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by Christian Dreger, Konstantin Kholodilin
Kirsten Lommatzsch, Jirka Slacalek
German Institute for Economic Research (DIW Berlin)

and Przemyslaw Wozniak
Center for Social and Economic Research (CASE Warsaw)

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Price convergence in the enlarged internal market*

By Christian Dreger (coordinator of the study)**, Konstantin Kholodilin,
Kirsten Lommatzsch, Jirka Slacalek**
German Institute for Economic Research (DIW Berlin)

And Przemyslaw Wozniak
Center for Social and Economic Research (CASE Warzaw)

Abstract:

The studies' main aim is to investigate the effects of the EU-10 enlargement on price convergence within the Internal Market. It distinguishes between the opposite forces provided by: (1) the catching up effect of the EU-10, expected to lead to a rise in price levels; and (2) increased competitiveness pressure on prices expected to lower price levels due to lower mark ups of prices over marginal costs. The study is based on comparative price levels for the EU-25, covering the period 1999-2004. Distinct variables were identified as proxies for the catching-up and competition forces. The following analysis proceeded in two steps. First, it is examined whether price convergence has occurred and, second, what are its main drivers. The results confirm the presence of price convergence. This process is particularly visible in the case of basic headings, most likely because they are related to more homogeneous products. Moreover, both catching up and competition have been important factors for explaining price convergence. In addition, both effects seem to be more pronounced for the EU-10 than for the EU-15.

Key words: EU enlargement, Internal Market, price convergence, Balassa Samuelson effect, catching up and competition
JEL classification: E31, F02, O40, P22

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Executive Summary

The main aim of this study is to investigate the effects of EU enlargement on price convergence within the Internal Market. The Internal Market is expected to foster market integration and thus the convergence of prices in product markets which leads to an increase in efficiency and welfare. Although a high degree of market integration is already achieved, price dispersion in the EU has considerably increased with the enlargement in 2004. Because of their lower income levels, price levels in the New Member States are as a rule substantially lower than in the Old Member States In addition, inflation rates in the New Member States exceed the average of the EU-15.

Two principal forces are crucial to explain the process of price convergence. On the one hand, the rise in competition in the Internal Market exerts a downward pressure on prices due to lower mark ups of prices over marginal costs. This tendency is based on market reforms, deregulation and a different composition of value added. On the other hand, the catching up process of low income countries leads to a rise in the price levels and higher inflation over a transition period. The overall price level tends to increase and affects the consumption and production pattern of the economies. Domestic factors become less important in particular for tradable products. It is the main task of this study to disentangle these two forces on price developments and to assess their relative importance.

The main contribution is on the empirical side. Equations incorporating both catching up and competition effects are estimated using a huge amount of data for different product categories. In addition, the study assesses the effects of the process of price convergence in the New Member States on the entire EU25, i.e. whether the price adjustment will occur through upward price trends in the New Member States or downward trends in (some of) the Old Member States.

Following the introduction in section I, the impact of competition on price convergence is discussed in section II. The Law of One Price (LOP) is taken as the natural point of departure, as it constitutes the basic mechanism for price convergence in a perfect competitive market.

In fact, the empirical relevance of the LOP is quite limited even in integrated markets such as the EU-12 or the US. The LOP predicts that in the absence of barriers to trade, arbitrage will force prices of identical products to converge, i.e. the domestic price is equal to the foreign price, both expressed in the same currency. Hence domestic prices are fully determined by foreign conditions, implying that prices in small open economies are completely exogenous. However, arbitrage will not occur if price differences are not sufficient to cover the related costs. Deviations can persist, for example, due to transportation costs, market segmentation, and different preferences of consumers at home and abroad. Therefore, in these cases the price setting behaviour of firms can be mainly traced to domestic factors. Nevertheless, consistent evidence is available that an increase in openness (market integration) has put a downward pressure on prices via the reduction of mark ups.

Given that countries in the Internal Market differ with respect to their per capita income, catching up processes need to be taken into account. Specifically, prices of non tradables should be substantially lower in the New Member States, as long as they are in a catching up phase. However, the estimated magnitude of the effect appears to be rather small, partly because of empirical problems. Therefore, catching up is likely related to a broader concept than the pure Balassa-Samuelson model, as it includes regulated prices as well as the quality and reputation of products. The implications of catching up on price convergence are discussed in section III. In particular, the Balassa Samuelson effect and the non tradable component of products provide a rationale for the presence of a trend in relative prices not related to the functioning of the Internal Market.

In the empirical model the impacts of competition and catching up have to be disentangled. Both effects should be studied simultaneously in order to get unbiased estimates. The methodological aspects of appropriate indicators to study the process of price convergence are explored in section IV. The empirical analysis is carried out on the basis of comparative price levels (CPLs). Research so far has mainly focused on absolute price data of certain areas or products, where prices are relatively easy available, such as in the food sector. Unfortunately, these prices are less representative for the functioning of the Internal Market. As to the use of relative price aggregates, such as consumer and producer price indexes, a distinction cannot be made whether the effect of lower price

dispersion is caused by the convergence of prices of individual goods or services or a change in the weighting system.

CPL measures have been constructed by Eurostat and the OECD as part of the European Comparison Programme and are calculated as the ratio between purchasing power parities (PPPs) and nominal exchange rates. The PPPs are based on price levels of a comparable and representative sample of products covering the various aggregates of GDP in the EU-25 member states. They are observed for 41 broad categories. Furthermore, at the most disaggregated level, PPPs rely on relative price ratios for 279 categories of goods and services labelled as basic headings. Section IV clarifies the construction principles of PPPs and CPLs, and gives insights into their limitations of these measures.

Recent price trends are explored in section V. Due to lower levels in per capita income and productivity the New Member States have lower prices than EU-15 countries. The backlog is most pronounced in services which are often non-tradable. However, price levels of manufacturing goods are also lower, which may indicate lesser tradability and an inferior quality and reputation of the goods produced in the New Member States. Furthermore, as tradability increases with the durability of the goods, price convergence should be more prominent for durables. However, it seems that price convergence has decreased for durable goods in recent years.

The econometric approach is presented in section VI. The analysis has to distinguish between catching up and competition forces. Therefore, distinct variables are identified as proxies for these forces in order to obtain insights on their impact on price convergence. A factor analysis to extract common information is conducted. Specifically, a catching up factor is derived from a dataset comprising real GDP, real productivity, and real compensation of employees. These measures are in relative terms, i.e., they refer to the individual country variables divided by the EU-12 benchmark. The first principal component is interpreted as the catching up factor. It represents almost all of the variation of the underlying variables.

Competition is more difficult to measure. It is partly, albeit not perfectly, manifested in the openness of countries to foreign trade and import penetration, which are both related to market integration. Openness and import penetration are strongly correlated. Import

penetration might be more informative because it reflects the exposure of the domestic market to international competition. Another indicator is the degree of business deregulation as measured by the Fraser index. This index comprises information about price controls, the burden of regulation, the time spent with government bureaucracy, the ease of starting a new business and irregular payments. The correlation of import penetration (openness) with either price controls or the overall Fraser index is rather weak. Therefore, the study did not use factor analysis to capture the competition factor, as a substantial part of information would be classified as idiosyncratic and dropped from the analysis. As a consequence, for the purpose of this study the import penetration indicator and the price control subindicator of the Fraser index are used.

After determining the variables of interest, the empirical analysis proceeds in two steps. First, the study examines if price convergence has occurred (by analysing β convergence, measuring convergence towards the mean) and whether a reduction in price dispersion over time took place (by analysing σ convergence). Second, empirical insights into the main drivers of price convergence are provided by regressing CPLs on a number of explanatory variables.

The results for the first step show a negative relation between the initial price level and subsequent price increases. Therefore, countries with lower initial price levels tend to have higher inflation rates thereafter. As a result, price convergence will gradually occur. The study found that convergence is stronger in the case of basic headings, probably because they are related to more homogeneous products. In addition, the speed of convergence rises with the tradability of the product considered. Shocks are expected to be removed by 50 percent after 2.1 years in case of durables, compared to 3.7 years for non durables. The impact of shocks is even longer for non tradables, such as services and buildings. Regarding σ convergence, a significant decline in price dispersion can be detected for both groups of countries, the EU-15 and the EU-10.

The results for the second step show that both catching up and competition are important factors for explaining price convergence, most notably for the New Member States:

→ Overall in the average EU-25 sample both catching up and competition effects are significant. However, there are differences on the sectoral level. Regarding catching up the effect is only insignificant for durables and buildings, for competition import

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penetration is only insignificant for semi-durables and services, whereas price controls are significant for non-durables and services.

→ Regarding the EU-15, catching up is insignificant for the broad categories, but it is significant for basic headings (non-durables, services and equipment). This is most likely due to countries such as Spain, Greece and Portugal that are still in the catching up process. Overall, the competition effect is significant with a mixed picture on sectoral level: a reduction in price controls leads to a significant decrease in prices in most sectors (confirming the competition effect), while an increase in import penetration decreases prices only in the non-durable sector.

→ For the EU-10 sample the catching up effect is significant both on the average sample and on the sectoral level (with the exception of buildings). While the competition effect is significant on the average sample, there are differences on the sectoral level: import penetration is significant in semi durables, durables, and equipment and price controls are significant in services and equipment.

To sum up, there is evidence that price convergence takes place in the Internal Market. Due to the enlargement, the speed of convergence has increased. Both catching up and competition factors are relevant to explain the process of convergence, especially for the New Member States. Nevertheless, it should be noted that the time series dimension of the analysis is too short to arrive at definitive conclusions. This is particularly true in the case of basic headings, and might explain some inconclusive results of the analysis.

Part I:

Introduction and objectives

The implementation of the Internal Market Programme and the introduction of a common currency in a number of key EU Member States have led to an unprecedented degree of economic integration. The introduction of the euro has improved price transparency and has removed costs of currency conversion and exchange rate risk premia for a number of countries. Because of the increase in trade, the level of competition in the European Monetary Union (EMU) and between EMU member states and third countries has risen. Advances in the integration of labour, product and financial markets have reduced the costs for economic agents, private households and firms to undertake price arbitrage. It may also give rise to industrial restructuring, mergers and acquisitions and a change in the market strategy of enterprises.

The EU enlargement with the accession of eight Eastern European economies, Cyprus and Malta has marked another cornerstone in the completion of the Internal Market. The New Member States are small open economies, i.e. they have a small market size, implying that they have only little impact on EU25 quantities. For example, these economies account for 15 percent of total population, but only for 5 percent of real GDP in the Internal Market. Moreover, the New Member States are in the process of catching up growth, i.e. they have lower per capita income and lower price levels than the average of the Old Member States. During the process of transition and accession, trade has expanded rapidly. In addition, the New Member States have received large foreign direct investments in manufacturing industries, financial, distribution and communication sectors. In a number of cases, firms in the New Member States have been included in international production chains. Multinational firms have utilized the comparative cost advantages of these countries through shifting labour intensive work into this region.

The rapidity of the transition process can be seen, among others, by the development of inflation. At the beginning of the transition all countries faced high inflation rates. Liberalization by the removal of controls and quantity allocations, which repressed demand formerly, led to rapid adjustments to free market prices. In addition, fiscal and financial crises resulted in periods of rapid monetary expansion since governments relied on seignorage to support public budgets as well as state owned enterprises. Especially the Baltic countries experienced annual inflation in excess of 1000 per cent. But, as stabilization took place in most accession countries, inflation was reduced very quickly to

moderate rates. Central banks in most of the New Member States have been rather successful in stabilizing inflation after initial shocks. This in turn led to a substantial build up of reputation. The majority of accession countries experienced annual inflation rates around 30 percent in 1995, while the rates were even below 10 percent in some countries. Further disinflation occured after the onset of the Russian crisis in 1998. This has been caused by a combination of negative demand shocks, i.e. lower foreign demand by Russia and the EU, and positive supply shocks due to a decrease in oil prices and market integration in the eve of the EU accession. The evolution was overlapped by positive demand shocks due to higher economic growth in major trading partners and negative supply shocks due to rising oil prices at the end of the 1990s. Currently all New Member States realize single-digit inflation rates. In some countries, inflation exceeds only slightly the euro area average.

Market integration is an ongoing process, which has not been completed yet. The need for further integration, covering also the markets for services, is stated in the Lisbon agenda (EU Commission 2000) and has been also emphasised in the Kok report (EU Commission 2004b). An important indicator measuring market integration is price convergence. In general, an increase in integration leads to a rise in competition, which puts pressures on the mark ups of prices over marginal costs and may lead to the convergence of prices towards the price of the most efficient supplier. The theoretical foundation of this proposition is the Law of One Price (LOP), which is supposed to hold in perfectly competitive markets. The LOP postulates that in the absence of natural or regulatory barriers, arbitrage forces prices of identical goods to converge. Apart from transitional frictions, which may impede price convergence in the short and medium run, commodities are expected to sell for the same price in each geographical region of the Internal Market (Obstfeld and Rogoff, 1996). From the perspective of consumers, an identical amount of money should buy the same bundle of goods and services in each location.

