Integration and Expansion in the European Union

by

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Abstract

The European Union continues to expand its membership and pass policies in hopes of integrating the economies of the member states to achieve the single market ideal. This paper examines what factors influence integration in the European Union for the period of 2000 to 2009 and if these factors were affected by the expansion of the European Union in 2004. We measure increased integration as a decrease in the price dispersion across country pairs. We find that a later year of ascension and larger distance between countries are the two main factors that increase price dispersion in the European Union. Smaller differences in GDP per capita and the use of the Euro currency also decrease price dispersion. We also find that the year of ascension is the only factor that had a significantly different influence on price dispersion before and after the expansion of 2004.

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1 Introduction

The European Union (EU) was initially created to promote peace and prosperity through economic integration. In this paper we examine price dispersion for fourteen categories of goods in the EU member states to explain how successful economic integration has been in the last decade and how it has been affected by the 2004 expansion. We measure economic integration as deviations from relative purchasing power parity (PPP). The larger is the price dispersion or the larger are deviations from relative PPP, the less integration is present between the countries. We have chosen distance between countries, year of ascension into the EU, the use of a common currency, gross domestic product (GDP) per capita, whether the countries share a common land border or language, and population as factors which may affect the degree of integration.

We focus on the last decade which was crucial for the expansion of the EU. In 2004 membership in the EU nearly doubled and in 2007 the EU celebrated its fiftieth birthday commemorating decades of economic cooperation and a commitment to achieving the single market ideal. In this period, we find that the distance and year of ascension are the most important factors in explaining price dispersion for the EU, and that sharing a common currency and the level of GDP per capita are also significant. We also split the data set into the years before and after the expansion of 2004 to examine if the factors influencing price dispersion changed significantly before and after the addition of ten new member states. We find that few factors other than year of ascension had a significantly different impact on price dispersion in the two sub-periods.

To understand the last decade of integration among the EU member states one must first examine its history and then construct a tangible measure for the degree of integration. Thus, our introduction continues with a brief history of the EU followed by a description of how deviations from relative PPP are used to measure integration.

1.1 A Brief History of the European Union:

Primarily, the union among European countries was established to integrate economic policy and regain prosperity and peace after the end of the Second World War. The European Coal and Steel Community was formed in 1951 to bring the large coal and steel industries under a common management. The success of the industrial union encouraged the signing of the Treaty of Rome in 1957, which created the European Economic Community, the precursor to the European Union. The original six member states were: Germany, France, Italy, the Netherlands, Belgium and Luxembourg. The Treaty of Rome implemented a common market with the abolition of custom barriers within the member states and the creation of a common external custom tariff.

In 1987, after the first expansion, the Single European Act was signed to solidify guidelines for establishing a single European market. The Single European Act advanced the common market idea to include physical, technical and tax barriers. It was completed in 1993 and the free flow of goods, services, people and money became a reality. This was accompanied by the Treaty of European Union signed in 2002 which gave the union its official name and clarified all economic obligations. Soon after, the Schenegen agreement greatly aided the free movement of people insuring that EU citizens could travel between member states without requiring a passport.

In 2002 the single market reached its final stages with the implementation of the Euro as notes and coins for twelve of the member states. It is now used in sixteen of the member states of the EU. The remaining member states are in different stages of economic integration and once they have met all criteria will enter as full members of the single market.

In 2004 and 2007, the two most recent expansions nearly doubled the size of the European Union. At the end of 2003 the EU consisted of fifteen longstanding member states: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom, the last

of which had joined in 1995. In 2004 ten new member states joined: Cypress, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. In 2007 the two newest member states Bulgaria and Romania joined the EU. This brings the EU to its current twenty-seven member states, with common economic goals and a desire for integration.[1]

1.2 Purchasing Power Parity as a Measure of Economic Integration:

For the past fifty years there has been a steady progression toward a single market in Europe. Yet, one would expect a different degree of integration between countries depending on the year of ascension to the EU and other social and economic factors. A natural measure of economic integration is the difference in the price of identical goods sold in a pair of countries. Intuitively, identical goods should sell for the same price in a pair of fully integrated countries, after adjusting for the exchange rate. The smaller the price differential for identical goods, the more integration there is between the pair of countries. This is the basic theory that underlies the law of one price and will be the foundation for the measure of integration in our paper.

The law of one price (LOP) states that an identical good should sell for the same price in any pair of countries, after adjusting for the exchange rate. The LOP assumes that there is perfect competition and that there are no trade barriers or transport costs between the two countries. For example, a red Jansport backpack should sell for the same price in Austria and Hungary, after adjusting for the exchange rate. Intuitively, if the LOP is violated then an opportunity for arbitrage exists. Suppose Hungary is selling the red Jansport backpack for less than Austria. An opportunity to make a profit arises by purchasing the backpack from Hungary and reselling it for a higher price in Austria. These price differentials would be eliminated because all

[1]Information about the history of the EU can be found at $http://europa.eu$.

consumers would simultaneously purchase the cheaper backpack driving the price of the backpack up in Hungary, the price down in Austria, or the exchange rate will adjust.

When the LOP is extended to an identical basket of goods it is called purchasing power parity (PPP). Absolute PPP states that an identical basket of goods should sell for the same price in any pair of countries, after adjusting for the exchange rate. Again, it assumes that there is perfect competition and no transport costs or barriers to trade. For example, if schools supplies represent a basket of goods then the red backpack, a pack of twelve yellow HB pencils, and 500 sheets of lined paper should sell for the same price in Austria and Hungary, after adjusting for the exchange rate.

Mathematically, the LOP is expressed by Equation (1):

$$p^i_{j,t} = S_{j/k,t} * p^i_{k,t} \tag{1}$$

where $p^i_{j,t}$ and $p^i_{k,t}$ represent the price of an individual good i in country j and k respectively and $S_{j/k,t}$ represents the exchange rate between country j and k, at time t.

Similarly, we can define absolute purchasing power parity by Equation (2):

$$P_{j,t} = S_{j/k,t} * P_{k,t} \tag{2}$$

where $P_{j,t}$ and $P_{k,t}$ now represent a basket of goods or a consumer price index for country j and k respectively, at time t. Equation (2) is a valuable expression for PPP; however it is difficult to obtain data to test it empirically. Absolute PPP would require an identical basket of goods measured by the same weighting scheme.

More commonly, PPP is expressed in relative terms as shown in Equation (3).

$$\Delta log(P_{j,t}/P_{k,t}) = \Delta log(S_{j/k,t}) \tag{3}$$

$$[log(P_{j,t}) - log(P_{k,t})] - [log(P_{j,t-1}) - log(P_{k,t-1})] = log(S_{j/k,t}) - log(S_{j/k,t-1})$$

$\Delta x_t = x_t - x_{t-1}$ represents first differences; $P_{j,t}$, $P_{k,t}$ and $P_{j,t-1}$, $P_{k,t-1}$ represent the CPI in country j and k respectively at time t and $t-1$.

Relative PPP reflects percentage changes and it states that a percentage change in the CPI of country j relative to the CPI of country k should equal the percentage change in the exchange rate between the pair of countries. In other words, the percentage change in the price of a basket of goods in country j should equal the percentage change in the price of a basket of goods in country k, after converting prices to a common currency.[2]In this paper we calculate percentage changes in fourteen categories of consumer price indexes and thus examine relative PPP. When we refer to PPP in our analysis we will always imply relative PPP.

The remainder of the paper is organized as follows. Section 2 is a brief literature review of the recent studies that examine price differentials for similar goods between countries. Section 3 describes the data and general methodology. Section 4 contains the results of a regression analysis comparable to Engel and Rogers (1996). Section 5 reports the results of our fully specified model and extensions. In Section 6 we test if relative prices and the factors influencing them are significantly different before and after the expansion of the EU in 2004. Section 7 is a series of robustness tests and section 8 concludes.

[2]A brief review of PPP and LOP can be found in Melvin (1985)

2 Literature Review

The seminal paper by Engel and Rogers (1996) is the foundation for the current research that measures economic integration between countries by identifying the factors that influence PPP deviations. Their data is bimonthly consumer price indexes for fourteen categories of consumer prices and covers the years 1978 to 2002. They model bimonthly consumer price indexes because of data limitations. Their results are robust when reducing the sample to cities with monthly observations.

Their data consists of twenty-three Canadian and U.S. cities. Engel and Rogers (1996) focus on the Canada and the U.S. because they are close geographically and have shared relatively free trade in the past three decades. Canada and the U.S. are also integrated through a shared language and similar consumption patterns. One would expect that their economic and cultural integration would appear in similar prices. However, they conclude that Canada and the U.S. are not fully integrated because cross-border cities have significantly higher price dispersion than within country pairs, even after controlling for distance.

They calculate PPP deviations as the dispersion between the log difference of relative price indexes for a pair of cities as shown by Equation (4).

$$V(P^i_{j,k,t}) = std[abs[log(P^i_{j,t}/P^i_{k,t}) * (S_{(j/USD),t}/S_{(k/USD),t})] - abs[log(P^i_{j,t-2}/P^i_{k,t-2}) * (S_{(j/USD),t-2}/S_{(k/USD),t-2})]]. \quad (4)$$

$P^i_{j,t}$, $P^i_{k,t}$ are the consumer price indexes for a specific category of goods, i in city j and k, respectively. For example, $P^1_{j,t}$ is the consumer price index for all food purchased at home and $P^2_{j,t}$ is the consumer price index for all food purchased away from home, in city j. $S_{(j/USD),t}$, $S_{(k/USD),t}$ are exchange rates converting all prices to U.S. dollars. If city j is located in the U.S. then $S_{(j/USD),t}$ will equal one. Similarly, $S_{(j/USD),t} = S_{(k/USD),t}$ if city j and city k are both located in Canada or both located in

the U.S. Their measure of dispersion, $V(P^i_{j,k})$, is the standard deviation of $P^i_{j,k,t}$. They focus on distance and the presence of geographical borders as the potential sources of PPP deviations and model the volatility of relative prices similar to Equation (5).

$$V(P^i_{j,k}) = \beta_0 + \beta_1 dist_{j,k} + \beta_2 border_{j,k} + \Sigma^n_{m=1}\beta_m D_m \tag{5}$$

Price dispersion is the dependent variable defined by Equation (4), $dist_{j,k}$ is log distance between cities, $border_{j,k}$ is an indicator variable taking the value of one if one city is in Canada and one city is in the U.S and zero otherwise, and D_m, for $m = 1, ...n$ are a set of city indicator variables.

