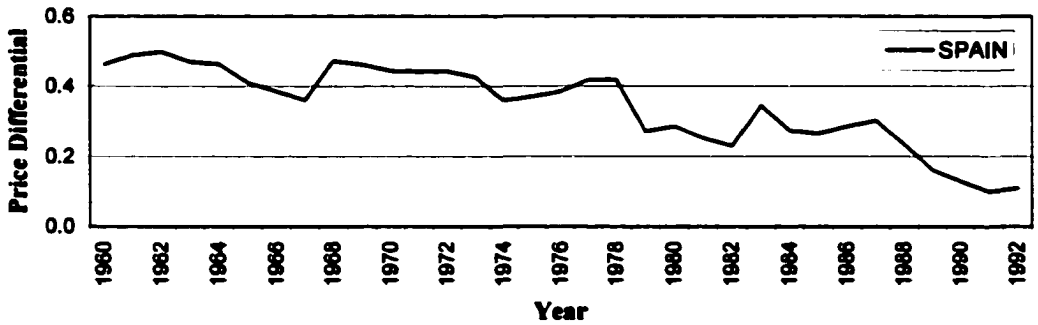


Chart 20

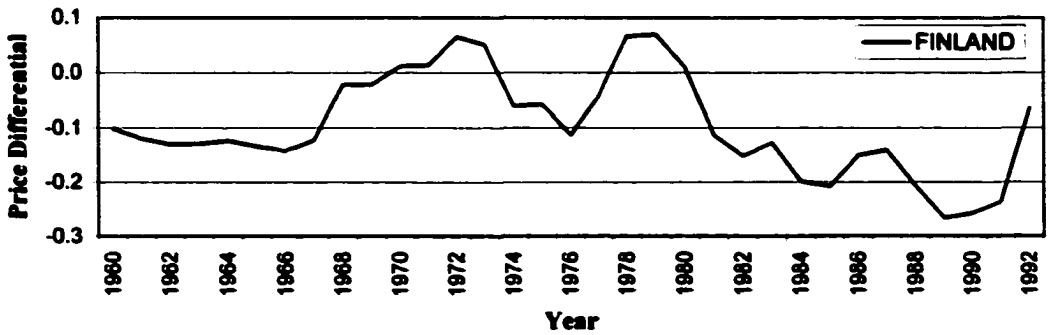
Price Differential of Greece With Average Price Level of Original Six Countries



Price Differential of Spain With Average Price Level of Original Six Countries



Price Differential of Finland With Average Price Level of Original Six Countries



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