Despite advances in the integration of markets, however, there is strong evidence that the pace of price convergence has slowed down in recent years, see several reports conducted by the EU Commission (2004a, 2005) and Eurostat (2003). Hence, other forces might be important to explain the development. Nevertheless, price level dispersion is higher for non tradables than for tradables, where the latter are clearly more affected by

the process of integration. The dispersion of overall price levels has decreased after the inception of the Internal Market in the EU12, but stayed rather unchanged after the introduction of the EMU. Nevertheless, the dispersion of prices for tradables has been on a stable declining trend over the entire period. In this study, the EU12 benchmark is preferred over EU15 as it allows eliminating the effect of exchange rate fluctuations in the euro area countries. But, even with EU12 as a benchmark these fluctuations are inherent in the remaining EU member states.

For the EU25 countries, a steep decline in price dispersion is observed until 2000, implying that the price levels in the New Member States have rapidly converged to those in the EU12 in the course of their preparation for accession. Because inflation rates have been higher on average in the former transition economies, price convergence has likely proceeded through rising prices in the New Member States towards the higher EU12 level. Due to the lower per capita incomes in the New Member States, the dispersion in the EU25 is much higher than in the EU12, which in turn exceeds that of the EU6 comprising the founding members of the EU. In sum, the evidence indicates that price convergence in the Internal Market takes place at least to some extent and that the duration of participation of countries in the Internal market may have an impact on the results. However, dispersion of consumer prices turns out to be significantly lower in the US and therefore, a further potential of prices to converge seems to exist, given that obstacles for arbitrage can be removed (Rogers, 2001, Faber and Stokman, 2005). For the founding members of the euro area, price dispersion is relatively low and closely to the US figures.

Price level convergence is often explored by means of aggregate price measures. However, preferences of agents at home and abroad need to be identical to obtain any robust insights from such an analysis. This condition is rejected in the sample considered here. Different weights of individual products can introduce a serious bias in the analysis. Weighting schemes are affected by the income level, which is substantially different between the New and Old Member States. Hence, persistent deviations in aggregate price levels may not necessarily imply that convergence has failed so far. Furthermore, the effects from higher competition could be overlapped by the catching up in per capita income of the New Member States.

There are several reasons why competition might be still imperfect in the Internal Market. The Balassa-Samuelson effect is the most popular explanation for the presence of a trend in the development of relative prices and real exchange rates. Prices of non tradable goods like services are predicted to be lower for the New Member States, as they are in the catching up process. Several papers have also emphasized the role of regulated prices, taxes and reputation problems of firms in the former communist economies. Different qualities and varieties of goods and services might also contribute to higher price dispersion.

The main objective of this study is twofold. First, it is explored whether price convergence has occurred within the enlarged EU. Second, the basic mechanisms through which convergence might have taken place are investigated. Specifically, competition and catching up forces are discussed as possible drivers of the convergence process. Overall, this will provide evidence on the sources of price dispersion, the past pace of and the future scope for price convergence in the enlarged EU with a particular emphasis on the functioning of the Internal Market and the role of the New Member States therein.

The report is organized in different chapters. The next part (section II) provides a survey of the literature covering theoretical and empirical aspects of the competition effect in an integrated market, while section III focuses on the catching up aspect. In the empirical model price reactions stemming from catching up and competition need to be disentangled. Both effects should be studied simultaneously in order to get unbiased estimates. Due to the absence of a sufficient amount of absolute price data, the analysis refers to comparative price levels and basic headings (section IV). They have been constructed by Eurostat and OECD as part of the European Comparison Programme. Stylised facts on recent price trends in the enlarged EU are presented in section V of the report. Section VI holds the empirical analysis. The econometric approach is built upon principal component analysis that is particularly suited to extract catching up and competition factors in the evolution of comparative price levels. The results are the basis for predictions of the future development of price convergence. Section VII summarizes the main conclusions.

Part II:

Competition and

price convergence

In perfectly competitive markets, prices in the domestic country are fully determined by international conditions. Therefore, price setting does not involve any local factors, such as cost or market structures. From the perspective of consumers an equal amount of money could buy the same bundle of goods and services at home and abroad. Individual prices have necessarily converged in equilibrium, implying that the Law of One Price (LOP) should hold. However, several imperfections have to be taken into account, implying that the LOP is unlikely to hold over reasonable time spans. Prices differ as the preconditions for perfect competition are not met. For example, product differentiation of firms and the presence of transaction costs might lead to a lack of competition. In addition, some goods and services are not tradable. As arbitrage does not occur for these products, their prices are not determined by foreign conditions, but by local factors such as preferences and cost structures. In addition, price levels of poorer countries are expected to be lower than those of countries with higher income. While the implications of a catching up process to the richer countries are discussed in the next section, this chapter focuses on the competition aspect.

II.1 The Law of One Price

The starting point for assessing price convergence in an integrated market is the Law of One Price (LOP). It states that a product must sell for the same price in all locations of the integrated market. Note that the LOP is different from the purchasing power parity (PPP) condition. The latter states that the LOP should hold on the average, i.e. equal baskets of goods and services should cost the same. For example, PPP can be fulfilled, even if the LOP does not hold in any individual product market. According to the LOP, the domestic price P is equal to the foreign price P^*, after both price levels have been expressed in the same currency:

(1) $P = SP^*$

The currency conversion is done by the nominal exchange rate S which is defined as the number of units of domestic currency for a unit of foreign currency. Deviations from the LOP would signal unexploited profit opportunities. In the absence of transportation and

other transaction costs perfect competition will equalize the price instantaneously by arbitrage in the product markets. For example, if the domestic exceed foreign prices, it would be profitable to buy products abroad and sell them at home. In consequence there is a flow of products from cheaper to more expensive countries. The additional supply puts a downward pressure on the domestic price until the equilibrium is restored. Then there is no longer motivation for arbitrage transactions. Under these circumstances, prices are fully determined by international forces. This implies that domestic factors do not play any role in the price setting behaviour of firms, unless the region considered is large compared to the size of the entire market.

The LOP is based on a number of idealizing assumptions. In particular, all firms are faced by the same horizontal demand curve and choose optimal quantities supplied. In equilibrium, marginal costs are equal to marginal revenues, i.e. product prices. Each firm might have a different cost function but this does not affect the price, just the quantity produced. The price of an individual product is exogenous for all firms and consumers, and determined by demand and supply decisions in the integrated market. This means that there are a large number of producers and consumers, none of them has the power to influence the price, agents are not able to collude, and firms can freely enter and exit the market without significant costs.

In the real world, several caveats need to be taken into account. Impediments to perfect competition might include cross country differences in the phase of the business cycle (demand pressure), market segmentation, regulations on product and labour markets, different consumer preferences at home and abroad, and transportation. Moreover, not all products and factors can be classified as tradable in international markets. Competitive pressures are less important in these cases.

In the presence of transportation costs, barriers to trade, and other transaction costs, arbitrage might not occur. Profits resulting from arbitrage are not large enough to cover the costs. These costs generates a neutral band around the equilibrium price where local prices can fluctuate independently from any competition pressures (Obstfeld and Taylor, 1997). Prices adjust only outside the band. Although barriers such as tariffs and similar regulations are not relevant for the Internal Market, non tariff barriers could be still important. Special inspection requirements on food imports and different national

standards such as warranties can foster market differentiation and monopolistic competition, where firms have some pricing power (Rogoff 1996).

International trade is not limited to final products, but also to the inputs needed for production (Engel and Rogers, 1996, Crucini, Telmer and Zachariadis, 2005). Deviations from the LOP can occur due to cross country differences in non traded and traded factor input costs, and to the differences in the production shares of these inputs. While the costs of tradable inputs are determined in an integrated market, the costs of the non tradable inputs are specific for the country considered. The final price can be decomposed into different stages of the production process. At each stage potential elements can affect price dispersion. For example, Corsetti and Dedola (2005) have emphasized the role of the distribution sector. Due to non tradable retail services, the intensity of competition need not be always reflected in prices. Different local costs can account for price differentials that do not open any profit opportunities arising from arbitrage, see also Wolf (2003).

A bias towards goods and services produced in a country may also cause a segmentation of markets. It can occur due to differences in quality or because of reputation problems, see Obstfeld and Rogoff (1996) and Benigno and Thoenissen (2003). Furthermore, a preference in favour of local products might exist because of traditions, climate, culture or different languages. As arbitrage does not take place, prices are also not forced to converge in these cases. Instead, they are determined by local factors. A border effect has been suggested by Engel (1993). It might be traced, to sticky prices, a home goods bias, and also the fact that prices of non tradable inputs are more similar within a country than across states. For instance, labour mobility is more pronounced within an economy than internationally.

II.2   Price setting models in segmented markets

Often firms are able to segment markets and reduce competition with strategies of product differentiation, local variants, product bundling, and special additional services. Differentiation implies that products are not homogenous in different locations of the market. In monopolistic competitive markets, firms have some power to charge a premium

over marginal production costs, thereby raising their profits. Thus, prices include a mark up over marginal costs, i.e.

$$(2) \qquad P = \frac{MC}{1 - 1/|\varepsilon_{y,p}|}$$

where MC is marginal costs and $\varepsilon_{y,p}$ is the elasticity of demand with respect to prices, i.e. the negative slope of the demand curve at some price level. Note that this approach includes the LOP as a special case: if markets are fully competitive, the elasticity would tend to infinity in absolute value, and prices and marginal costs coincide. The lower the elasticity in absolute value is, however, the smaller is the reaction of demand to price changes, and the higher the mark up firms can exploit. Provided that labour input L is the variable input factor to production at least over short time intervals, the price setting formula can be rewritten as

$$(3) \qquad P = \frac{\partial C / \partial L}{(\partial Y / \partial L)(1 - 1/|\varepsilon_{y,p}|)}$$

where $\partial C/\partial L$ and $\partial Y/\partial L$ denote the partial derivatives of costs C and output Y with respect to labour input (Varian, 2006). Apart from a particular market structure, i.e. competitive or monopolistic markets, the optimal price depends positively on nominal wages, and negatively on real productivity, as these two components constitute the marginal costs. Often, a more general model

$$(4) \qquad P = (1 + \eta)MC \quad , \quad \eta = f(\varepsilon, gap, ptm),$$

is specified, with *gap* as the output gap, i.e. a measure of excess demand over the business cycle, and a pricing to market variable, measured as the degree of the exchange rate pass through (Romer, 2001, Smets and Wouters, 2002). Country price levels will depend on these arguments.

The lower the demand elasticity is in its absolute value, the lower the pressure from competition and the higher the mark up. An increase in the output gap could also raise the mark up, as firms might adjust prices easier in periods of economic upturns. But, the

interpretation is controversial on this point. Recent work has stressed that the mark up may be nonstationary (Banerjee and Russell, 2004, 2005). Thus only its short run part is related to the business cycle, as it exhibits stationary fluctuations. While the mark up seems to be negatively related to inflation in the long run, it behaves countercyclical in the short run. In an environment of uncertainty and asymmetric loss functions, imperfect competitive firms might set their mark ups below profit maximizing values, in particular in higher inflation periods. The costs in terms of lost profits exceed those arising from the lower level of the mark up.

Mark up pricing behaviour is also the basis of approaches to explain the stickiness of prices. A key feature of these models initially advocated by Taylor (1982) and Calvo (1983) is that forward looking firms fully understand the necessity to reoptimize prices in a periodic way. Therefore, they are able to front load future expected marginal costs into their current price. Firms behave in this manner as they might not be able to raise prices when the higher marginal costs materialize. Similarly, to avoid a relative decline in their own prices, firms transmit expected overall inflation into the prices they control. The number of firms that change prices in a given period is specified exogenously, but can be also determined endogenously. Eichenbaum and Fisher (2004) have provided a recent review of these approaches. Standard model versions are strongly rejected by the data, as point estimates on the frequency of price adjustments are too high and inconsistent with the existing microeconomic evidence (Bills and Klenow, 2002). Nevertheless, extended settings that allow for delays in the implementation of the new prices seem to be more in line with the experience.

The key message from the mark up model is that prices in imperfect markets depend on country individual factors, such as demand and cost conditions, the state of the business cycle and pricing to market effects. To examine price convergence, price differentials across economies have to be explored. Therefore, appropriate models are built upon the respective variables of the home and foreign country.

In addition to the impact of country specific determinants, trade openness plays a vital role. Recent studies have stressed the increasing role of global drivers to explain price and inflation dynamics, in particular in industrialized countries, see Pain, Koske and Sollie (2006), Borio and Filardo (2006) and Mumtaz and Surico (2006). Almost 70 per-

cent of the inflation variance in the OECD countries can be explained by their first common component, see Ciccarelli and Mojon (2006). Competitive pressures and openness to foreign trade are closely related. Trade openness has raised both in industrial and emerging market economies over the past 35 years. The increase has been even stronger in the emerging economies, including the New Member States. While openness, measured as a ratio of the sum of exports and imports to GDP has risen from 70 to 90 percent of GDP in the Old Member States, many of the New Member States exhibit shares from 90 to 180 percent.[1] Eventually these economies have become more competitive due to market reforms and deregulation. Internalization of markets should lead to higher competition between firms, improve the allocation of capital, and increase efficiency. For example, domestic firms in the New Member States had to face competition from the Old Member States. They had to lower their prices and cut mark ups to stay in the market.