Engel and Rogers (1996) expect that distance and the border effect would be positively related to the volatility of relative prices. Distance is used as a proxy for transportation costs which are expected to increase the larger the distance between cities. Similarly, they expect the border effect to be positive because cities within a country should be more integrated than cross-border city pairs. They find that distance and the border effect are positive and significant for a majority of the goods and that the border effect is larger in magnitude. In fact cities within a country would have to be 1,780 miles apart to observe the same price dispersion as the impact of a national border.

They also extend their model to include a concave relationship between distance and price dispersion. This relationship is significant for eleven of the fourteen goods for which distance is positive and distance squared is negative. This implies a threshold exists after which a greater distance would decrease the difference in prices.

Engel and Rogers (1996) were the first to focus solely on how the presence of a border and distance increased price dispersion between countries. Transport costs and geographical boundaries have a great influence on integration. They conclude that economic integration which should accompany the cultural similarities and geographic

proximity between Canada and the U.S. is much weaker than expected.

Rogers et al. (2003) use a more extensive data set to extend the research of Rogers and Engel (1996) to one hundred goods for fourteen Canadian and U.S. cites. The data consists of actual prices instead of price indexes making possible the comparison between absolute and relative PPP and LOP. Furthermore, the disaggregated nature of the data is used to decompose the goods into tradable goods and services. Their focus is still strongly on a distance and border effect but population is now included as a potential source of price dispersion.

The main contribution of this study is the analysis of tradable goods and services separately. Their results show evidence that prices of tradable goods are positively related to distance but services are invariant to distance. Intuitively, only traded goods are effected by shipping costs so the distance variable must be reflecting these additional expenditures.

More surprisingly, the border and population variables have the same magnitude for both tradable goods and services. Higher wages in the U.S. compared to Canada and a persistent overvaluation of the U.S. dollar are potential explanations for the border effect. The magnitude and positive sign of the population variable supports the claim that even prices of tradable goods are influenced by local wages. Here, population is a proxy for city size and it is assumed that larger cities have higher prices. Therefore, the larger the difference in population size of two cities the more dispersion is present between prices.

Overall, their data continues to support the hypothesis that distance, national borders, and city size increase the price differential of similar goods in Canada and the U.S. However, the prices of services react less to distance than the prices of tradable goods. Canada and the U.S. still appear to be less economically integrated than expected.

Recently, studies of PPP deviations have focused on the European Union and its

integration. The sample of European countries studied vary across papers depending on data availability. Similar to Engel and Rogers (1996), Foad (2005) calculated the effect of distance and a border in western European countries. He finds a positive and significant border and distance effect but one much smaller in magnitude than for North American countries. He estimates that it would take merely twenty to 75 miles to equate to the effect of the border. He also finds that the implementation of a monetary union decreased price dispersion but the decrease varies heavily by the size of the country pairs.

Wolszczak-Derlacz (2008) studies the dispersion of European prices with a much larger set of explanatory variables. She relies on data from the Economist Intelligence Unit for 150 individual tradable goods to evaluate price dispersion in the EU between 1990 and 2005.

Wolszczak-Derlacz's (2008) models price differences similar to Equation (6).

$$\Delta log(P_{j,t}/P_{k,t}) = \alpha_{jk} + \beta_1 ln(dist_{jk}) + \beta_2 ln(GDP_{jk,t}) + \beta_3 vol_{jk,t} \tag{6}$$
$$+\beta_4 T_{jk,t} + \beta_5 VAT_{jk,t} + \beta 6 Euro_{jk,t} + \beta_7 border_{jk} + \beta_8 lang_{jk} + \epsilon_{jk,t}$$

In order of appearance above the explanatory variables represent: distance between capital cities, difference in log GDP per capita, volatility of bilateral exchange rates, trade volume, difference in tax level, the use of a common European currency, a common land border, and finally a common official language for country j and country k. The dependent variable measures price dispersion as the absolute difference in log prices. Her dependent variable is a direct measure of price differentials of similar goods and not a measure of price dispersion. Unlike many previous studies, both the dependent and some of the explanatory variables such as the GDP, tax levels, and bilateral exchange volatility, are time dependent.

Of all variables indicated above the three most influential factors are GDP per

capita, a common currency, and tax level. As expected GDP per capita is positive and significant. This supports the hypothesis that rich countries have higher prices. The use of the Euro as a common European currency decreases price volatility between the member states. Tax level has a positive effect on prices. Countries with higher tax levels appear to have higher prices.

The remaining variables have the expected sign but their coefficients are small in magnitude or insignificant. Surprisingly, distance is significant and positive but is of a trivially small magnitude. Similarly, trade volume is negatively related to price dispersion but its effects are small, a one percent rise in trade between countries increase price volatility by one fourth of a percent. Sharing a common border or a common official language are also negatively related to price volatility but again of a small magnitude.

Wolszczak-Derlacz (2008) concludes that Europe still experienced high price dispersion for much of the 1990's indicating a lack of integration. The main cause of price dispersion are economic and social indicators. Similar social structures, economic markets, and geographic location all appear to decrease price dispersion in Europe. The three largest factors influencing price dispersion are GDP per capita, tax level and the effect of a common currency.

After distance, the second most commonly examined source of price dispersion in Europe is the common European currency. Several studies have focused on the integrating effect of the Euro. The implementation of the Euro in 1999 was seen as the final steps to achieving a single market ideal. The European Commission believed that the Euro would squeeze out price dispersion. A common currency would increase competition and price transparency, decrease transaction costs, and eliminate exchange rate risk. However, recent studies have mixed conclusions about the importance of the Euro for integration.

The paper by Beck and Weber (2001) examined the impact of two monetary

unions: the German and European Monetary Union. They find that for the six countries: Italy, Spain, Portugal, Germany, Austria and Switzerland, the border and distance effect remain valuable in explaining LOP deviations even after the formation of monetary unions. However, after the formation of both unions the influence of distance and a border are greatly reduced implying a significant increase in integration.

Two other studies rely on a difference in difference approach to examine if the Euro has had a positive integrating effect on European prices. This method allows for a comparison of social and economic factors between countries in the EU that began using the Euro for currency against those countries that did not. Allington (2005) focuses on comparative price level indexes from Eurostat for the period 1995 to 2002. 200 goods are analyzed for the fifteen EU member states. He concludes that there was a structural break in the time trend of price dispersion at the time the Euro was implemented. This implies that the Euro had a positive integrating effect above the general EU tendency for price convergence. This result is strongest for tradable goods.

On the other hand, Lutz (2002) applies a difference in difference approach but finds little evidence that the implementation of the Euro decreased price dispersion. He examines four major data sets of final goods prices: the price of Big Macs, The Economist cover price, car prices in the EU, and prices and earnings around the globe for various goods. Many criticize this study and claim that the insignificance of the Euro as an integrating factor in Europe is largely attributed to the narrow choice of goods and is not applicable to more diverse data sets.

Palenmark (2004) uses a different approach to analyze how the start of the Single Market Programme, the precursors to establishing the Euro as a single currency six years later, has effected price dispersion in Europe. He first models the factors that influence price dispersion in the EU from 1990 to 1998. Then, he divides the data set into two sub-periods, the period before and the period after the Single Market

Programme began. This allows him to test if the factors influencing price dispersion have changed over time. Our study relies heavily on his methodology.

Palenmark (2004) first models price dispersion similar to Equation (7) for the full time period from 1990 to 1998.

$$\begin{aligned} \mid log(P_j^i/P_k^i) \mid = \beta_1 km_{j,k}^i + \beta_2 Single_{j,k}^i + \beta_3 VAT_{j,k}^i + \beta_4 C_{j,k}^i \\ + \beta_5 GDP_{j,k} + \Sigma_h \beta_h D_h + \epsilon_{j,k} \end{aligned} \tag{7}$$

where $km_{j,k}^i$ is the log kilometer distance between capital cities, $Single_{j,k}^i$ is an indicator variable equaling one if the country pair participates in the Single Market Programme and zero otherwise, $VAT_{j,k}$ and $C_{j,k}^i$ are country wide and corporate tax levels respectively, $GDP_{j,k}$ is GDP per capita and $\Sigma_h D_h$ are country specific control variables. i represents the good category and j, k represent a country pair. Price dispersion is measured similarly to Wolszczak-Derlacz (2008) as the log difference in prices. Again, the regression has a time dimension because GDP per capita, and the tax levels have a time component.

His results largely support the conclusion of previous studies. He finds evidence that tradable goods have higher price variability than services. As expected, distance is significant and positive for seven out of ten goods. This again implies that transport costs play a role in determining prices. $Single_{j,k}$ is negative and significant lending support to the idea that a single market can integrate the economies of the participating member states. Prices are significantly lower for the participating member states. The result for tax rates are ambiguous. The positive and significant coefficient on GDP supports the Balassa Samuelson theorem that on average countries with higher income levels have higher prices.