II.3   Empirical evidence on the competition effect

The LOP provides the basic mechanism on why prices should converge in the Internal Market. The pressure of competition will lead to a convergence of prices towards the price of the most efficient supplier. As stated above, several imperfections have to be acknowledged in the real world, especially in the short and medium run. Not surprisingly, the evidence in favour of the LOP is very limited, and if support could be established, it is mostly related to the long run. In this section, results on the LOP are reviewed. The presentation is focused on the LOP and does not cover the PPP condition, which restates the LOP in terms of a basket of products. In the PPP analysis, additional problems occur due to different weighting schemes of goods and services within the domestic and foreign basket.

Furthermore, the discussion is focused on papers that refer to price convergence in large markets sharing the same currency such as the US and the euro area. In these markets, the effect of exchange rate fluctuations cannot bias the evidence. However, for the euro area this is only the case since the launch of the EMU in 1999. In addition, the empirical

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[1] Macroeconomic data used in this study have been taken from the AMECO database provided by the EU Commission.

performance of the LOP for identical goods in less integrated markets is considered. Overall, the evidence suggests that convergence tends to be faster in integrated markets and for tradable goods. National borders and geographical distances between countries exert an adverse effect on integration. Nevertheless, a competition effect appears to be significant and robust, but its impact on the path of price convergence does not seem to be very strong.

The Law of One Price for identical goods in less integrated markets

Haskel and Wolf (2001) have examined the LOP in 25 industrial countries using prices of 100 products sold in IKEA stores. The results indicate that price disparities exist and are substantial across countries. Deviations in a range between 20 and 50 percent can be detected. This might be due to strategic pricing, local distribution costs, taxes and non traded components. The evidence points to strategic pricing, which would lead to different mark ups: although relative prices between individual products vary significantly, no clear cut pattern emerged in their ordering. Pricing is affected by the behaviour of local competitors, but the relationship could be nonlinear, i.e. convergence is faster if price differences are more pronounced.

Parsley and Wei (2003) looked at the importance of tradable and non tradable ingredients in a Big Mac using data from 34 countries. The non tradable component is estimated to exceed 50 percent and can be as large as 60 percent. The convergence of prices in the tradable components turns out to be relatively fast. Therefore, the slow convergence of the price for the entire product is likely due to slow adjustment in the non tradable part.

The Law of One Price in the US

Parsley and Wei (1996) have analysed price convergence based on raw prices of 51 products in 48 cities in the US during the 1975-92 period. The products are divided into tradables (26), perishables (15) and non tradables (10), most of them services. While perishables show the highest dispersion across cities, services exhibit the largest price differential on average. Price convergence is investigated by unit root tests to the price

differentials for each product. It should be noted, however, that a unit root analysis is not completely suited to study the convergence phenomenon. Even if price differentials are stationary, price dispersion might increase.

Given this remark, the null hypothesis of a random walk is rejected for tradables and for most perishables and services. Hence, price differentials do not contain stochastic trends, and prices should move together in the long run. Convergence appears to be slower for services than for perishables and tradables. But the result is hardly robust, as the inclusion of city dummies weakens the path of convergence. The analysis reveals that price differentials are higher the larger the distances. Therefore, distance exerts an adverse effect on the integration of markets (Engle and Rogers, 2001). By exploiting the same dataset, O'Connell and Wei (1997) studied adjustment towards parity by linear and nonlinear models. The existence of transaction costs could introduce nonlinearities in the convergence process, i.e. a neutral band around the LOP, where arbitrage does not occur. The evidence is broadly in line with this prediction. In the linear model, the random walk is rejected only for 7 out of 23 tradables. This would cast serious doubts on the validity of the LOP even as a long run condition. However, if nonlinear adjustment are allowed for, the evidence against nonstationarity is quite strong. Similar results are found for perishables and services. In these cases, adjustment takes more time and is detectable only in some cases.

Cecchetti, Mark and Sonora (2000) have tested CPI convergence for 19 cities over a longer period (1918-1995) using panel unit root tests. Relative CPIs are stationary, and this result seems to be robust across sub periods. Anyway, the test statistics might be biased in favour of this conclusion, as they neglect the issue of cross section correlation. Furthermore, deviations are long lasting with estimated half lives as large as 9 years. The half life indicates how long it takes for the impact of a shock to diminish by 50 percent. The distance between locations cannot fully rationalize the long lasting adjustment periods: convergence across cities that are closer to each other is a bit faster, but this result is not very strong in the data. A faster convergence in the tradables sector is only confirmed by some of the tests.

Engel and Rogers (2001) looked at the dispersion of inflation between US cities using information from 43 product categories. A volatility ratio is defined, i.e. the numerator

refs to deviations in inflation of the same good at different locations, i.e. the deviations from the LOP, while the denominator measures the deviations between inflation rates in different product in one place. The lower the volatility ratio, the more integrated the market. The findings indicate higher volatility ratios in tradables, again questioning the presence of price convergence.

The Law of One Price in the EU Member States

Based on a sample of EU cities and individual items data, Rogers (2002) have tested how price dispersion evolved between 1990 and 2001, in particular when compared to the US. Price dispersion has declined in the first half of the 1990s, mainly for tradables. But no further convergence could be determined after the introduction of the euro in 1999. The results of Wolszczak-Derlacz (2006) demonstrate that convergence can even occur due to aggregation, since the magnitude of price dispersion is larger on the micro than on the macro level.

Lutz (2002) has studied a wide array of individual prices to see whether the introduction of the euro has led to higher convergence. Price dispersion is compared between euro and non euro area countries before and after the introduction of the common currency. Only for the minority of products, a euro effect can be detected. Allington, Kattuman and Waldmann (2004) and Engel and Rogers (2004) did not find an additional downward shift in price level dispersion in response to the euro introduction. While dispersion declined between 1995 and 1997, it remained unchanged thereafter. Goldberg and Verboven (2004, 2005) have investigated the EU car market over the last three decades. Here, transport costs are relatively low compared to the price of the product. The LOP holds quite well in terms of price changes, but there is a lack of price level convergence. Price dispersion has only slightly decreased after the euro was introduced. The euro did not speed up convergence after 2002.

In principle, the introduction of the euro has reduced currency costs and exchange risk, while price transparency has been improved. This should lead to higher price convergence. However, the empirical evidence on this claim seems to be quite inconclusive. Nevertheless, it should be noted that most research has focused on the impact of the common currency on the path of consumer price convergence and therefore relied on a

cost of living concept. In contrast, Andrén and Oxelheim (2006) have looked at the development of producer prices in the transition from a national exchange rate regime to the currency union. Convergence of producer prices is equally significant before and after the introduction of the euro. To the extent that developments in producer prices are passed through to consumer prices, a further potential for convergence seems to exist in the euro area over the years to come.

Mathä (2005) has explored price differentials between Luxembourg and its neighbouring economies. Many commuters cross borders every day and are able to compare prices. The study is based on store prices in Luxembourg and near distant towns in Germany (Trier), France (Metz) and Belgium (Arlon). Six stores of a similar size are included, and prices of branded goods available in all countries are compared. Transaction costs are proxied by the distance between stores, and national borders. Also a dummy is included to control for habit persistence because of the former currency union between Belgium and Luxembourg. On average, differences between a pair of prices amount to 13 percent, with a standard deviation of 12 percentage points. Distance and border variables are important to explain the dispersion. In addition, the currency union exerts a significant impact. For example, price differentials between Luxembourg and Belgium are lower by 2.2 percentage points.

Due to lower costs of arbitrage, among others, exchange rate stability seems to promote price convergence. This claim can be restated for the former currency union between Luxembourg and Belgium (Mathä, 2005), but also for the founding members of the euro area. In fact, price dispersion is relatively low and closely to the US figures (Rogers, 2002). However, these effects might occur as long term benefits, and can hardly be detected in short time intervals.

The impact of the liberalisation of the network industries and internet trade on price convergence has been examined by the EU Commission (2001). Although liberalisation of markets led to a decline in prices especially in telecommunications, price dispersion between EU members has not decreased. For example, prices are substantially lower in gas producing countries.

Crucini, Telmer and Zachariadis (2005) have employed cross sectional variances to determine whether the variability in price differentials is related to tradable or non tradable

inputs. While deviations from the LOP are quite large the mean of the distribution is often close to 0. Price dispersion did not show a trend pattern over time. However, non traded goods have higher price dispersion compared to tradables. A similar conclusion holds for products with a substantial share of non traded inputs.

A few studies have modelled the impact of the euro on real exchange rate developments in the euro area. For example, Koedijk, Tims and van Dijk (2004) reported some evidence in favour of stationarity of real exchange rates for euro area countries. This result is obtained if cross country heterogeneities like different rates of mean reversion within the euro area are acknowledged. The evidence for stationary real exchange rates is quite stronger than outside the euro area. Thus, the process of European integration seems to accelerate convergence.

Openness to trade and competition

The substantial increase in openness has likely put a downward pressure on prices. Domestic factors become less important in particular for tradables. Insights can be revealed from sectoral studies which relate the increase in sectoral prices to the extent that these industries are subject to international competition. Chen, Imbs and Scott (2006) have reported estimates for the competition effect for manufacturing sectors in some EU countries, i.e. the size by which prices and mark ups fall and productivity is enhanced due to intensified competition. Explanatory variables are domestic and foreign openness (import penetration), the number of firms in domestic and foreign markets and aggregate prices. Competition exerts a positive, albeit small, but significant effect in the short run. In the long run, however, the analysis suggests that the effect diminishes and can even reverse. As domestic firms face tougher competition they might relocate production abroad into more the protected and less competitive regions.

Additional evidence has been reported by the IMF (2006) for industrialized countries. In sectors that are exposed to intensified competition, such as manufacturing and business services, producer prices has increased less than headline inflation especially after 1995. A possible explanation of this finding could be the extent of deregulation in important business services such as telecommunications. In addition, the IMF (2006) has found that prices in high tech sectors declined less than in low tech sectors. This might reflect

a tendency to outsource larger parts of the production of low tech products in low wage countries.

Moreover, prices have grown more slowly in sectors which are exposed to international competition, such as textiles, telecommunications and electrical equipment. A 1 percent increase in the import share (imports divided by output of the respective sector) reduces relative producer price inflation by less than 0.2 percent on the average of the products considered. Similar effects are found for an increase in labour productivity. The impact of competitiveness on price dynamics seems to have accelerated as integration has intensified due to the globalization of markets. Although significant and robust to alternative specifications, the impact of the competition variable does not seem to be very strong, and other variables are important as well. For example, the effect of a rise in the import share on producer price inflation is slightly lower than the effect of a change in import prices in absolute value.

Part III:

Catching up and

price convergence

As the empirical support in favour of the LOP is rather limited, prices are not entirely determined by competitive pressures in the Internal Market, and domestic factors need to be taken into account. For developments in the New Member States additional forces come into play. While initial price levels were lower, these countries have experienced an upward trend in price aggregates and a real appreciation of their currencies thereafter. This evolution is not related to the functioning of the Internal Market. According to the Balassa Samuelson hypothesis, it might reflect the catching up process of productivity and per capita income that imply differences in the patterns of consumption and production. If convergence towards the EU15 level of per capita income proceeds, prices will rise, implying that price differentials will gradually diminish. Hence, price convergence is related both to market integration and convergence in per capita income. The two effects overlap each other and have to be disentangled on empirical grounds.

A lower price level is due to the fact, that the differential between productivity in the tradables and non tradables sector is lower for the poorer countries, as long as they catch up to the richer ones. This point is especially relevant for the New Member States but also for southern regions within the euro area. To the extent that inflation differentials are caused by catching up behaviour, they will not affect competitiveness and disappear when real convergence is achieved. Thus a part of the divergent inflation experience in the euro area might be transitory, as the countries move towards a common price level (Rogers, Hufbauer and Wada, 2001). If the euro area widens to include low price countries in Eastern and Central Europe, inflation in the New Member States can substantially increase if price convergence is fastened.

III.1 The Balassa-Samuelson hypothesis

According to the Balassa-Samuelson model (Balassa 1964, Samuelson 1964) the existence of non tradables can imply differences in aggregate price levels and the presence of trends in the evolution of relative prices, i.e. real exchange rates. The model is also able to demonstrate why price levels of poorer countries are lower than those of countries with higher income. Specifically, the economy is divided into a sector producing internationally traded goods and a sector with non traded goods. The overall price index

is a (geometrically) weighted average of the prices for tradable (*T*) and non tradable (*N*) goods, i.e.