Next, Palenmark (2004) uses the model of Equation (7) to examine if the factors influencing price dispersion have changed over time. He reruns the regression for two

separate time periods 1990 to 1992 and 1993 to 1998. 1993 marks the beginning of the Single Market Programme and the first steps in unifying economies for the implementation of the Euro. Preliminary results from a variance equality test show that price dispersion has in fact decreased for a majority of the goods in the second sub-period. The Single Market Programme did have an integrating effect on prices.

A more detailed examination of price dispersion between the two sub-periods follows. Seemingly unrelated regressions are performed for the two sub-periods to test the equality of individual parameters. The results show that distance is statistically the same in the two sub-periods, implying that transport costs remained similar even after the Single Market Programme began. Unexpectedly, the coefficient on $Single_{j,k}$ became less negative in the second sub-period. This implies that the anticipation and preparation for the arrival of a common currency did more to lower price dispersion for the participating member states than its implementation. The coefficient on $GDP_{j,k}$ decreases in the second sub period for the five of seven groups for which it was significant in.

The other branch of literature on PPP and LOP deviations examines convergence and the half life of the deviations. The study of particular interest to our analysis is a study by Funke and Koske (2008). They use our data set and a similar method of categorizing goods to analyze sigma and beta convergence in the EU. This study finds that price convergence is stronger in the member states that joined the EU prior to 2004 than the new member states. We use this data set and should find similar results.

Our study combines the methodology of Palenmark (2004) with the theory of Engel and Rogers (1996). We use the most recent observations from a reliable Eurostat data set that has been utilized by previous studies. To our knowledge because the expansion of the EU occurred in the last ten years no previous research has studied how the factors that influence price dispersion have changed over this time frame.

Our study involves all 25 member states that joined the EU by 2004 which is a more thorough examination of European countries than the smaller samples of other studies would allow. Also unique to our study, is the use of a group variable that mimics the border variable of Engel and Rogers (1996). Our group variable indicates not only geographic borders but more importantly year of ascension into the European Union. We are able to draw a clear line between long standing members of the EU and recent entrants. Our study is a first glimpse of the integrating effects of the expansion of the EU.

3 Data and Methodology

Our study examines the factors influencing EU integration from 2000 to 2009 and how integration was affected by the 2004 expansion. The countries are sub-divided into two main groups. The first group is what we denote as the original fifteen member states (EU15): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. These are the original six member states and all countries that joined the EU prior to 2004. The second group is the ten member states that joined the European Union in 2004 (EU10): Cypress, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia, and Slovakia. We will also often refer to the EU25 which is the current EU member states less Bulgaria and Romania. To maintain clarity and brevity throughout the paper we will refer to these groups as the EU10, EU15, and EU25 respectively. The list of all countries and their year of ascension and grouping are listed in Table 1.

Our price measures use the disaggregated Harmonized Indices of Consumer Prices available from the Statistical Office of the European Communities (Eurostat) Statistical Database. Our data is monthly consumer price indexes available from December 2000 to May 2009 for fourteen categories of goods. The fourteen good categories closely mimic those of Engel and Rogers (1996) and are reported in Table 2.

The consumer price indexes are calculated according to a harmonized approach with a single set of definitions to foster comparability across EU and surrounding countries. They are collected in many cities throughout each country ensuring full coverage of the entire country including residents and non residents alike. The consumer price indexes comprise a full range of household consumption goods and include sales tax such as Value Added Tax but exclude interest and credit charges. The base year for all calculations is 2005.

Similarly, we obtain monthly data on exchange rates from the Eurostat database

Table 1: Countries by Year of Ascension and Group Label

Country	**Year of Ascension**	**Group Label**
Austria	1995	EU15
Belgium	1957	EU15
Denmark	1973	EU15
Finland	1995	EU15
France	1957	EU15
Germany	1957	EU15
Greece	1081	EU15
Ireland	1973	EU15
Italy	1957	EU15
Luxembourg	1057	EU15
Netherlands	1957	EU15
Portugal	1986	EU15
Spain	1986	EU15
Sweden	1995	EU15
UK	1973	EU15
Cyprus	2004	EU10
Czech Republic	2004	EU10
Estonia	2004	EU10
Hungary	2004	EU10
Latvia	2004	EU10
Lithuania	2004	EU10
Malta	2004	EU10
Poland	2004	EU10
Slovakia	2004	EU10
Slovenia	2004	EU10
Bulgaria	2007	EU2
Romania	2007	EU2

Table 2: Categorization of Goods

Good	Description
1	Food and Non-Alcoholic Beverages
2	Restaurant Services
3	Alcoholic Beverages and Tobacco
4	Household Rent
5	Household Spending on Electricity and Utilities
6	Household Furnishings and Operations
7	Clothing
8	Footwear
9	Transport Purchases not Including Services or Repairs
10	Public Transportation
11	Health
12	Personal Care
13	Recreation and Culture
14	Educational Services

entitled the Euro/ECU Exchange Rates. The exchange rates denote the value of each currency relative to the Euro and are calculated as period averages. The exchange rates are used to convert all indexes to Euros to allow for comparability across countries with different currencies.

Price dispersion is measured as the standard deviation of prices across a country-group at time t for all t between December 2000 and May 2009. All prices are converted to Euros before calculating the standard deviations.

Table 3 reports summary statistics of the average price dispersion and average distance within and between the groups of EU25 countries based on year of ascension, for all fourteen goods. For example, we report the average standard deviation of price indexes for pairs of countries within the EU15, countries within the EU10, and the cross-group combinations where one country is in the EU15 and one country is in the EU10, denoted EU15-EU10.

Table 3 reports that in ascending order of average price volatility first is the EU15, then cross-group pairs EU15-EU10, and finally EU10. This holds for a majority of

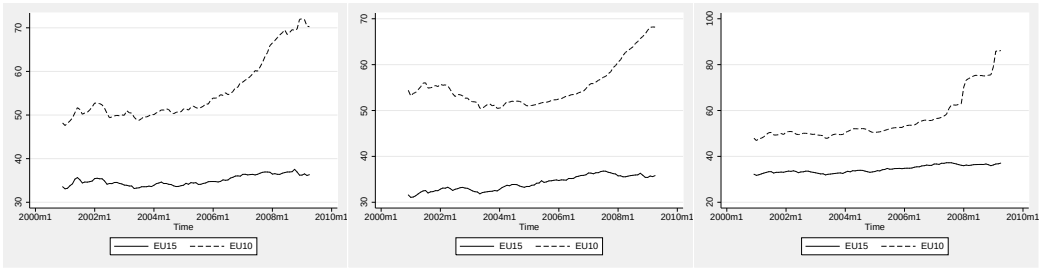
Table 3: Average Price Dispersion

Good	EU15	EU10	EU15-EU10
1	0.010	0.021	0.017
2	0.007	0.018	0.014
3	0.025	0.049	0.039
4	0.009	0.028	0.021
5	0.020	0.034	0.028
6	0.011	0.017	0.015
7	0.053	0.046	0.058
8	0.044	0.051	0.050
9	0.008	0.023	0.018
10	0.024	0.030	0.028
11	0.012	0.025	0.019
12	0.008	0.017	0.014
13	0.012	0.021	0.018
14	0.018	0.023	0.022
Distance	1774	1447	1790

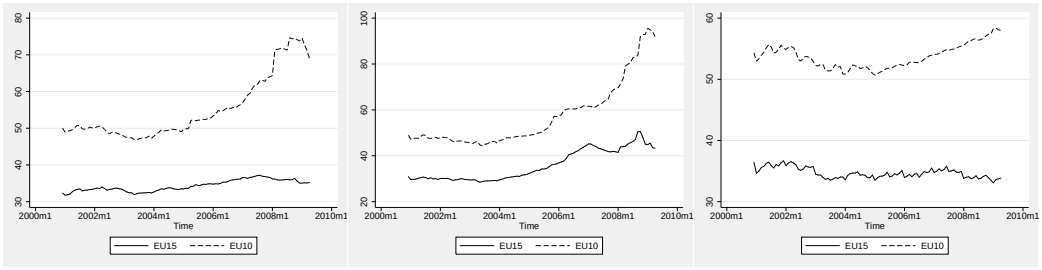
the goods. The countries that have been in the EU the longest, have had more time to integrate their economies, and have the least average price dispersion. Distance between countries is larger between EU15-EU10 than EU15. The EU10 countries are located nearest to each other.

Figures 1 and 2 coincide with the summary statistics in Table 3. Figures 1 and 2 depict the price dispersion between the EU15 and EU10 member states. The graphs support the conclusion that the EU15 member states have less average price dispersion than the EU10 member states. This is true for all goods except transport purchases where the levels of price volatility for the two groups of member states appear to be very similar in magnitude.