(5) $\quad P = P_T^{\alpha} P_N^{1-\alpha}$,

where $0 < \alpha < 1$ denotes the share of tradables in the price index. A similar decomposition holds for the foreign country, where α is assumed to be equal for simplicity. A different weight for the foreign country does not affect the major conclusions. Due to goods arbitrage the price of tradables is determined by the price of foreign tradables, both denoted in the same currency. The LOP is assumed to hold, but only in the tradables sector:

(6) $\quad P_T = S P_T^{*}$

As competition is perfect, the real wage in the tradables sector is equal to the marginal product of labour

(7) $\quad \dfrac{W_T}{P_T} = \dfrac{\partial Y_T}{\partial L_T} \quad , \quad \dfrac{W_T^{*}}{P_T^{*}} = \dfrac{\partial Y_T^{*}}{\partial L_T^{*}}$

where *W* denotes the nominal wage and an asterisk refers to the foreign country. Because of equation (6) the relationship

(8) $\quad \dfrac{1}{S} \dfrac{W_T}{W_T^{*}} = \dfrac{\partial Y_T / \partial L_T}{\partial Y_T^{*} / \partial L_T^{*}}$

is implied. If the nominal exchange rate is constant, relative wages in the tradables sector are expected to move in line with relative productivity in this sector. Countries with higher productivity in the tradables sector are able to pay higher wages, while countries with lower productivity have a lower wage level. As labour mobility is perfect across the sectors within a country, nominal wages in the tradables and non tradables sector are expected to equalize:

(9) $\quad W = W_T = W_N \quad , \quad W = W_T^{*} = W_N^{*}$

Again, this assumption can be easily weakened without affecting the main findings. As the nominal wage is set in line with the productivity in the tradables sector, this condition implies that services in the less productive country are cheaper. Given that competition for non tradables is perfect, but only within each country, wages are equal to their marginal products:

$$(10) \quad \frac{W_N}{P_N} = \frac{\partial Y_N}{\partial L_N} \quad , \quad \frac{W_N^*}{P_N^*} = \frac{\partial Y_N^*}{\partial L_N^*}$$

The perfect competition assumption for non tradables within a country simplifies the presentation and does not affect the principal argument. The Balassa-Samuelson point can be also made by the mark-up model. Putting things together, an expression for the equilibrium real exchange rate can be derived. Using (5), (7), (8), (9) and (10) in (1), the condition

$$(11) \quad S\frac{P^*}{P} = S\left(\frac{P_T^*}{P_T}\right)^\alpha \left(\frac{P_N^*}{P_N}\right)^{1-\alpha} = \left(\left(\frac{\partial Y_T^* / \partial L_T^*}{\partial Y_T / \partial L_T}\right) \middle/ \left(\frac{\partial Y_N^* / \partial L_N^*}{\partial Y_N / \partial L_N}\right)\right)^{1-\alpha}$$

is implied. The real exchange rate depends on marginal productivity levels in the tradables and non tradables sectors. Given that productivity in the non tradables sector differs not too much across countries, the denumerator is roughly equal to 1. Then, domestic prices will fall below foreign prices as long as productivity in the international sector is lower. More generally, the productivity differential between the tradables and non tradables sector is smaller in the low price country. In case of a Cobb-Douglas production technology, marginal and average productivity coincide. Hence, the conclusion can also be stated in terms of average productivity levels.

As long as price levels are lower in less productive countries, for example in the New Member States when compared to the Old Member States, the Balassa Samuelson effect is at work. In a dynamic perspective, catching up countries will experience faster productivity growth in the tradable than in the non tradable sector. Higher productivity in the tradable sector allows wages to be bid up in that sector without increasing the price of the tradables being produced. The non tradable sector must raise wages in response. However, since productivity is lower, firms in this sector must fund the higher wages by

raising the price of non tradables. Thus the effect predicts higher inflation rates in non tradables compared to tradables, implying an increase in the relative price of non tradables. Wage growth in the non tradables sector would be somewhat lower provided that labour is not perfectly mobile across the sectors. The process results in a real exchange rate appreciation ($\Delta(SP*/P)<0$) and a higher overall inflation rate in the domestic economy when the nominal exchange rate is fixed, or through some combination of nominal appreciation and inflation if the exchange rate is flexible.

The productivity gap to the Old Member States is still substantial and allows for massive productivity growth in the transition countries. If these economies become more advanced, the Balassa Samuelson effect will gradually disappear. In the long run, convergence in productivity levels in the traded goods sector would imply convergence of the overall price levels. Due to wage spillovers prices of non tradables are also expected to converge in this process.

III.2   Empirical evidence on the catching up effect

In general, the presence of the Balassa-Samuelson effect is confirmed, but its magnitude appears to be rather small, see Égert (2003) for a review. This finding is partially caused by empirical shortcomings. Instead of the ordinary tradables and non tradables distinction, goods and services are produced with a different composition of tradable and non tradable inputs. For example, a share of non tradable inputs is required to produce tradable products (Lee and Tang, 2003, MacDonald and Ricci, 2001). In addition, the impact of inflation in the services sector on price convergence is rather limited because of a low weight of services in representative consumer baskets (Blaszkiewicz, Kowalski, Rawdanowicz and Wozniak, 2004). With rising income levels, the relevance of services will gradually increase.

Many contributors have explained the relative price of non traded to traded goods by productivity indicators in both sectors or tested for cointegration, i.e. equilibrium relationships between relative prices and productivities. Prices in the traded and non traded sectors are often proxied by producer and consumer price indices, respectively, where different weighting schemes are neglected. By using a set of control variables, Arratibel, Rodriguez-Palenzuela and Thimann (2002) have concluded that the Balassa Samuelson

effect is almost insignificant in explaining inflation developments in accession countries. In particular in the early years of transition, market reforms appear to be more important in explaining relative price movements. Mihaljek and Klau (2003) has explained inflation differentials between six transition economies and the euro area using the spread of productivity growth across tradables and non tradables sectors. The contribution of the Balassa Samuelson effect to the annual inflation differential is less than one percentage point except of Slovenia. By employing a very detailed dataset, Égert (2003) has estimated the size of the effect between 2 and 3 percentage points for Estonia over the 1993-2002 period. At the end of the period the contribution to inflation is found to be less than one percentage point. In fact, Estonia has converged rather rapidly towards the EU level, both in terms of per capita income and productivity. Similar effects have been reported by Kovács (2002) using a sample of five Central and Eastern European countries.

Other studies have focused on the implications for real exchange rates. De Broeck and Sløk (2001) have investigated the effect of sectoral productivity growth on real exchange rate developments in a sample of 26 transition countries. They find that differential productivity growth between the tradables and non tradables sector exerts a different impact on the real exchange rate in the EU accession countries compared to the other economies. According to Lojschová (2003), the Balassa-Samuelson effect can account for an average annual rate of real appreciation of around 2.5 percent. In principle, a constant nominal exchange rate could justify an inflation rate 2.5 percentage points above the rate in the euro area. The size of the effect, however, is smaller, if the assumption of the LOP is relaxed for the tradables sector. Wagner (2005) has detected larger Balassa-Samuelson effects between the Old Member States, see also Hlouskova and Wagner (2004).

The essential point to be taken from these studies is that catching up is important, but it is likely related to a broader concept than the pure Balassa-Samuelson model (Cihak and Holub, 2001, Wagner, 2005, Égert, Halpern and MacDonald, 2006). For example, Cihak and Holub (2003) have reported a strong positive relationship between GDP per capita and the price level, suggesting that relative per capita income is a powerful variable to proxy a catching up effect. As an extension to the pure Balassa Samuelson

model, the quality of products, regulated prices and reputation problems have to be taken into account.

Indeed, price behaviour in the New Member States might be influenced by several forces linked to the period of transition. Catching up countries could have lower reputation and need to underprice their products to stay in the market, see Égert and Lommatzsch (2005) and Lommatzsch and Tober (2005). This effect will gradually diminish over the catching up period, as reputation will improve, thereby promoting price convergence. Price levels are not uniformly lower in the New Member States, but can differ depending on the product category considered.

Furthermore, regulated prices constitute an obstacle to price convergence. Although most of the prices have been liberalised rather quickly, sensitive prices have been deregulated only gradually, and some of them are still in the liberalisation process (Backé, Fidrmuc, Schardax and Reininger, 2002 and MacDonald and Wojcik, 2004). The transition countries started from a distorted system of relative prices. While the weight of regulated prices in price aggregates does not deviate much from the Old Member States, the size of adjustment differs. Over the catching up period, regulations will be reduced, and this will reinforce convergence. In addition, a number of public services requiring networks and capital have been of poor quality in the former planned period. The improvement in the quality and variety of services from network industries like telecommunications, transport or energy will lead to faster price convergence. The prices of these services have an impact on other markets, as they are inputs to other products. This may foster the convergence of prices towards the EU12 level.

Part IV:

Measuring price convergence by comparative price levels

In this section, the methodological aspects of empirical indicators available for investigating the process of price convergence are discussed. Due to the lack of data on absolute prices, data on relative prices are considered. In the analysis, cross country comparisons are carried out by using comparative price levels (CPLs). They are calculated as ratios between purchasing power parities (PPPs) and nominal exchange rates (to the euro). This chapter clarifies the construction principles of CPLs, and gives also insights into their limitations. Other aggregates like deflators, consumer and producer price indices are also reviewed.

IV.1 Deflators, consumer and producer price indices

A serious problem to assess price convergence is the fact that the required data are not easily available. Under the LOP, prices of identical goods should equalize in all regions of the Internal Market. But data on prices of individual goods are scarce and only a few studies are based on them. Likewise, baskets of identical goods are considered, such as the Big Mac Index reported by the Economist or prices in IKEA stores, see Haskel and Wolf (1999, 2001). The number of items is often rather small and the selection might not be representative for the entire economy. In addition, even the products of the same producer and brand can sell in different sizes at different locations, are bundled together with different products or are modified according to local tastes. Therefore, these measures can provide only anecdotical evidence on the impact of market integration on the path of price convergence.

Because of the lack of individual data, aggregate price measures like the GDP deflator, consumer, producer or wholesale price indexes are often used instead. Indexes also exist for specific components of the major price indexes. The indicators are harmonised across countries and are available over long time spans. They contain a large bundle of representative goods and services and reveal more information on overall price developments than a arbitrary choice of a few items. The main objective of the indicators is, however, to determine the change in price level.

Specifically, the GDP deflator is useful to determine real growth in the entire economy. It is applied to nominal GDP to derive the real GDP series. Hence, it compares prices of

the output aggregate over different periods of time. Subindicators include deflators for particular expenditure components, such as private and government consumption, fixed business and government investment, construction, and exports and imports of goods and services.

The consumer price index (CPI) monitors the average change in the prices consumers pay for a certain basket of products, i.e. it measures the changes in the purchasing power of households. In this sense, the CPI can be seen as a proxy for the change in the cost of living over time. The representative basket is derived from budget surveys and includes goods and services actually purchased by private households regardless on whether they are produced at home or abroad. In addition, special indexes focus on some of the major components, for instance the CPI of all items less food and energy. The producer price index (PPI) reflects average changes of prices that producers receive for a basket of goods and services at all stages of the manufacturing process, from crude materials to finished products. Subindicators of the PPI include the PPI for chemicals and manufactured goods, among others.

Since the deflators, CPIs and PPIs are intended to calculate the changes in prices in the economy, they reflect inflation rates but not absolute prices. The indexes may be used to investigate price comovements across countries. In particular, inflation rates are expected to move together in the long run provided that a relative version of the LOP is fulfilled. If arbitrage works sufficiently well, inflation differentials are stationary and will cancel out gradually over time. In shorter time intervals, however, national inflation rates may differ substantially. It should be noted that inflation divergence across countries can also reflect adjustment towards the same price level, i.e. it is caused by different initial conditions.

The relative version of the LOP does not require that the weighting schemes of goods and services in price aggregates are the same at home and abroad. However, if differences exist, they need to be rather stable over time. This assumption does not hold in a sample of EU25 countries: the weights are affected by income levels, which are quite different between the New and Old Member States. Therefore, structural factors put a serious bias on tests of the relative variant of the LOP.

Regarding price convergence, aggregates like the CPI are informative for the catching up process in the New Member States, as they inform about the evolution of the cost of living. But they contain less information about advances in competition, as they reflect cumulated inflation rates and not absolute price levels. The latter remains unknown in an analysis based on CPI and PPI measures. Moreover, the extreme focus on the representativity of goods and services for the country considered makes them less useful for cross country comparisons.

IV.2 Comparative price levels

To enable the comparison of price levels across countries, Eurostat and the OECD have undertaken the European Comparison Programme which produces PPPs and comparative price levels for a number of product categories. At the most detailed level, PPPs are labelled as basic headings (Eurostat, 2005). The basic headings are related to expenditure categories that are not disaggregated further. For example, cheese is a basic heading, and cheddar, camembert, roquefort, feta, gorgonzola, and gouda are specific individual products that share the same basic heading. Expenditures of cheese are reported by countries, but expenditures of cheese varities remain unpublished. Different basic headings include a different number of goods and services, depending on the complexity and the heterogeneity of the product group considered.