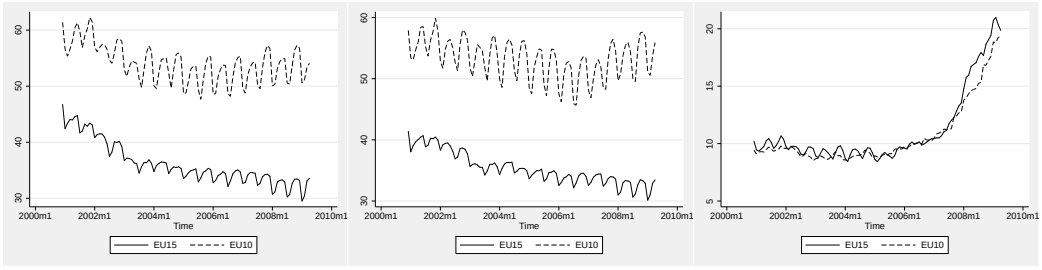
Interestingly, cross-group pairs, EU15-EU10, usually have average price volatility between the two within group price volatility. This implies that on average a cross-group pair of countries has less variability than a pair of countries in the EU10. This could be an artifact of the heterogeneous economies that compose the EU10. In our



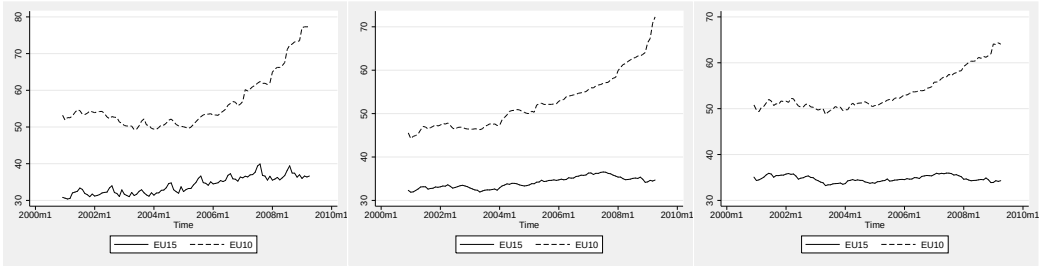
(a) Food **(b)** Restaurants **(c)** Alcohol



(d) Rent **(e)** Electric **(f)** Furniture

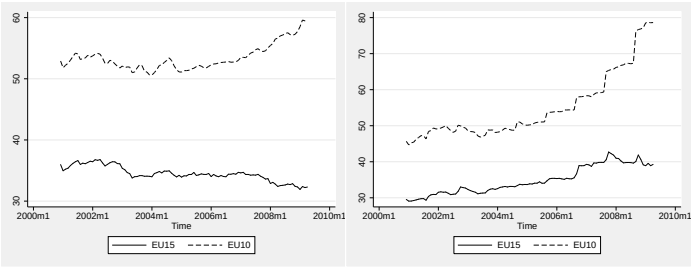


(g) Clothing **(h)** Footwear **(i)** Transport Purchases



(j) Transport Services **(k)** Health **(l)** Personal Care

Figure 1: Average Price Dispersion for Goods 1 to 12



(a) Recreation **(b)** Education

Figure 2: Average Price Dispersion for Goods 13 and 14

analysis we will attempt to adjust for country specific components that could affect our results by the use of country specific indicator variables.

Clothing and footwear have the highest average price dispersion. Some possible explanations are the seasonal nature of clothing and footwear sales and the highly differentiated nature of these goods. This large volatility will be evident in our regressions as well.

The introduction contains a brief review of LOP and PPP derivations and terminology. To reiterate, absolute PPP is based on the idea that an identical basket of goods should sell for the same price in two different countries after adjusting for the exchange rate. Relative PPP states that the percentage change in the price of a basket of goods in country j should equal the percentage change in the price of a basket of goods in country k, after adjusting for the exchange rate. When we refer to PPP in our analysis we are always implying relative PPP. Mathematically relative PPP can be written as Equation (8)

$$\Delta log(P_{j,t}/P_{k,t}) = \Delta log(S_{j/k,t}) \tag{8}$$

$$[log(P_{j,t}) - log(P_{k,t})] - [log(P_{j,t-1}) - log(P_{k,t-1})] = log(S_{j/k,t}) - log(S_{j/k,t-1})$$

$\Delta x_t = x_t - x_{t-1}$ represents first differences; $P_{j,t}$, $P_{k,t}$ and $P_{j,t-1}$, $P_{k,t-1}$ represent the price index for a category of goods for country j and k, respectively at time t and

$t-1$.

We are interested in explaining what causes changes in relative prices indexes for identical categories of goods among European Union member states. First we examine factors that influence PPP deviations from December 2000 to May 2009 for the 25 countries that were members of the EU in 2004. Then, we examine how the source of PPP deviations changed after the ascension of the new member states in 2004.

Our dependent variable is the volatility of relative prices for a pair of countries, as in Equation (9).

$$V(P^i_{j,k,t}) = std[|[log(P^i_{j,t}/P^i_{k,t}) * (S_{(j/Euro),t}/S_{(k/Euro),t})]| - |[log(P^i_{j,t-1}/P^i_{k,t-1}) * (S_{(j/Euro),t-1}/S_{(k/Euro),t-1})]|] \quad (9)$$

where $S_{(j/Euro),t}$, $S_{(k/Euro),t}$ are the exchange rates that convert each country's currency to a common Euro currency and $P^i_{j,t}$ and $P^i_{k,t}$ are price indexes for each of the i categories of goods, for country j and k, respectively. If country j already uses the Euro as currency then naturally $S_{(j/Euro),t}$ will equal one. Our measure of price dispersion is $V(P^i_{j,k,t})$ representing the deviations from PPP or the standard deviation of the first difference in log relative prices over time. We would expect $V(P^i_{j,k})$ to equal zero if PPP holds.

From previous studies we already know that PPP does not usually hold. We take this as given and instead identify what factors cause PPP deviations. We use first differences because many of PPP deviations appear to be trending across time.

This papers examines what social and economic factors influence the deviations from PPP in the EU. In our analysis of PPP deviations we focus on the distance between countries, what EU group the countries belong to based on year of ascension, if the countries use the EURO for currency, GDP per capita, whether the countries

share a common border or language, and population as the possible factors to explain the magnitude of PPP deviations. Our main focus will be on the distance, group variables, the use of the Euro and GDP per capita. Equation (10) depicts the model we estimate to explain the PPP deviations.

$$V(P^i_{j,k}) = \beta_0 + \beta_1 Dist_{j,k} + \beta_2 EU10_{j,k} + \beta_3 (EU15 - EU10)_{j,k} + \beta_4 Euro_{j,k} + \quad (10)$$
$$\beta_5 GDP_{j,k} + \beta_6 Prox_{j,k} + \beta_7 Lang_{j,k} + \beta_8 Pop_{j,k} + \Sigma \beta_n D_n + \epsilon_{j,k}$$

The dependent variable is a measure of dispersion dispersion defined in Equation (9). We focus on the 25 member states that joined the EU by 2004 resulting in $(25) * (24)/2 = 300$ country pairs.

$Dist_{j,k}$ is calculated as the fastest driving distance from Google-Maps Canada between the capital cities of each country. $Dist_{j,k}$ represents log distance measured in kilometers. The distance is approximated as the actual kilometer driving distance for those country pairs that are not connected by roads and thus have no driving distance available. Driving distance is a good proxy for transportation costs. We expect distance to have a positive effect on price dispersion. The further the two countries are the more expensive it is to transport goods and the less similarity remains in their cost and market structures.

The $(EU15 - EU10)_{j,k}$ group variable has a similar interpretation to the border variable in the study by Engel and Rogers (1996). Whereas Engel and Rogers (1996) explain PPP deviations between U.S. and Canadian cities with a border variable, we explain PPP deviations between the EU15 and EU10 member states with a group variable. The year of ascension acts as a border between the countries that have been in the EU prior to 2004 and recent entrants. $(EU15-EU10)_{j,k}$ is an indicator variable that takes the value one if the country pairs are a cross-group pair (one country is in

the EU15 and one country is in the EU10) and zero if the country pairs are in the same group (both in EU15 or both in EU10).

We also include an indicator variable for the EU10 member states. $EU10_{j,k}$ takes the value of one if the country pairs are both in the EU10 and zero otherwise. The reference group for EU15-EU10 and EU10 is EU15. Therefore, relying on the summary statistics we would expect both the coefficients on $(EU15 - EU10)_{j,k}$ and $EU10_{j,k}$ to be positive relative to PPP deviations and the coefficient of $EU10_{j,k}$ to be larger in magnitude than $(EU15 - EU10)_{j,k}$. This analysis differs from Engel and Rogers (1996) who do not include an additional border variable to differentiate between cross-border and within border pairs. However, in their study the summary statistics clearly showed that for twelve out of the fourteen goods the cross-border pairs of cities had higher price volatility than the city pairs that were within one country. Thus, a simple cross-border variable is sufficient to examine difference between and across-countries. In our study we must include the $EU10_{j,k}$ variable or the $(EU15-EU10)_{j,k}$ variable would be misleading because it would show the average relationship between the cross-group pairs and the low prices of the EU15 and the cross-group pairs and the higher prices of the EU10. The addition of $EU10_{j,k}$ allows us to analyze the result that the cross-group country pairs have less price dispersion than the EU10 member states.

$Euro_{j,k}$, $Prox_{j,k}$,and $Lang_{j,k}$ are all indicator variables. $Euro_{j,k}$ takes the value one if the pair of countries both uses the Euro and zero otherwise. There were no other shared currencies in our sample of countries. $Prox_{j,k}$ takes the value of one if the pair of countries shares a common land border and zero otherwise. Countries such as Cypress that are surrounded by water are considered to not border any other country. $Lang_{j,k}$ takes the value one if the pair of countries shares at least one common official language and zero otherwise. We hypothesize that $Euro_{j,k}$, $Prox_{j,k}$, and $Lang_{j,k}$ should be negatively related to price dispersion. Country pairs that have

these common social, geographic and economic similarities are more integrated in other respects as well.

The annual data on gross domestic product per capita is obtained from the International Monetary Funds International Financial Statistics (IFS) Database and converted into Euros. The population data is likewise obtained from the IFS database and is measured annually on the first of January. $GDP_{j,k}$ represents the average log difference in GDP between the pair of countries. We expect that the sign of GDP should be positive because of the Balassa Samuelson Theorem. Wealthier countries are expected to have higher prices. Similarly, $Pop_{j,k}$ represents the average log difference in population between pairs of countries. Rogers et. al (2003) find evidence that when population is a proxy for city size, larger cities have higher prices. We examine if this relationship also holds at the national level.