The basic headings are calculated as unweighted (geometric) averages of the price ratios of goods and services within the same heading, see the Eurostat (2005) manual for the details. Because these ratios are not weighted cross country differences in the structure goods and services within the same basic heading are ignored. Countries have to price not only the items which are representative for their own market, but also at least one item representative in the other countries. Some missing country pairs can be calculated through a bridging procedure. The basic headings are robust against any differences in the preference structure at home and abroad. If country A consumes more high quality and expensive products than country B, this has no consequence for the basic headings, as all products enter the calculation with equal weights. Likewise, a move to higher quality products in B does not show up in the basic headings unless individual prices

adjust. Eurostat does not publish the basic headings on a regular basis, but they can be found in specialized publications.

Purchasing power parities (PPPs) are defined for different GDP aggregates from very detailed (basic headings) to highly aggregated levels (final consumption expenditures of households and GDP). PPPs are the rates of currency conversion that equalise the purchasing power of different currencies by eliminating differences in price levels. PPPs are obtained as relative prices, i.e. they show the ratio of prices expressed in national currencies for the same good or service in different countries. It is important to note that country specific weighting schemes are not applied if PPPs are expressed for basic headings (Eurostat, 2005).

PPPs for basic headings are combined with those from other basic headings to provide a PPP for each stage of the aggregation process. For example, the PPP of the entire consumer basket aggregate is based on data for 147, and final household consumption expenditures comprise 226 basic headings. Aggregated PPPs are calculated as Fisher-type PPPs, i.e. as the geometric mean of the Laspeyres and Paasche type indices. In the combination of PPPs, the technique proposed by Esteto, Koves and Szulc (EKS) is applied, which computes the nth root of the product of all Fisher indices, where n denotes the numbers of countries in the analysis. The EKS method is selected as it is invariant with respect to the choice of the base country and fulfills the transitivity condition. In sum, PPPs above the basic heading level can change not only because of a change in the underlying relative prices, but also due to a change in the weighting system in the domestic or foreign country.

Comparative Price Levels (CPLs) are used for cross country comparisons of price levels. CPLs are defined as the PPPs divided by the nominal exchange rate, i.e. they relate market exchange rates to purchasing power parities. Stated another way, the CPL level for a certain bundle of goods and services is its cost in one country as a per cent of the cost of the same bundle in another country, when prices in both countries are expressed in the common currency. CPLs are conventionally expressed in terms of indices such that a base country is set equal to 100. A comparative price level of 100 means that, at the given exchange rate, price levels are the same in the country under examination and in the reference country. Figures below 100 indicate that the price level in the country

under examination is lower than its counterpart in the reference country. Therefore, the market exchange rate assigns a lower value (in currency units of the reference country) to one local currency unit than the purchasing power parity. Starting from such a position, price level convergence is a process of real appreciation of the local currency relative to the currency of the reference country.

The CPLs show the extent of price level dispersion and inform which countries have higher prices. As a guideline, Eurostat (2005) recommends the use of these measures for monitoring price convergence for higher levels of aggregation rather than for very detailed groups. In particular, the selection of monitored products changes every year to ensure that items are both comparable and representative for consumption patterns. This could introduce volatility especially in highly disaggregated CPLs.

IV.3   Drawbacks of comparative price levels

Price convergence implies that the dispersion of CPLs will decline over time. However, it is quite important to recognize that convergence of price aggregates differ from convergence of individual prices in several respects. These issues need to be acknowledged for a proper interpretation of the outcome of convergence tests.

First, provided that all individual prices exhibit convergence, the aggregates will also exhibit convergence. But, when convergence and divergence occur at the same time for individual prices, the behaviour of the aggregates may be hard to explain and interpret. In particular, convergence may occur just because of the aggregation. CPLs might converge even if individual prices are far from being in parities.

Second, CPL convergence may reflect not only the dynamics of CPLs in certain subaggregates, but also a change in the weights in the home and the benchmark country. This is a serious problem whenever aggregates above the basic heading level are considered. It might be argued, however, that weights could be rather stable over relatively short periods. However, this is hardly the case for the New Member States, as their expenditure structure will change during the catching up period. Due to the complex process of calculating CPLs, it is rather difficult to carry out sensitivity analysis for these measures in response to changes in weights and relative prices. Nevertheless, it should be kept in

mind that CPL convergence or divergence can be a joint outcome of a change in prices and the weighting system.

Third, it could be more appropriate to study convergence in terms of PPPs or CPLs for basic headings. For the latter, the PPPs calculated at the basic headings level are divided by the market exchange rate. As stated above, the basic headings are robust against any change in the weighting structure. Thus only price changes can affect the corresponding PPPs and CPLs. However, shifts in the expenditures for products sharing the same basic heading are masked in the aggregate. Overall, the analysis of basic headings can provide additional insights in the process of price convergence. A switch to basic headings provides also a way to get insights into the relative importance of catching up and competition for price level convergence. A look at individual markets is required to address the impacts of higher competition on price convergence, and the basic headings are more related to them.

Fourth, shifts towards a higher quality of products can result in higher CPLs because of inaccuracies in the selection of goods and services to monitor (Eurostat, 2005). The listing for each basic heading contains products that are comparable and representative across countries. If the condition of comparability is strictly adhered to, no potential for a quality shift is left. But the strict rules may not always be easy to fulfil and some room for flexibility is left to the national statistical offices. Goods and services monitored in the New Member States may be of a lower quality compared to the Old Member States. The selection of differing products might be also motivated by the fact that national statistical offices need to monitor representative goods because at least one good for each basic heading is necessary for the PPP calculations (Eurostat, 2005). Whenever the generic product specification leaves some room for interpretation they can choose a leading product sold in the country which may turn out very different from the selections in other countries.

In practice this problem can be relevant to a sizeable group of products. There is a high likelihood that price levels in poorer countries will be underestimated as the price quotations of these countries refer to goods and services of an inferior quality. When per capita income increases in those countries, households will shift their consumption expenditures towards more expensive, higher quality products.

Part V:

Price trends in the enlarged European Union

In this chapter recent price trends are explored. The New Member States have lower price levels than the Old Member States, most probably related to the lower level of per capita income. The backlog is most notable in services, which are often non tradable. Price levels for goods are also lower. This might indicate either insufficient market integration, deficiencies in tradability or in the reputation of goods and services produced by the New Member States. Price convergence is most visible for durables, i.e. the most easily traded goods. During the past decade, price levels have been rising towards the euro area average in almost all product categories. The adjustment takes place through higher inflation rates and currency appreciation on part of the New Member States. Inflation differentials have been reduced since 2000, and in a number of categories, prices have even declined when converted into euros. This suggests that increased competition in the run up to the EU enlargement has also affected price trends in the New Member States. Higher competition has led to declining prices for many goods, while services have recorded constantly higher inflation rates.

V.1   Comparative price levels across countries

Aggregate GDP price levels are rather close to one another for the founding members of the EU, but substantially lower in the New Member States, see Graph V.1. Taken the year 2005 as an example, France had a price level of 105% of the euro area and Italy of 100%. Some countries at the periphery (Ireland, Finland) and Luxembourg have experienced higher levels. In the Southern part of the euro area, prices in Spain, Portugal and Greece fall below 90% of the average. However, the price levels in the New Member States are lower. Only Cyprus (84%) exceeds the price level of the lowest price EU15 countries, i.e. Greece (81%) and Portugal (82%). Prices in the other accession countries are much lower; they range from from 70% in Slovenia and 66% in Malta down to 48% in Lithuania and Latvia.

The New Member States have significantly recorded lower per capita income and productivity levels compared to the EU12 countries. According to the Balassa-Samuelson effect, this implies a lower aggregate price level because of the lower nontradable costs and hence lower prices of non tradable and (partly also) tradable goods. Graph V.2 confirms that the link between per capita income and the price level is indeed rather strong.

Nevertheless, significant deviations can be observed for some countries. Although the Czech Republic and Portugal as well as Netherlands and Denmark realize similar levels of per capita GDP (67% and 117%), their CPLs differ by 27 and 25 percentage points, respectively. Consequently, income alone does not explain the cross-country differences in CPL and some other factors are also important.

Graph V.1: Comparative price levels for GDP across EU countries, 2005
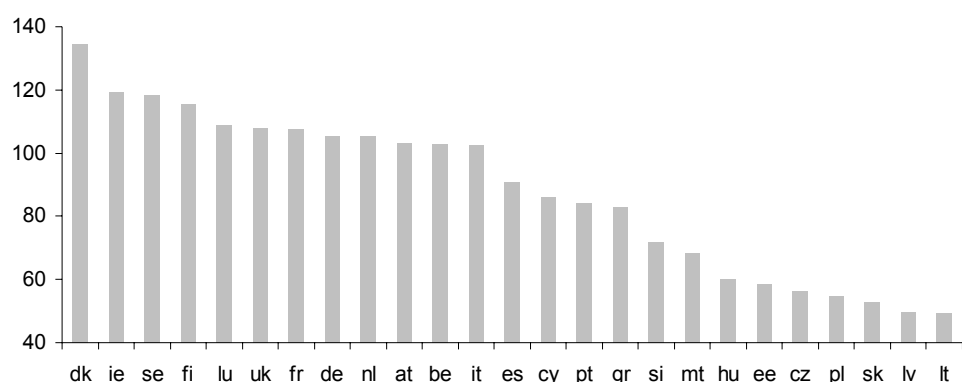
Note: Raw data from Eurostat, CPLs in terms of the EU12 average (=100).

Graph V.2: Comparative price levels of GDP (vertical) and relative per capita income (horizontal), 2005
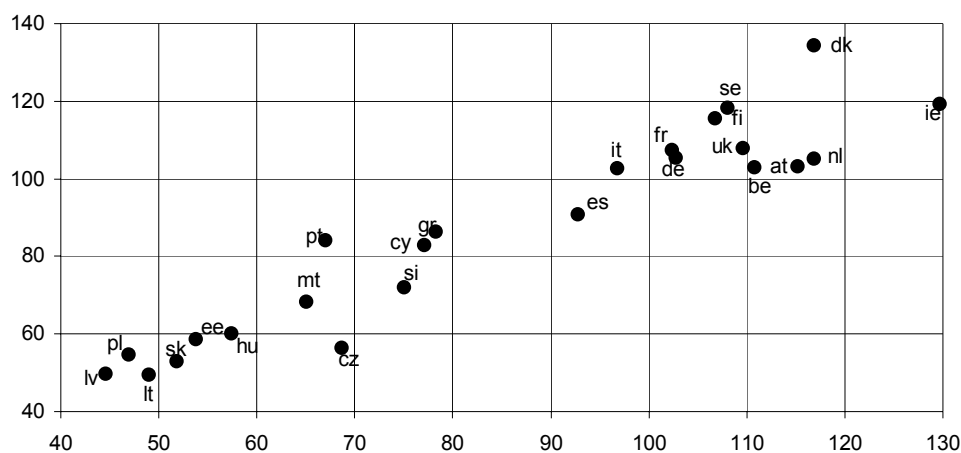
Note: Raw data from Eurostat, in percent of EU12 average (=100). Per capita income is real GDP per capita in PPP. Luxembourg not included due to outlier problems (GDP per capita 233% of EU12, CPL is 109%).

Relative wages in 2005 were considerably more dispersed than relative income (Graph V.3). There appears to be also a clearer division between the New Member States (most scattered around 15-35 per cent) and core old members (90-120 per cent). Even within

these groups substantial heterogeneities exist. Poland and Slovakia have the same CPL, but differ by 29 per cent in terms of relative wages. Denmark and Belgium have similar wages but show a difference of 32 per cent in the CPL.

Graph V.3: Comparative price level of GDP (vertical) and nominal relative wages (horizontal), 2005
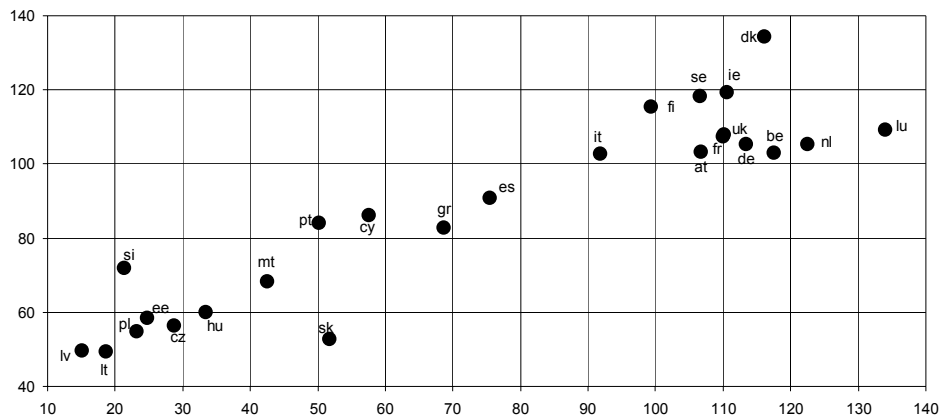
Note: Raw data from Eurostat and AMECO (nominal wages), in percent of EU12 average (=100). Wages are nominal compensation per employee in the total economy.