The final term in our regression is a set of country indicator variables. We hope to capture the idiosyncratic measurement error and allow the variance of relative prices to differ between the country pairs. To avoid collinearity of the country indicator variables and the group indicator variables we have chosen to omit Poland and Luxembourg. We tried many other specifications and the significance and sign of the explanatory variables seemed unaffected by which countries were dropped.

Equation (10) is the benchmark model for our paper. In the following sections we examine different extensions of this model and tests for robustness of our results.

4 Simplified Regression Relating Price Volatility to Distance and the Border

We first examine a simple model similar to Engel and Rogers (1996) and then extend the model to include all explanatory variables introduced in the previous section. The simple model contains only the distance and group variables and is first evaluated separately for each good and then as a pooled regression.

The results coincide with our expectations and are reported in Table 4. The coefficients reported in Table 4 and all subsequent regressions have been multiplied by 1000 for clarity and comparability. Similar to Engel and Rogers (1996) we use distance as a proxy for transport costs. The coefficient on distance is positive for all of the goods and significant for thirteen of the goods, at the five percent level. Transport costs are an important factor in explaining PPP deviations in the EU.

The group coefficients $(EU15-EU10)_{j,k}$ and $EU10_{j,k}$ are positive for all the goods and highly significant for thirteen of the goods. These results support the conclusion that the EU15 member states who have participated in the EU the longest are the most integrated. There is also evidence of heterogeneity among the EU10 member states because the coefficient on $(EU15 - EU10)_{j,k}$ is smaller than that of $EU10_{j,k}$. This implies less price variability in the cross-group country pairs than in the member states that joined in 2004.

The pooled regression results are reported at the bottom of Table 4. The coefficients on distance and the group variables remain highly significant and positive. Furthermore, we test the restriction that the coefficients for the group variables and distance are the same in all regressions. This restriction is strongly rejected.

We also calculate a border-width measure similar to Engel and Rogers (1996), as shown by Equation (11). They measure the mile equivalent to a border and find that a distance of 1,700 miles is equivalent to having an international border

between two cities. Our border measure is the $(EU15 - EU10)_{j,k}$ variable which is representing the border between the old and new member states. We find that the border between old and new member states is equal to approximately 3,498 km, or 2,174 miles, in distance. This is much larger than the border-width estimated by Foad (2005). However, Foad (2005) measured the distance equivalent to a border effect between countries in Europe whereas we measure the border effect between old and new member states.

$$\begin{aligned} border_{width} &= exp[(EU15 - EU10)/dist] \\ border_{width} &= exp[(14.37/1.76)] \\ border_{width} &= 3,498km \end{aligned} \tag{11}$$

Table 4: Regression of EU25 on Distance and Border Only

Good	**Dist**	**EU10**	**EU15-EU10**	R^2
1	1.14***	35.4***	19.4***	0.93
	(0.0002)	(0.002)	(0.0009)	
2	0.63***	36.1***	19.6***	0.93
	(0.0002)	(0.002)	(0.001)	
3	0.8***	29.7***	15.3***	0.91
	(0.0002)	(0.002)	(0.0007)	
4	1.05***	32.6***	18.4***	0.94
	(0.0003)	(0.002)	(0.001)	
5	0.73*	5.05**	3.74***	0.89
	(0.0004)	(0.002)	(0.001)	
6	0.8***	19.8***	10.8***	0.90
	(0.0003)	(0.002)	(0.001)	
7	8.48***	19.4**	17.1***	0.70
	(0.002)	(0.009)	(0.004)	
8	6.46***	8.05	5.55	0.71
	(0.002)	(0.007)	(0.004)	
9	0.57**	35.6***	20.0***	0.94
	(0.0002)	(0.002)	(0.0009)	
10	0.61**	22.6***	12.3***	0.90
	(0.0003)	(0.002)	(0.001)	
11	0.5**	25.8***	13.9***	0.96
	(0.0002)	(0.002)	(0.0008)	
12	0.55***	32.6***	17.6***	0.93
	(0.0002)	(0.002)	(0.001)	
13	0.95***	27.8***	15.1***	0.91
	(0.0002)	(0.002)	(0.0009)	
14	1.32***	26.2***	14.2***	0.91
	(0.0003)	(0.002)	(0.001)	
Pooled	1.76***	25.2***	14.37***	0.12
	(0.0005)	(0.003)	(0.001)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 300 observations for the regression of individual goods and 4200 observations for the pooled regression. A set of country specific indicator variables are included in each regression

5 Results for the Fully Specified Model and Extensions

Next, we report the results for our fully specified model in Tables 5 and 6. We regress relative PPP deviations on all social, geographic, and economic variables represented by Equation (10). The results are consistent with our expectations.

Distance continues to approximate transportation costs. We expect that countries with a greater distance between their capital cities should have high transportation costs. The coefficient on distance remains positive for all of the goods but is now significant for only five of the goods. All coefficients on distance are smaller than in our simplified regression implying that much of the price dispersion previously attributed to distance is actually explained by the addition of the new variables. Rogers et al. (2003) and Palenmark (2004) both find that the price of tradable goods is most receptive to transportation costs. Our results show that clothing and footwear have the largest coefficients on distance, as we expected from our summary statistics. After the apparel goods, two out of the three highest coefficients on distance are for the tradable goods (food and non-alcoholic beverages; alcohol and tobacco) closely resembling the results of Palenmark (2004). The third coefficient is on education services and has not been measured in other studies so we are unable to make a valuable comparison. However, the large heterogeneity in style and costs of educational services across Europe could lead to the dispersion in relative prices.

The second most common factor explaining the failures in PPP are borders. We mimic the border variable discussed in Engel and Rogers (1996) with the use of group variables representing the year of ascension into the EU. There is a geographic and political border present between the European countries participating in the EU and the member states that joined in 2004. We expect that the coefficient of the cross-group pairs and the coefficient on $EU10_{j,k}$ to be positive, with respect to EU10,

because these groups have had less time to integrate their economies. Our results show that the coefficients on $EU10_{j,k}$ and $(EU15 - EU10)_{j,k}$ are highly significant and positive for thirteen of the goods. Again, the cross-group pairs have lower price dispersion than the EU10 countries for all the goods, except footwear, which is not significant. This can partially be attributed to the heterogeneity in the economies of the EU10 countries. Except for restaurant services many of the goods with high cross-group coefficients are tradable goods.

Of the remaining variables $Euro_{j,k}$ and $GDP_{j,k}$ are the most influential. Previous studies have mixed evidence on the effects of the Euro. A common European currency was introduced to increase the transparency of market prices and eliminate exchange rate risk. All fourteen of the goods have a negative coefficient on $Euro_{j,k}$ but only five are significant at the ten percent level and one is significant at the five percent level. Member states who share a common currency appear to be benefiting from their stronger economic integration. This is in support of Allington (2005), but constitutes at most a 0.4 percent drop in price volatility for those countries that have a common currency.

The results for $GDP_{j,k}$ are similar. We expect the coefficient on GDP to be positive. The Balassa-Samuelson theorem states that wealthier countries should have higher prices. The coefficient on $GDP_{j,k}$ is positive for all of the goods and significant for five. For transport purchases $GDP_{j,k}$ is negatively related to price dispersion, but not significant. Therefore, there is some evidence of an integrating effect of both using a common currency and convergence in GDP levels.

The remaining variables are of the expected sign but have minimal influence on price dispersion because their coefficients are small and often insignificant. The coefficient of $Prox_{j,k}$ is negative for all fourteen goods and significant for two. The coefficient for $Lang_{j,k}$ is negative for eight goods but insignificant. For the remaining goods the coefficients are small in magnitude implying a limited impact on relative

price volatility. The coefficient on $Pop_{j,k}$ is negative for all goods but significant only for educational services. It appears geographic proximity, sharing a common language and country size help increase economic integration between countries but on a small scale.

The results for the pooled regression are shown in the last row of Table 6. The coefficients on distance and the group variables are highly significant and positive. The effect of the group variables is also much larger implying that year of ascension is more influential in explaining PPP deviations than distance. The coefficients on $Euro_{j,k}$ is negative and significant and positive and significant for $GDP_{j,k}$. This result conforms to our previous expectations. Transport costs, a later year of ascension, and larger difference in GDP per capita increase deviations from relative PPP. On the other hand, sharing a common currency has a negative effect on deviations from PPP. We again test the hypothesis that the coefficients for the explanatory variables are the same for all goods. This hypothesis is strongly rejected at the five percent level.