If the LOP holds, prices of (tradable) goods are set by the international market, whereas prices of (non tradable) services are determined by local conditions. The evidence is broadly in line with this prediction: while the CPLs of goods in New Member States range between 60 and 70 per cent of the EU12 in most cases, those of services are significantly lower and range between 30 and 45 per cent (see Graph V.4). The divergence is most notable for government services, where prices in the Eastern countries are even below 30 per cent of the euro area.

While the difference between the EU15 and New Member States is much smaller for goods, convergence in their prices is far from complete. Only Cyprus exceeds 80 per cent of the euro area average. The sources of this divergence could be better understood when goods are broken down into aggregates according to their durability. Indeed, Tables A1 and A2 in the appendix suggest that the more tradable goods are the closer their prices converge to the euro area level and the less is the dispersion within the New Member States. This finding is in line with the LOP. The fact that convergence is not full even for durables (CPLs in Eastern accession countries range between 80 and 90 per

cent) may point to significant nontradable components in the prices of all goods, such as wages, rents and transportation, but can also reflect reputation problems of goods produced in the New Member States.

Graph V.4: Comparative price levels of goods (bright) and services (dark), 2005
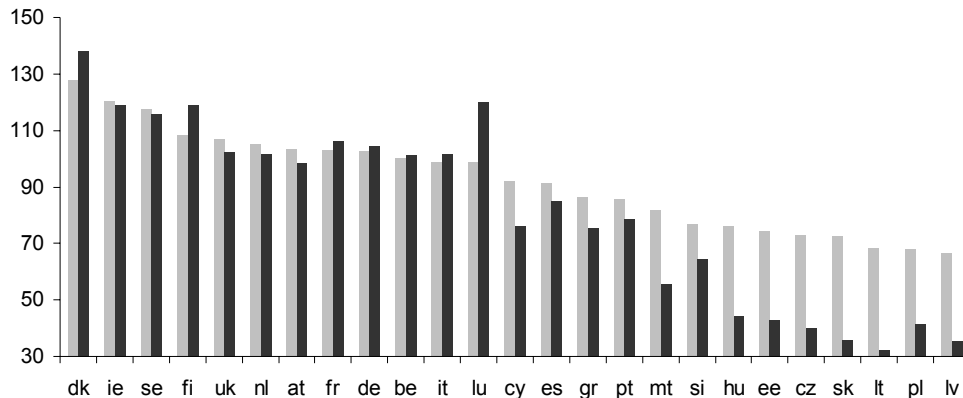
Note: Raw data from Eurostat, in percent of EU12 average (=100).

Most of the previous findings can be confirmed for COICOP[2] categories, see Table A3 in the appendix. Products that are tradable or contain a large share of traded goods, such as clothing and footwear or personal transport equipment have a relative high price level in the New Member States. On the other hand, housing, which includes rents and public utilities, and labour intensive services such as restaurants and hotels or education and health have relative low price levels. Large price disparities can be observed for alcohol and tobacco. They are mainly caused by EU differences in taxation. The EU directive has imposed a harmonized minimum rate. But many Old Member States have chosen higher rates on both alcohol and tobacco, while most New Member States negotiated prolonged adjustment periods and still charge rates below the minimum. The sources of large disparities in housing, water and electricity are also administrative. These products are regulated at the municipal or national level and large cross country deviations may stem from different policies of local authorities or regulatory agencies. In the New Member States, these prices have been substantially increased as they were set well below costs under communism.

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[2] COICOP refers to the Classification of Individual Consumption According to Purpose (United Nations statistical methodology).

It should be noted that prices of network industries, particularly in the telecommunications sector are higher than in the EU12 for some transition economies. This may indicate that either the liberalisation of these industries has proceeded at a lower pace or that investments to upgrade the quality of services have been passed over to prices in the New Member States to a higher extent.

V.2   Changes in comparative price levels over time

On the aggregate level, prices for GDP and household consumption expenditures have converged over the past decade. Graphs V.5 and V.6 present scatter plots of related CPLs in 1995 and 2005 for all 25 EU countries. Any point above the 45° line reflects an increase in CPL in 2005 relative to the base period. Countries with high price levels in 1995 have seen their prices decline relative to the EU12 average, while those with lower CPLs have increased. The dispersion of GDP and household consumption CPLs has been reduced in the course of this process.

Graph V.5: Comparative price levels of GDP in EU25 countries in 1995 (horizontal) and 2005 (vertical)
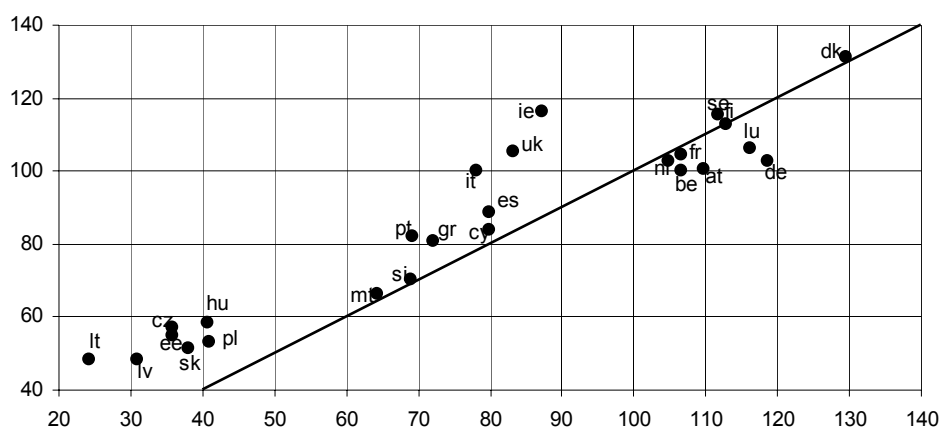
Note: Raw data from Eurostat and AMECO, in percent of EU12 average (=100), Malta 1999 instead of 1995.

Regarding the individual country developments, the rise in CPLs has been sizeable for the New Member States (more than 15 per cent in Czech Republic, Estonia, Latvia and Lithuania) with the exception of Slovenia, where it amounted to a only 1 per cent. A significant CPL increase has been observed in Italy, Portugal, Spain and Ireland. In con-

trast, the CPLs for France, Germany, Belgium and Austria which performed relatively poorly in terms of GDP growth have declined.

Graph V.6: Comparative price levels for household consumption in EU25 countries in 1995 (horizontal) and 2005 (vertical)
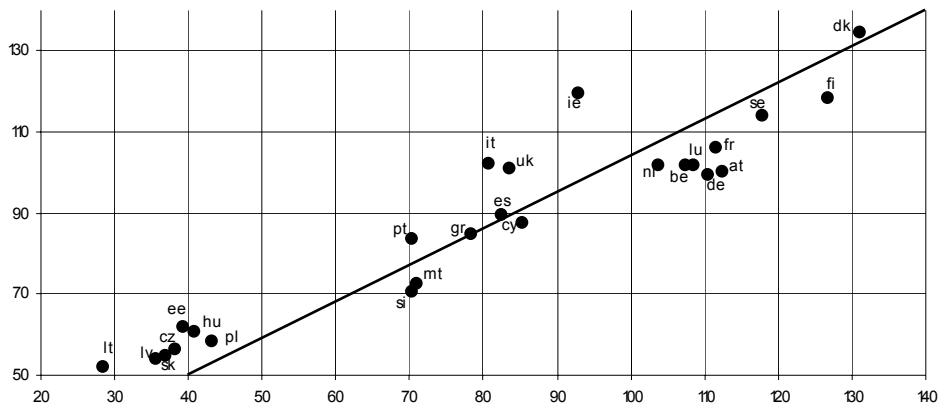
Note: Raw data from Eurostat, in percent of EU12 average (=100), Malta 1999 instead of 1995.

Price convergence has mainly occurred through higher inflation and currency appreciation in the New Member States. This is more likely than a price rise in the low CPL and a price fall in high CPL countries, since aggregate inflation in all EU25 countries has been positive throughout the period.

Convergence in price aggregates can mask disparities at more disaggregated levels. Thus it is important to also consider the developments at the level of narrower GDP or COICOP aggregates. Graph V.7 presents the coefficient of variation for the CPLs in the EU25 over the 1999-2005 period. Furthermore, Table V.1 presents an extensive summary of various statistics (including HICP inflation) documenting the process of price convergence for several COICOP and GDP categories.

Evidence in favour of a decline in the price dispersion can be established for most categories. It has been particularly pronounced in the case of government consumption and services as well as semi durables and machinery and equipment. Among COICOP categories the largest reduction in dispersion has been registered for communication as well as clothing, including footwear. For some categories dispersion has increased in the later years.

Graph V.7: EU25 price convergence in COICOP categories, 1999-2005
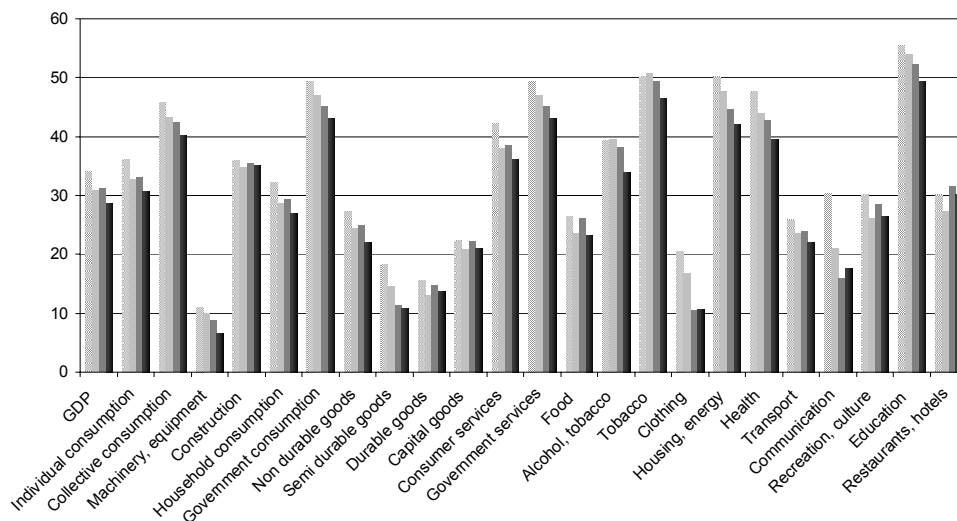
Note: Raw data from Eurostat. Coefficient of variation of country CPLs. From left to right: First column 1999, second 2001, third 2003, fourth 2005.

An analysis of inflation rates (Table V.1) can shed more light on the dynamics of the price convergence process. The moderate decline in dispersion of durables has been a result of deflation in both the Old and the New Member States. Clothing and footwear as well as communications have seen deflation in the EU15 and positive inflation in the New Member States.