Table 5: Results of Fully Specified Regression for Goods 1 to 7

Good	Dist	EU10	EU15-EU10	Euro	GDP	Prox	Lang	Pop	R^2
1	0.88***	35.2***	18.7***	-0.63	0.66**	-0.61	0.18	-0.085	0.93
	(0.0003)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0006)	(0.0006)	(0.0001)	
2	0.3	35.7***	18.8***	-0.63	0.55*	-0.76	-0.10	-0.12	0.94
	(0.0003)	(0.002)	(0.001)	(0.0005)	(0.0003)	(0.0006)	(0.0005)	(0.0001)	
3	0.67***	29.7***	14.9***	-0.46	0.42	-0.18	0.019	0.049	0.91
	(0.0002)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0006)	(0.0005)	(0.0001)	
4	0.47	32.6***	17.0***	-1.02	1.44***	-1.27**	-0.2	-0.14	0.95
	(0.0003)	(0.002)	(0.001)	(0.0006)	(0.0004)	(0.0006)	(0.0006)	(0.0001)	
5	0.24	4.52**	2.93***	-0.83*	0.34	-0.91	-1.35	0.22	0.90
	(0.0005)	(0.002)	(0.001)	(0.0005)	(0.0006)	(0.0007)	(0.001)	(0.0002)	
6	0.56	19.7***	10.0***	-0.52	0.85*	-0.49	0.20	-0.23	0.91
	(0.0003)	(0.00268)	(0.001)	(0.0003)	(0.0004)	(0.0008)	(0.001)	(0.0002)	
7	7.2***	27.5***	9.18**	-4.51*	13.7***	-1.62	4.43	-1.10	0.74
	(0.002)	(0.00909)	(0.004)	(0.002)	(0.003)	(0.004)	(0.005)	(0.0008)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticiy consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 300 observations for the regression of individual goods. A set of of country specific indicator variables are included in each regression

Table 6: Results of Fully Specified Regression Regression for Goods 8 to 14

Good	Dist	EU10	EU15-EU10	Euro	GDP	Prox	Lang	Pop	R^2
8	4.4***	7.94	-0.96	-4.31*	6.95***	-3.79	-1.72	-0.85	0.74
	(0.002)	(0.00775)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.0006)	
9	0.38	33.8***	19.5***	-4.17	-0..51	-0.16	-1.17*	-0.14	0.94
	(0.0003)	(0.002)	(0.001)	(0.0003)	(0.0004)	(0.0007)	(0.0006)	(0.0001)	
10	0.31	21.9***	11.1***	-0.86**	0.95**	-0.012	-1.59	-0.034	0.90
	(0.0004)	(0.002)	(0.001)	(0.0004)	(0.0004)	(0.0008)	(0.002)	(0.0002)	
11	0.17	25.5***	13.4***	-0.62	0.28	-1.00	0.77	-0.12	0.96
	(0.0002)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0007)	(0.0006)	(0.0001)	
12	0.28	31.9***	16.9***	-0.66	0.26	-0.62	0.048	-0.12	0.93
	(0.0003)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0007)	(0.0005)	(0.0001)	
13	0.38	27.5***	14.3***	-0.56*	0.59	-1.55**	-0.39	-0.14	0.91
	(0.0003)	(0.002)	(0.001)	(0.0003)	(0.0004)	(0.0007)	(0.0008)	(0.0001)	
14	1.12***	25.0***	13.5***	-0.56*	0.11	-0.44	-0.07	-0.32**	0.92
	(0.0004)	(0.002)	(0.001)	(0.0005)	(0.0004)	(0.0009)	(0.001)	(0.0002)	
Pooled	1.24**	25.3***	12.7***	-1.18***	1.92**	-0.95	-0.091	-0.22	0.13
	(0.0005)	(0.003)	(0.001)	(0.0003)	(0.0008	(0.001)	(0.002)	(0.0002)	

***,**, and * represent 1, 5 and 10 percent level of significance. The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 300 observations for the regression of individual goods and 4200 observations for the pooled regression. A set of country specific indicator variables are included in each regression

Next we extend our model to test the theory that distance is concave with respect to price volatility. For these regressions $Dist_{j,k}$ represents km distances and is not in logarithmic form. Tables 7 and 8 report the results. The addition of $Dist^2_{j,k}$ changes the sign on all of the coefficients for $Dist_{j,k}$. However, only five of the coefficients on $Dist_{j,k}$ are significant and very close to zero. $Dist^2_{j,k}$ is negative for all of the goods but significant for only two of the goods. Our results compare but are weaker than Engel and Rogers (1996). They discover a threshold after which price dispersion appears to decrease with transport costs and distance which is significant for a majority of the goods. We discover a similar but less significant relationship for the European Union member states for the period 2000 and 2009.

Our final specification of the model is to divide the goods into two categories: tradable goods and services. Our data set allows for further disaggregation to this level. The categories: transport purchases, health, personal care, and recreation have been disaggregated into tradable goods and services. Housing electricity and furnishings have been omitted because it was not possible to disaggregate this data. The remaining variables were already composed solely of tradable goods or services.

Most previous studies find evidence that tradable goods are more responsive to transport costs. This is shown in the magnitude and significance of the coefficient on distance. This phenomena should enter our model through a positive coefficient on distance that is much larger in magnitude than the coefficient on services.

Table 9 reports that the price dispersion of tradable goods is much more influenced by distance. The coefficient of $Dist_{j,k}$ for tradables goods is positive and strongly significant at the five percent level and positive and insignificant for services. The magnitude of the coefficient on $Dist_{j,k}$ for tradable goods is four times larger than services. Interestingly, the sign of the group variables are negative for services implying that more integration is present for the EU10 and cross-group pairs than the EU15.

Table 7: Regression Results Including $Dist^2$ for Goods 1 to 7

Good	Dist	Dist^2	EU10	EU15-10	Euro	GDP	Prox	Lang	Pop	R^2
1	1.04e-03*	-8.14e-8	35.3***	18.7***	-0.612	0.64**	-0.81	0.22	-0.089	0.93
	(5.83e-07)	(1.34e-10)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0006)	(0.001)	(0.0001)	
2	6.36e-03	-1.09e-7	35.7***	18.9***	-0.63	0.53*	-0.73	-0.080	-0.12	0.94
	(6.27e-07)	(1.41e-10)	(0.002)	(0.001)	(0.0005)	(0.0003)	(0.0006)	(0.001)	(0.0001)	
3	1.51e-03***	-2.80e-7**	29.7***	15.0***	-0.48	0.36	-0.10	0.058	0.059	0.91
	(5.30)	(1.23e-10)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0006)	(0.001)	(0.0001)	
4	4.07e-04	0	32.7***	17.0***	-0.99	1.45***	-1.41**	-0.17	-0.14	0.95
	(7.33e-07)	(1.76e-10)	(0.002)	(0.001)	(0.0006)	(0.0004)	(0.0006)	(0.001)	(0.0002)	
5	9.22e-04	-1.63e-7	4.57**	2.99***	-0.82*	0.29	-0.68	-1.3	0.22	0.90
	(8.90e-07)	(2.07e-10)	(0.002)	(0.001)	(0.0005)	(0.0006)	(0.0007)	(0.001)	(0.0002)	
6	1.55e-03**	-3.19e-7*	19.7***	10.1***	-0.54	0.78*	-0.33	0.24	-0.21	0.91
	(7.50e-07)	(1.81e-10)	(0.003)	(0.001)	(0.0003)	(0.0005)	(0.0007)	(0.001)	(0.0002)	
7	0.012***	-1.91e-06*	28.0***	9.67**	-4.52**	13.3***	-2.12	4.73	-1.16	0.74
	(4.33e-06)	(1.00e-09)	(0.009)	(0.004)	(0.002)	(0.003)	(0.004)	(0.006)	(0.0008)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 300 observations for the regression of individual goods. A set of country specific indicator variables are included in each regression

Table 8: Regression Results Including $Dist^2$ for Goods 8 to 14

Good	Dist	Dist^2	EU10	EU15-10	Euro	GDP	Prox	Lang	Pop	R^2
8	8.07e-03**	-1.38e-06*	8.16	-0.6	-4.36*	6.63***	-3.96	-1.56	-0.80	0.74
	(3.23e-06)	(7.63e-10)	(0.008)	(0.004)	(0.002)	(0.002)	(0.003)	(0.004)	(0.0006)	
9	3.97e-04	0	33.9***	19.5***	-0.41	-0.52	-0.27	-1.16*	-0.14	0.94
	(6.47e-07)	(1.52e-10)	(0.002)	(0.001)	(0.0002)	(0.0004)	(0.0006)	(0.001)	(0.0001)	
10	1.10e-03	-2.81e-7	21.9***	11.2***	-0.90**	0.88**	0.11	-1.58	-0.019	0.90
	(9.23e-07)	(2.11e-10)	(0.002)	(0.001)	(0.0004)	(0.0004)	(0.0008)	(0.002)	(0.0002)	
11	9.21e-04	-2.20e-7*	25.5***	13.5***	-0.63*	0.23	-0.79	0.8	-0.11	0.96
	(5.63e-07)	(1.30e-10)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0007)	(0.001)	(0.0001)	
12	6.74e-04	-1.19e-7	31.9***	16.9***	-0.66	0.23	-0.57	0.075	-0.12	0.93
	(6.32e-07)	(1.42e-10)	(0.002)	(0.001)	(0.0004)	(0.0003)	(0.0007)	(0.001)	(0.0001)	
13	1.78e-03**	-4.44e-7***	27.4***	14.5***	-0.60*	0.48	-1.22	-0.36	-0.11	0.92
	(7.20e-07)	(1.68e-10)	(0.002)	(0.001)	(0.0003)	(0.0004)	(0.0007)	(0.001)	(0.0001)	
14	3.19e-04	1.78e-7	25.1***	13.4***	-0.51	0.16	-1.05	1.29e-03	-0.34**	0.92
	(8.65e-07)	(2.02e-10)	(0.002)	(0.001)	(0.0005)	(0.0004)	(0.0009)	(0.001)	(0.0002)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 300 observations for the regression of individual goods. A set of country specific indicator variables are included in each regression

Table 9: Regression Results for Tradable Goods and Services

	Dist	**EU10**	**EU15-10**	**Euro**	**GDP**	**Prox**	**Lang**	**Pop**	R^2
Tradables	1.71**	25.3***	12.2***	-1.39***	2.56**	-0.98	0.25	-0.29	0.12
	(0.0007)	(0.004)	(0.002)	(0.0004)	(0.001)	(0.001)	(0.002)	(0.0003)	
Services	0.39	-15.4**	-6.67*	-0.67**	0.25	-0.69	-0.14	-0.14	0.23
	(0.0007)	(0.008)	(0.004)	(0.0003)	(0.001)	(0.001)	(2.56)	(0.0005)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 18000 observations for the regression of tradable goods and 2700 observations for the regression of services. A set of country specific indicator variables are included in each regression

6 Explaining the Effects of the 2004 EU Expansion

We have shown that deviations from PPP are strongly influenced by distance, year of ascension, a common Euro currency, GDP per capita and less by sharing a common land border or an official language and city size. It remains unclear if these variables have changed over time. To understand how these variables have been influenced by the expansion of the EU we first evaluate if price dispersion has changed between the periods 2000 to 2003 and 2004 to 2009, and then evaluate the effect of each of the coefficients separately for the two sub-periods.

We expect the volatility of prices to decrease after the expansion of the European Union. The cross border pairs and EU10 are now benefiting from the free movement of goods, people and services. The original fifteen member states are benefiting from a larger market that extends the free flow of goods, services and people to a larger resource base. We perform variance equality tests similar to Palenmark (2004). Table 10 shows the variability of each good for the first period denoted S_1 and the second period denoted S_2. The F-stat and probability are also reported for the null hypothesis that the variances are equal in both sub-periods. Finally, the true relationship is reported in the last column. Surprisingly, only five of the goods have less variance after the enlargement of the EU, two are equal, and five have more variance after enlargement. Many of the goods that experienced an increase in the variance of prices have a large service component.

Next, Table 11 and 12 report the estimated coefficients for each sub-period and the results for testing their equality. Similar to Palenmark (2004) we use seemingly unrelated regressions because we expect the errors might be correlated. The model for our regression remains Equation (10) but we are now estimating the model separately for each sub-period. Only the coefficients that are significant and of the correct sign for both sub-periods are reported. A probability greater than five percent implies a rejection of the null hypothesis that the coefficients are equal in both sub-periods.

Table 10: Equality of Variance Tests

Good	**2000-2003** S_1	**2004-2009** S_2	**F-stat** $S_1 = S_2$	**Probability** $S_1 = S_2$	**True Relationship**
1	0.007	0.007	1.10	0.42	*Equal*
2	0.007	0.008	0.75	0.01	$S_1 < S_2$
3	0.006	0.007	0.70	0.00	$S_1 < S_2$
4	0.011	0.010	1.33	0.01	$S_1 > S_2$
5	0.010	0.010	1.02	0.87	*Equal*
6	0.007	0.009	0.68	0.00	$S_1 < S_2$
7	0.026	0.029	0.78	0.03	$S_1 < S_2$
8	0.019	0.023	0.67	0.00	$S_1 < S_2$
9	0.011	0.007	2.40	0.00	$S_1 > S_2$
10	0.011	0.010	1.17	0.08	$S_1 > S_2$
11	0.007	0.011	0.46	0.00	$S_1 < S_2$
12	0.007	0.008	0.69	0.00	$S_1 < S_2$
13	0.008	0.007	1.20	0.06	$S_1 > S_2$
14	0.012	0.010	1.57	0.00	$S_1 > S_2$

The distance between two countries is constant for both sub-periods. This implies that any change in the magnitude of the distance coefficients can be attributed to a change in transport costs. The results show that the coefficient on distance was significantly different for only two of the goods, and decreases only for one of the goods. Surprisingly, we conclude that transport costs did not change after the ascension of the new member states. A possible explanation is that many of the transport costs were reduced prior to the ascension of the member states as they modified their economies to meet the criteria for joining the EU.

The ten new member states joined the EU in 2004 and immediately started benefiting from the EU's joint economic policy and the free movement of goods, services and people. We would expect that joining the EU would increase economic integration between the new member states implying that the coefficient on $EU10_{j,k}$ should be smaller after 2004. The results indicate that seven of of twelve coefficients on $EU10_{j,k}$ are significantly different in the two sub-periods. More surprisingly, of the

seven coefficients five have increased in magnitude. There is a greater difference in the relative price of similar goods for the ten new member states after ascension. A possible explanation is that each member state has a different speed of adjustment in prices and some were faster at implementing joint policies and benefiting from integration. Also, shortly after joining the EU there were cases of inflation in the new member states as the prices began to adjust to the higher EU levels. Inflation could drive a wedge between relative prices. Lastly, the free movement of goods and services was also met by agricultural quotas. The enforcement of quotas on agricultural goods would effect prices differently depending on which good the country produced.

The cross-group pairs should also have benefited positively from the expansion of the EU in 2004 through an enlarged market and harmonized economic policies. This implies a decrease in the price differential of similar goods and a smaller coefficient on $(EU15 - EU10)_{j,k}$ in the second sub-period. Our expectations are supported by the data. Five of the goods have significantly lower coefficients on $(EU15-EU10)_{j,k}$ after the ascension of the ten new member states. The five years after the enlargement of the EU already shows an increased level of integration and a convergence in relative prices between the original and new EU member states.

We would expect the coefficient on $Euro_{j,k}$ to be more negative after 2004. Countries participating in a common monetary union now have more resources available to compliment their increasingly competitive and transparent financial markets. This result was only true for footwear. Likewise a convergence in income level would imply a smaller coefficient on $GDP_{j,k}$. The European Commission hoped that increasing integration would eventually lead to a common standard of living, but this is not yet supported by the data. However, convergence in income is a long-run phenomena and our data is only available for the five years after the expansion of the EU. These results might change in the next decade. The remaining variables had no significant difference in their effect on price dispersion for the EU before and after 2004.

Table 13 shows the results of estimating the regression in Equation (10) with the addition of the interaction terms. Again, only the coefficients that are of the right sign and significant in both sub-period are reported. The interaction terms are $EU10_{j,k}$ and $(EU15-EU10)_{j,k}$ interacted with $Dist_{j,k}$, $Euro_{j,k}$, $GDP_{j,k}$, $Prox_{j,k}$, $Lang_{j,k}$, and $Pop_{j,k}$. Each variable is interpreted as how distance and the other factors influence price dispersion for only the EU10 or only the cross-group country pairs. For example, the coefficient on $EU10_{j,k} * Dist_{j,k}$ is interpreted as the percentage change in price dispersion given a one percent increase in the kilometer distance between two countries in the EU10, ceteris paribus. Likewise, the coefficient $(EU15 - EU10)_{j,k} * Dist_{j,k}$ is interpreted as the percentage change in price dispersion given a one percent increase in the kilometer distance between two countries in the cross-group category, ceteris paribus. The results show that at the group level the coefficients on all but one of the interaction terms are equal in the two sub-periods. This implies that price dispersion before and after the ascension of the ten new member states did not change as a result of group specific differences in distance, GDP, sharing of a common land border or language or population.

The sub-period regressions show that there was limited immediate integration that occurred on the day of the ascension of the ten new members to the EU. The equality of many of the coefficients in the two sub-period support this claim. The factors that did seem to effect price dispersion before and after the expansion of the EU are the group variables. The results of the coefficients on $EU10_{j,k}$ are ambiguous because the relative prices of some goods converged after the expansion and some diverged after expansion. The only factor to truly show a significantly different effect on price dispersion before and after 2004 is the cross-group variable. The cross-group pairs become significantly more integrated after 2004.

A possible explanation for an equal effect of distance and the other socio-economic factors on price dispersion before and after the expansion of the EU in 2004 could be

the gradual integration of prices before and after the expansion. The new member states had been striving to become members of the EU and had to adhere to strict economic guidelines before entry into the EU was permitted. Perhaps this gradual adjustment diminishes the impact of dissolving the final barriers to trade and explains why the effect of many variables did not change with he ascension of the new member states.

Table 11: Regression Results for the Sub-periods

	Distance			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
1	1.30	0.51	7.63	0.01
3	0.70	0.78	0.05	0.82
7	4.93	8.61	5.36	0.02
8	3.67	4.90	1.1	0.30
	EU10			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
1	3.88	3.13	28.14	0.00
2	3.41	3.61	2.05	0.15
3	2.96	2.87	0.31	0.58
4	3.59	2.98	15.6	0.00
6	1.41	2.28	21.84	0.00
7	1.62	2.75	1.94	0.16
9	3.13	3.67	10.96	0.00
10	2.20	2.22	0	0.94
11	2.12	2.96	16.79	0.00
12	2.94	3.27	5.39	0.02
13	2.82	2.62	1.25	0.26
14	1.89	3.01	17.18	0.00
	Proximity			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
13	-0.65	-0.47	0.48	0.49

All coefficients have been multiplied by 10^3 except EU10 which was multiplied by 100.

Table 12: Regression Results for the Sub-periods Continued

	EU15-EU10			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
1	2.10	1.67	35.43	0.00
2	1.83	1.91	1.26	0.26
3	1.49	1.45	0.19	0.67
4	1.91	1.61	15.3	0.00
5	0.34	0.24	0.53	0.46
6	0.77	1.14	16.18	0.00
9	1.96	1.97	0.01	0.94
10	1.15	1.12	0.05	0.83
11	1.13	1.56	17.3	0.00
12	1.64	1.72	1.13	0.29
13	1.49	1.40	0.94	0.33
14	1.10	1.60	13.43	0.00
	Euro			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
1	-0.66	-0.56	0.24	0.62
2	-0.52	-0.66	0.51	0.47
4	-0.73	-1.22	4.66	0.30
5	-0.90	-0.78	0.08	0.77
6	-0.50	-0.49	0	0.98
8	-3.19	-4.82	3.53	0.06
10	-0.58	-1.02	1.6	0.20
11	-0.67	-0.54	0.19	0.66
12	-0.57	-0.70	0.36	0.55
13	-1.54	-1.63	0.02	0.90
	GDP			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
7	11.92	9.36	1.3	0.26

All coefficients have been multiplied by 10^3 except EU15-EU10 which was multilingual by 100.