Table V.1 Price convergence in consumer goods and services

Expenditure aggregate	year	CPL		Coefficient of variation			Average annual HICP inflation 1999-2005 (%)	
		EU15	NMS	EU25	EU15	NMS	EU15	NMS
Household final consumption expenditure	1995	98.0	44.5	39.3	17.8	37.1	1.9	4.5
	1999	102.7	50.8	32.2	13.9	26.7		
	2002	102.7	58.7	28.8	14.9	20.1		
	2005	100.9	59.3	26.3	12.6	16.7		
Food and non-alcoholic beverages	1995						1.7	2.9
	1999	101.4	55.0	26.4	11.0	24.6		
	2002	101.7	61.7	23.5	12.2	20.2		
	2005	100.7	64.2	23.2	11.9	19.1		
Alcoholic beverages, tobacco and narcotics	1995						3.9	4.9
	1999	113.6	65.2	39.2	30.6	27.7		
	2002	114.8	77.8	37.9	32.8	27.6		
	2005	110.8	67.9	33.9	26.6	31.9		
Clothing and footwear	1995						-0.1	0.7
	1999	101.2	68.2	20.6	10.6	17.5		
	2002	96.8	76.1	17.0	11.1	9.2		
	2005	97.3	83.1	10.6	8.5	8.5		
Housing, water, electricity, gas and other fuels	1995						2.8	7.9
	1999	96.8	32.1	50.1	24.5	42.2		
	2002	97.6	37.5	47.0	25.6	31.0		
	2005	95.5	39.6	42.0	18.1	22.7		
Household furnishings, equipment and maintenance	1995						0.9	2.2
	1999	102.9	63.1	22.4	12.1	17.1		
	2002	104.1	69.4	21.2	11.6	13.8		
	2005	101.8	71.6	18.5	8.4	15.6		

Category	Year							
Heath	1995						2.9	7.1
	1999	101.3	32.0	47.5	18.7	53.3		
	2002	101.7	41.2	42.0	18.2	44.3		
	2005	102.7	43.8	39.6	17.3	35.7		
Transport	1995						2.8	6.2
	1999	105.2	64.7	25.9	15.0	14.0		
	2002	105.1	73.4	23.5	16.5	12.8		
	2005	104.3	77.2	22.0	16.1	12.6		
Communication	1995						-2.9	3.1
	1999	108.3	95.4	30.3	27.3	25.7		
	2002	100.8	111.1	20.3	12.6	27.8		
	2005	96.5	89.1	17.5	12.3	21.8		
Recreation and culture	1995						0.3	3.8
	1999	102.9	55.2	30.2	12.0	30.9		
	2002	103.3	64.6	25.7	12.0	22.9		
	2005	101.4	60.4	26.4	10.6	21.0		
Education	1995						3.9	6.8
	1999	103.4	27.2	55.4	23.9	65.4		
	2002	104.9	33.6	52.3	24.5	56.7		
	2005	103.5	34.7	49.4	21.2	47.5		
Restaurants and hotels	1995						3.2	5.4
	1999	107.1	59.4	30.1	12.8	29.1		
	2002	107.2	67.0	30.0	17.1	28.7		
	2005	104.9	63.2	30.2	16.9	22.5		
Miscellaneous goods and Services	1995						2.5	4.7
	1999	102.8	42.7	37.3	14.3	30.2		
	2002	103.7	51.1	35.3	16.2	25.8		
	2005	103.1	52.6	32.7	15.0	23.3		
Consumer goods	1995						1.5	3.6
	1999	103.1	62.8	23.3	10.9	18.8		
	2002	102.7	71.6	20.1	11.8	14.5		
	2005	101.2	73.3	18.0	10.2	13.6		
Non-durables	1995						1.6	4.8
	1999	102.9	56.8	27.3	12.7	20.4		
	2002	103.6	67.1	24.0	14.9	16.0		
	2005	101.9	68.4	21.9	12.5	15.9		
Semi-durables	1995						0.0	1.2
	1999	102.3	71.4	18.2	9.0	15.1		
	2002	99.4	79.3	14.9	9.0	8.5		
	2005	98.7	82.4	10.7	7.3	7.8		
Durables	1995						-0.6	-0.5
	1999	104.4	84.7	15.6	12.1	16.4		
	2002	103.5	88.5	13.8	11.1	13.5		
	2005	101.6	88.4	13.7	10.9	12.2		
Consumer services	1995						2.5	5.8
	1999	102.1	39.9	42.2	18.1	37.1		
	2002	102.4	47.0	38.0	18.1	27.8		
	2005	100.6	47.4	36.2	15.5	21.7		

Note: Raw data from Eurostat. CPL in % of the EU12 (=100) level. HICP inflation is refers to the annual average over the 1999-2004 period. For the New Member States shares in total final consumption expenditures are used as weights.

Finally, there is clear evidence that convergence in consumer prices occurred through both high inflation in the New Member States and exchange rates appreciations. However, despite a positive relation between changes in CPLs and HICP inflation rates, the correlation is far from perfect. Increasing price levels have been observed in all New Member States, except of Slovenia. By contrast, HICP inflation rates were often lower or even negative (Latvia). Despite the substantial similarities in the data included in the CPL and HICP calculation, there is no unequivocal relationship between the two price measures.

V.3 Changes in HICP subcategories over time

Changes in relative price levels can also be studied by exchange rate adjusted Harmonized Indices of Consumer Prices (HICPs). As noted in chapter IV, however, one needs to be aware of limitations of such analysis. Inflation measured by the HICP provides a useful insight into the developments of purchasing power of local currencies over time. The methodology of HICP puts special emphasis on the representativity of monitored items for local markets and does not attach high importance to international comparability. The harmonization refers to statistical procedures used for choosing items and monitoring their prices rather than to the selection of goods and services to be monitored. Whenever consumption patterns differ between EU countries, inflation figures for any specific subaggregate will refer to a heterogeneous basket of goods reflecting locally representative items.

Graph V.8.: Annual HICP inflation in the euro area (bright) and the New Member States (dark), adjusted by the exchange rate, average 2001-2005
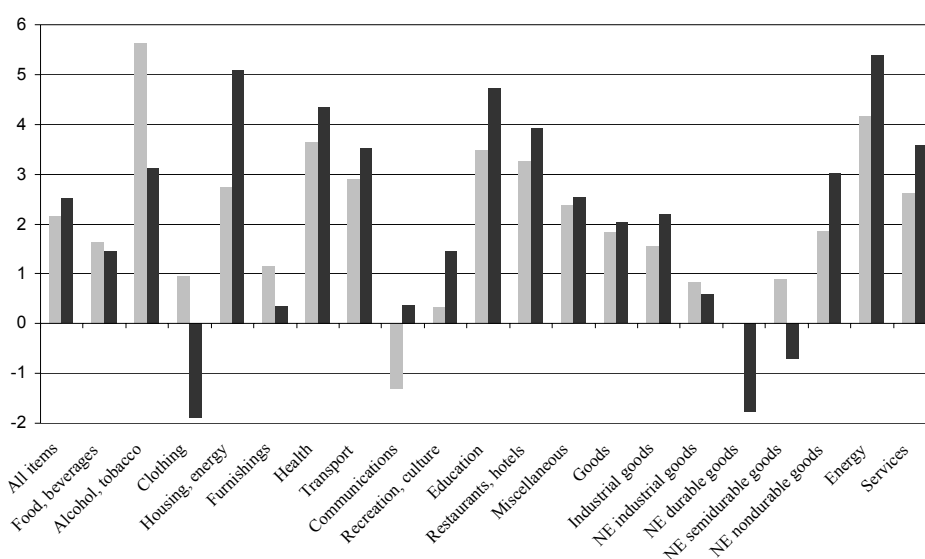
Note: Raw data from Eurostat. Eastern European transition countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) and euro area (dark). NE=Non energy.

The New Member States have registered a higher inflation rate over the period, albeit the difference is not very significant for the aggregate: 2.5% in the New Member States vs. 2.2% in the euro area. But there are sizeable differences within the COICOP categories. Service dominated aggregates such as housing, water, electricity and other fuels as

well as communications are characterised by considerably higher inflation in the New Member States. In line with the Balassa Samuelson effect, this is caused by faster price increases in services enhanced by price hikes in public utilities and network industries. Energy and various communication and transportation services have been underinvested in the former communist period. The technological catching up process requires costly investments which inevitably leads to higher price dynamics in New Member States. This is particularly striking in the case of communication services which are subject to a sizeable deflation in euro area, but exhibit positive (albeit low) inflation in the New Member States.

COICOP categories such as health, education, recreation and culture and restaurants and hotels are dominated by market services and have exhibited higher price dynamics in the catching up countries. Prices for goods dominated categories such as food, clothing including footwear as well as furnishings including household equipment have risen slower in the New Member States when compared to the euro area. In contrast to durables and semi durables, prices of non durables tend to grow faster in the New Member States than in the euro area. In line with the Balassa-Samuelson effect inflation rates in services have been higher than in the euro area. This evolution could be related to housing services, education and catering.

Part VI:
Empirical analysis of
price convergence

The empirical analysis determines whether price convergence has occurred and provides insights into the driving forces and impediments of this process. As already argued in previous chapters, the empirical support of the LOP is rather limited, as the assumption of perfectly competitive markets is not met. In an environment of monopolistic competitive markets firms are able to charge prices that include a mark up over marginal costs. Therefore, cross country deviations in price levels may be traced to cross country differences in marginal costs or in mark ups. These determinants can be distinguished to investigate the impact of recent developments in the Internal Market on the process of price level convergence: increased competition due to the EU enlargement and the catching up of the New Member States.

Higher market integration is expected to boost competition and puts a downward pressure on prices via the reduction of mark ups. However, this development is overlapped by the catching up process of the New Member States. As far as convergence of income per capita is not achieved, prices in the transition economies are expected to be on an upward trend. The analysis has to separate these two forces. Proxies for catching up and competition reveal insights into the impact of these components on the path of price convergence. Because of the transition period, the time span of data available for the New Member States is rather short. As a consequence, simple time series models are not appropriate. Instead, the analysis is conducted in a panel framework, where the cross section dimension is taken into account. Hence, the estimated effects display the average across countries and markets. To save regressors, circumvent multicollinearity problems and strengthen the interpretation of the empirical results, a factor analysis is performed. Specifically, a catching up factor is extracted by principal component analysis. This common component is employed in regression models together with alternative competition measures, as a common factor for the competition phenomenon is not suitable. A competition factor would relegate a substantial part of the variation to the idiosyncratic elements.

After determining the factors of interest, β convergence is investigated in the first step. Here a negative relationship between the initial price level and subsequent changes in the price level is expected to hold. The empirical results indicate the presence of β price convergence: countries with lower initial price levels have experienced higher inflation

thereafter and vice versa. This finding is especially confirmed for tradables that are subject to international competition. Second, the analysis switches to the study of price dispersion over time, i.e. σ convergence. A decline in standard deviations can be detected, and the trend parameter is significant. Third, catching up and competition measures are employed as regressors when relative prices are explained for particular markets, such as non durables, semi durables, durables, services, and investment in equipment and buildings. CPLs for broad categories and basic headings are endogenous. For broad categories, the analysis is done for the 1999-2005 period. For the basic headings the sample period is even shorter (2000-2004).[3]

Catching up and competition seems to be important factors to explain the path of price convergence, most notably for the New Member States. The closer per capita incomes are to the EU12 level, the closer their price levels. Catching up implies price increases especially in the non tradables sector, such as services. The evidence is broadly consistent with this prediction. Competition variables are often significant with the correct sign. In particular, higher competition exerts a downward pressure on prices. Furthermore, the removal of price controls will lead to a decrease in CPLs in the Old, but to an increase in the New Member States. Again, the latter reaction is due to catching up behaviour. Throughout the analysis, the EU12 are used as the benchmark, as euro area prices are not subject to exchange rate fluctuations.

VI.1 Description of variables

Possible determinants to explain the path of price convergence are grouped into competition and catching up regressors. Competition is proxied by several indicators. At the sectoral level openness to foreign trade and import penetration have been constructed using the ProdCom (Production Communautaire) database from Eurostat. On the nationwide level, the business deregulation index and its ingredients are taken from the Fraser Institute database, see Gwartney and Lawson with Gartzke (2005). Catching up is expressed in terms of national variables, like per capita income, labour productivity

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[3] Eurostat has recently calculated basic headings for 2005, but the classification has changed. Under the new system, data are available only for 2003-2005. For the analysis, the older classification is preferred because of the longer time span.

and compensation of employees. The main characteristics of the series are given in the appendix (Table A4).

Differences in per capita income constitute the major reason for divergences in price levels across countries. One explanation is provided by the Balassa-Samuelson effect. The catching up process is almost always associated with higher productivity gains in tradables and higher relative productivity growth than in richer, less dynamic economies. Therefore, prices of non tradables are expected to grow faster in the New Member States. Price levels in the New Member States and poorer EU15 countries are expected to follow an upward trend correlated with per capita income, wage and productivity convergence. Note that prices of tradables are also affected in this process, as they include non tradable inputs.

Measures for the overall state of the economy are per capita income (in PPP), compensation of employees and labour productivity, all of them obtained at constant market prices (2000=100). The series are taken from the AMECO database of the EU Commission and are defined in relative terms, i.e. they show the country specific information divided by the EU12 benchmark. As argued in section III, these variables should be positively related to the CPLs. Graph V.2 has already confirmed this relationship between relative GDP per capita and the CPL of GDP, with a highly significant slope coefficient of 0.92.

Main competition measures refer to the integration of the countries in international markets. Trade openness is proxied by the sum of exports and imports divided by GDP. An alternative measure is import penetration which is obtained as the ratio between imports and output. In order to measure the competition effect, openness and penetration have to be measured on a sectoral scale. For this reason, the ProdCom classification has been used. The raw data refer to 4500 headings related to certain products. They are condensed to 212 categories and aggregated further to match the sectoral division used in this study: non durables (36), semi durables (39), durables (35), equipment (38), investment buildings (18) and services (0). If no sectoral information can be revealed, the competition indicators are measured by national variables which have been taken from the AMECO database.

On the nationwide level, Graph VI.1 shows that openness might have a negative impact, i.e. higher trade is associated with a lower price level. The slope coefficient of a regression is -0.23, and significant at the 0.1 level. The New Member States are concentrated in the lower right part of the graph: the countries are generally more open, and have lower price levels than the EU12 average. Compared to relative GDP, the relationship appears to be somewhat weaker. Higher openness to foreign trade implies that the domestic producers are confronted with stronger competition from abroad, thereby reducing their mark ups. Therefore an increase in openness should exert a dampening effect on the price evolution.