Table 13: Regression Results for the Sub-periods with Interaction Terms

	$EU10 * Dist$			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
1	3.25	2.6	0.4	0.53
2	2.84	1.97	0.84	0.36
4	3.8	5.93	4.85	0.03
12	2.7	2.32	0.16	0.69
13	5.4	4.54	0.47	0.49

	$(EU15 - EU10) * Euro$			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
8	-9.44	-12.1	0.96	0.33

	$EU10 * GDP$			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
4	2.66	4	0.92	0.34

	$(EU15 - EU10) * Lang$			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
5	-5.89	-5.3	0.05	0.82

	$(EU15 - EU10) * Prox$			
Good	**2000-2003**	**2004-2009**	**Wald Test**	**Probability**
2	3.63	3.36	0.05	0.82
12	3.29	2.66	0.29	0.59

All coefficients have been multiplied by 10^3.

7 Results of Robustness Tests

This section contains a series of robustness tests. First, we estimate the model of Equation (10) with quarterly data. Next, we estimate the model of Equation (10) with higher differenced series. Originally, we were interested in a one month difference of relative prices to remove the potential trend in price dispersion. We now extend the differences to three months, six months, and a year. The regression results of higher order differencing are withheld for brevity but a summary of the results is shown in Table 16. We also reiterate that there was a series of specification tests run to determine if the choice of reference country dummies influenced the sign or significance of the parameters and found that the results were unaffected by these choices.

Table 14 and 15 report the results of modeling Equation (10) with quarterly data. A majority of the coefficients maintain their significance and sign but have a larger magnitude when quarterly data is used. For thirteen of the goods the sign and significance of the coefficients on $prox$ and GDP remain the same. Only footwear changed sign and significance for the group variables because seasonal variables are removed with quarterly data. All coefficients on $Euro_{j,k}$ maintained their sign but four became less significant. Two coefficients on $prox$ changed significance, and finally four of the coefficients on $Lang_{j,k}$ changed sign and two changed significance.

Of the fourteen regressions involving a total of 112 coefficients only seventeen were effected by changing the frequency of observations to quarterly data. In fact, of the thirteen affected coefficients most retained their sign but became more significant lending stronger support to our previous discussions. Many of the coefficient changes occurred for the clothing and footwear categories which as shown in Figure 1 appear very cyclical. Therefore, our model is robust to choice in the frequency of data used to model price dispersion.

Table 14: Regression Results for Quarterly Data Goods 1 to 7

Good	Dist	EU10	EU15-10	Euro	GDP	Prox	Lang	Pop	R^2
1	2.53***	79.7***	42.2***	-2.00	2.10**	-0.93	1.51	-0.32	0.89
	(0.0007)	(0.005)	(0.003)	(0.001)	(0.0009)	(0.002)	(0.002)	(0.0004)	
2	0.77	87.2***	45.3***	-1.91	1.89**	-1.44	-0.072	-0.089	0.91
	(0.0006)	(0.006)	(0.003)	(0.001)	(0.0008)	(0.002)	(0.001)	(0.0003)	
3	1.87***	73.3***	36.6***	-1.73	1.58**	-0.35	0.17	0.046	0.90
	(0.0006)	(0.005)	(0.002)	(0.001)	(0.0008)	(0.002)	(0.001)	(0.0003)	
4	1.36	77.1***	39.7***	-2.63	4.20***	-3.52**	0.86	-0.53	0.91
	(0.001)	(0.006)	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.0004)	
5	-0.22	22.0***	11.9***	-2.23*	0.196	-3.76*	-4.35	0.11	0.83
	(0.001)	(0.007)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)	(0.0006)	
6	0.14	86.1***	45.1***	-1.58	0.487	-1.63	-0.46	-0.26	0.91
	(0.0007)	(0.006)	(0.003)	(0.001)	(0.0008)	(0.002)	(0.001)	(0.0003)	
7	8.36***	76.6***	36.3***	-3.20	4.78	-1.66	8.94**	-0.88	0.74
	(0.002)	(0.008)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.001)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 34 observations in each regression. A set of country specific indicator variables are included in each regression

Table 15: Regression Results for Quarterly Data Goods 8 to 14

Good	Dist	EU10	EU15-10	Euro	GDP	Prox	Lang	Pop	R^2
8	6.86***	64.4***	33.2***	-4.63**	1.15	-2.40	5.02	-1.25	0.76
	(0.002)	(0.008)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.001)	
9	0.31	74.7***	43.8***	-1.28	-1.72**	-1.25	-2.96**	-0.33	0.91
	(0.0007)	(0.005)	(0.003)	(0.001)	(0.0008)	(0.002)	(0.001)	(0.0003)	
10	0.28	68.5***	34.3***	-1.90	1.54	-2.52	2.41	-0.097	0.85
	(0.0008)	(0.005)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.0004)	
11	0.01	68.6***	36.1***	-1.49	0.29	-3.00*	1.18	0.013	0.94
	(0.0006)	(0.005)	(0.002)	(0.001)	(0.0008)	(0.002)	(0.001)	(0.0003)	
12	0.61	84.5***	44.7***	-1.64	0.26	-1.47	-0.26	-0.17	0.91
	(0.0006)	(0.006)	(0.003)	(0.001)	(0.000736)	(0.002)	(0.001)	(0.0003)	
13	0.6	79.3***	40.4***	-1.69	1.18	-1.87	1.32	-0.04	0.90
	(0.0006)	(0.006)	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.0003)	
14	0.00181**	66.2***	34.6***	-1.15	0.35	-1.84	1.06	-0.5	0.89
	(0.0008)	(0.005)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.0003)	

***,**, and * represent 1, 5 and 10 percent level of significance.The heteroskedasticity consistent standard errors are reported in parentheses, and all coefficients have been multiplied by 10^3. There are 34 observations in each regression. A set of country specific indicator variables are included in each regression

Table 16: Results for Higher Ordered Differences

	Significance	**Sign**	**Sign and Significance**
Distance	2	1	3
Eu10	0	0	0
Eu15-Eu10	0	0	1
Euro	4	0	0
GDP	4	0	1
Proximity	1	1	0
Language	0	2	1
Population	0	0	0

Similarly, the regressions results were robust to an increase in the monthly lag when differencing the data. A majority of the coefficients maintained the same sign and significance when we estimated the model of Equation (10) using a three month difference, six month difference and a difference of a year. The results in Table 16 report the amount of times the estimated coefficients changed sign, significance, or both for the differenced series. Our results appear to be robust to the higher ordered differencing.

Engel and Rogers (1996) had monthly and bimonthly data. When they extended the monthly data to bimonthly differencing they reported a decrease in the magnitude of the parameters. We have similar results for all goods.

8 Conclusion

Our study analyzes relative price dispersion in the EU from 2000 to 2009 to examine the factors influencing integration and how they have been affected by the 2004 expansion. The expansion in 2004 nearly doubled the size of the EU greatly enlarging the common market and more thoroughly integrating the economies of the member states. We focus on how distance, years of ascension to the EU, the use of a common currency, GDP per capita, sharing a common land border or official language and population size effect price dispersion. We find evidence that the economies of the EU member states are not yet fully integrated.

Our preliminary results focus only on the effect of distance and year of ascension and support a highly significant distance and group effect for a majority of the fourteen goods. The year of ascension has a much larger impact than distance on price dispersion. In fact, nearly 3,500 km equate to the effect of a later year of ascension. Transport costs seem to increase the price differential of similar goods in the EU. The original fifteen member states that have had the most amount of time to integrate their economies have the least price dispersion. Surprisingly, the cross-group pairs where one country joined the EU prior to 2004 and one country joined the EU in 2004, have less price dispersion than the EU10 member states. Even after controlling for country specific characteristics with the use of indicator variables there still remains much heterogeneity between the economies of the EU10 countries. We also show that there is some evidence of a concave relationship between distance and price dispersion in the EU member states.

Our fully specified model explains deviations from PPP with a distance and group effect and the addition of several cultural, economic and geographic factors. We again find a significant positive relationship between price dispersion and both distance and the group variables, though this relationship is significant for fewer goods. The coefficients on distance and the group variables are of large magnitude implying they

are still very influential after controlling for other factors. The other two influential factors are the Euro and GDP per capita. The use of a common currency eliminates exchange rate risk and creates a more transparent market, decreasing the difference in relative prices in the EU. GDP is positively related to price dispersion supporting the notion that richer countries have higher prices. The remaining variables were of the expected sign but were less significant implying a smaller influence on deviations from PPP.

We are also interested in understanding if the factors that influence PPP deviations changed after the expansion of the EU in 2004. We find evidence that the cross-group pairs are more integrated after the expansion of the EU. There is mixed evidence for the integration of the EU10 member states. The other variables have an equal impact on integration before and after the expansion. This implies that the adjustment of prices is a gradual process in the EU and the ascension of the new member states did not cause a large leap in integration for the member states.

The gradual process of integration would become clearer if we were able to include the two newest member states in our analysis. Bulgaria and Romania joined the EU in 2007 and have much larger deviations from PPP than the countries that have been longstanding members of the EU. In our preliminary regression we attempted to include Bulgaria and Romania in our analysis but the estimates were highly sensitive to the which country was dropped as a reference. In the next few years a valuable extension to our study would be to include the new member states and see if their joining the EU affected PPP deviations.

9 References

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