Graph VI.1: Trade openness (horizontal) and CPL of GDP, 2005
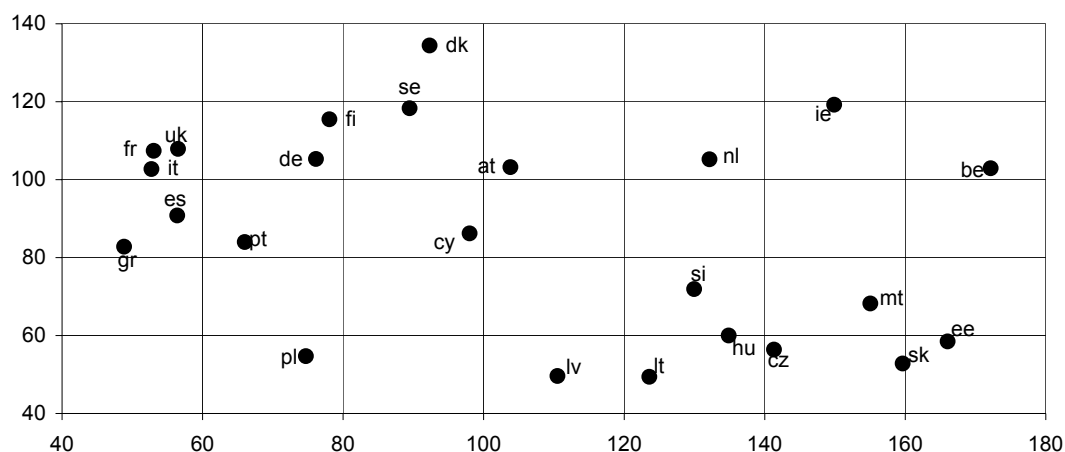
Note: Raw data from Eurostat, in percent of EU12 average (=100). Luxembourg not included due to an outlier (trade is 294% of euro area average, CPL 109%).

Another option to proxy the competition effect is the business deregulation index reported by the Fraser Institute; see Gwartney and Lawson with Gartzke (2005). It comprises information about price controls, the burden of regulation (administrative conditions and entry of new businesses), time with government bureaucracy, the ease of starting a new business and irregular payments, for example payments for special business licences. The indicator is ranged between 1 to 10, with 1 indicating the lowest and 10 the highest level of deregulation. Because of the rank scale only the sign, but not the size of the impact is interpretable. Data are provided on an annual base from 2000 to 2005 at the nationwide level. Before 2000, the indicator is available at the 5 year fre-

quency. Therefore, the value for 1999 has been interpolated on the base of the 1995 information.

The overall measure can be broken down into its subcomponents. This is important because the Fraser index is a too broad concept. For example, time with government bureaucracy may not have an obvious impact on price developments. A stronger deregulation in this area would lead to a rise in the Fraser index, although the fundamental price determinants might not have changed. Therefore, for the purpose of this study, price controls seems to be the most relevant variable (Égert, 2006). A removal of price controls during a catching up period is expected to lead to price increases in the EU10. In the EU15, the situation is different, as prices have been already liberalized to a higher extent. A further reduction of controls will introduce more competition, which is especially relevant in network industries, such as telecommunications. Thus a downward pressure on prices should be observed for the EU15.

Finally, CPLs for 41 broad categories and basic headings for 279 product groups have been taken from Eurostat. Nominal bilateral exchange rates to the euro are from the ECB Monthly Bulletin. Exchange rates are needed to convert the PPP type expression of basic headings into a CPL comparable series.

VI.2 Catching up and competition factors

The first step is to derive suitable factors describing catching up behaviour and competition as the main determinants of price convergence. Catching up is relatively easy to quantify as it is directly captured by relative per capita income, productivitiy and wages. These measures are closely correlated among each other. The inclusion of all them in the same regression would inevitably create a collinearity problem, see Table A5 in the appendix for the correlation matrix of the original variables. Therefore a common component is extracted instead. It could be interpreted as a catching up factor and can be used as a substitute for the individual variables in a regression of the determinants on price convergence. This approach is also a convenient way to extenuate data problems caused by a short time series dimension.

The catching up factor is extracted by means of principal component analysis (PCA). The idea behind the PCA is that the variability of all observed variables can be reduced to a limited number of sources, or common factors. The remaining variability is attributed to the idiosyncratic component, i.e. an individual factor for each variable observed. Formally, the decomposition

(12) $\quad X_t = \Lambda F_t + u_t$

is applied, where X_t is the $n \times 1$ vector of observed variables; Λ is the $n \times k$ matrix of factor loadings; F_t is the $k \times 1$ vector of common factors (k substantially lower than n); and u_t is the $n \times 1$ vector of idiosyncratic shocks. The extraction of the common factors from the series observed is done by PCA. The factors are organized in descending order according to the proportion of the total variability they explain. Therefore, the first principal component contributes more than any other principal component to the variance of the original variables.

Table VI.1: Principal component analysis

Proportion to overall variance		Correlation (Catching up factor, variables)	
PC_1	99.32	GDP	0.996
PC_2	99.78	Productivity	0.996
PC_3	100.00	Compensation	0.998

Note: Sample period 1999-2005, Luxembourg excluded. Apart from the deregulation index, all series are measured in relative terms (EU12=100). Principal components are calculated across countries, i.e. each of the underlying series comprises 168 observations (24 countries x 7 periods). PC_x denotes the x*th* principal component, the other variables are defined in the text. The catching up factor refers to the first principal component.

The PCA is based on the correlation matrix of the variables. To derive the catching up factor, it is applied to GDP, labour productivity, and compensation of employees, all of them at constant (2000) prices. The first principal component amounts to 99 percent of the total variation of the underlying variables, see the left half of Table VI.1. As shown in the right part of the table, it is strongly correlated with the original variables. Hence, the interpretation as catching up factor is straightforward.

Competition is more difficult to address. It is partially, albeit not perfectly, manifested in the openness to foreign trade or the degree of import penetration, and the strength of business regulation. Openness and import penetration are strongly correlated and both are related to market integration. Import penetration might be more informative because it reflects the exposure of the domestic market to international competition. Therefore, it is preferred in the subsequent analysis. The results obtained with openness are almost identical. The correlation of import penetration and openness with either price controls or the Fraser index is rather weak, see Table A5 in the appendix. Hence the estimation of a common factor would be rather imprecise, since a substantial part of information is classified as idiosyncratic and dropped from the analysis. Due to the low correlation, it is more reasonable to directly include the original variables in the regression of the determinants on price convergence.

VI.3 Beta and sigma convergence

Two general concepts to measure convergence of certain variables are distinguished in the literature: β- and σ-convergence. They have been used extensively in the literature of economic growth to assess regional or cross country per capita income and productivity convergence (Barro and Sala-i-Martin, 1995). β-convergence in its absolute form postulates that poor countries (low income or productivity) will experience faster income or productivity growth thereafter. This implication is usually tested by regressing the growth rate, taken as average over some period of time on initial levels for a cross section of countries. The conditional form predicts β-convergence only after other factors have been taken into account. The latter control for a different steady state position across countries. On the other hand, σ-convergence implies a decrease in the dispersion of per capita income or productivity levels across countries. It can be shown that β-convergence is necessary, but not sufficient for the existence of σ-convergence, see Barro and Sala-i-Martin (1995). Evidence for both concepts would reveal support of the LOP as a long run condition.

In the analysis of prices, absolute β-convergence is built upon a negative relationship between the initial price level and subsequent price increases. Countries with low prices

at the beginning of the period have had higher inflation on average, implying convergence to the mean of the distribution. In terms of CPLs, an initial CPL level (the national price compared to a numeraire price) is used to explain subsequent changes in the CPL measure, i.e.

(14) $\quad \Delta CPL_{i,t} = \alpha_i - \beta CPL_{i,t-j} + u_{i,t}$

where i is a country index, α_i a country specific fixed effect, u_i the error term and t denotes time. The initial CPL is the CPL level lagged j periods. The one period lag ($j=1$) is usually employed in empirical studies, see Dobado and Marrero (2005) and Wolszczak-Derlacz (2006). Then, the equation

(15) $\quad CPL_{i,t} = \alpha_i + (1-\beta)CPL_{i,t-1} + u_{i,t}$

relating subsequent CPLs is equivalent. The estimated coefficient of the lagged CPL is an indicator of β-convergence. In particular, two parameters of interest can be immediately revealed from the regression results. The speed of convergence and the half lives of shocks are calculated as

(16) $\quad \lambda = -\ln(1-\beta) \quad , \quad t^* = -\ln 0.5/\lambda$

where λ is convergence per period. The half life t^* measured in years indicates how long it takes for the impact of a unit shock to diminish by 50 percent. In case of higher autoregressive orders in the convergence model, the absolute value of the first order coefficient is a suitable approximation to obtain measures for the speed of convergence and half lives. Due to the dynamic structure of the panel regression (15), the Arellano and Bond (1991) GLS method is appropriate.[4]

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[4] It should be noted that some well known statistics are not informative in this case. For example, the familiar R-squared statistic is an OLS concept that is useful because of the unique way it breaks down the total sum of squares into the sum of the model sum of squares and the residual sum of squares. When the parameters are estimated using GLS techniques, the total sum of squares cannot be broken down in the the same way. Specifically, an R-squared statistic computed from GLS sums of squares need not be bounded between zero and one and does not represent the percentage of total variation in the dependent variable that is accounted for by the model. Also, eliminating or adding variables does not always increase or decrease the computed value.

As mentioned earlier, β-convergence is a necessary, but not a sufficient condition for price convergence. Here, σ-convergence must also hold, which is related to a decrease of the standard deviation of prices over time. In principle, β-convergence is perfectly compatible with a shift in the ranking of prices across countries, without affecting price dispersion. In the analysis, the presence of σ-convergence is investigated by the sign and significance of the slope coefficient in a regression of the CPL dispersion on a linear time trend.

In particular, a panel regression is performed for 41 CPLs for broad categories and 279 basic headings, which are observed for 24 countries. Luxembourg is excluded from the EU25 because of outlier problems. The cross section dimension is 984 (41x24) in case of broad categories and 6696 (279x24) for basic headings. Broad categories are available at the annual frequency from 1999 to 2005, while basic headings are observed over the 2000 to 2004 period. The basic headings have been converted into the same currency, i.e. divided by the nominal exchange rate to the euro. Thus they are measured in a CPL fashion, but related to specific markets. Overall, the cross section dimension is rather large, but the time series dimension is very short in any case. As the results refer to time series phenomena they should be taken with some caution. But at least, they are useful to provide a first indication of the path of convergence.

The results are shown in Table VI.2. The speed of convergence and half lives are calculated according to the formula (16). The convergence regressions include a multiplicative dummy to control for a possible different speed of convergence due to the EU enlargement in 2004. This is done only for the broad categories, as the basic headings data end in 2004. Due of the short time span, multicollinearity might occur. However the correlation between the price and the price times the dummy is below 0.1. Thus the dummy regressor can be included directly. Its coefficient indicates the change of the impact of the lagged price after 2004.

Overall, the evidence points to the presence of beta convergence: countries with low relative prices in the initial period have experienced higher changes in the price level thereafter. According to the speed of convergence, only 6 percent of the price differential are removed each period, if the analysis focuses on CPLs for broad categories. The speed of convergence seems to have increased due to the EU enlargement. Given the

change in the regression coefficient, the half life drops to 8 years after 2003. In case of basic headings, 10 percent of the price differential diminish in each period. Convergence is expected to take a long period of time, but tends to be faster in the case of basic headings. This might be explained by a higher level of competition for more homogeneous products. Similarly, the ECB (2003) has concluded that β-convergence does play an important role in explaining different rates of inflation. However, the ECB study is limited to the euro area.

Table VI.2: Price convergence in terms of broad categories and basic headings
-EU25 countries

	Broad categories	Basic headings
β-convergence		
CPL_{t-1}	0.941 (0.003)	0.795 (0.030)
Dummy*CPL_{t-1}	-0.024 (0.009)	
Speed of convergence		
Entire period		0.100
Before enlargement	0.061	
After enlargement	0.087	
Half-life		
Entire period		6.9
Before enlargement	11.4	
After enlargement	8.0	
σ-convergence		
Time trend	-0.027 (0.006)	-0.009 (0.001)
Dummy*Time trend	0.008 (0.001)	

Note: Sample period 1999-2005 for broad categories, 2000-2004 for basic headings, Luxembourg excluded. Dummy is equal to 1 from 2004 onwards, 0 elsewhere. Arellano-Bond estimation for β-convergence, OLS regression for σ-convergence. Numbers in parantheses denote robust standard deviations. 5.096 observations for broad categories (24 countries×41 indices×6 years), 32.280 observations for the basic headings (24 countries×269 indices×5 years). The original number of basic headings (279) has been reduced by 10 outliers.

Beta convergence can be also confirmed if more homogeneous groups of countries are considered, such as the EU15 and the EU10. The speed of convergence seems to be a little bit faster in the EU15, see Table A6 in the appendix. Thus the Old Member States converge to their steady state at a faster pace. Note that the steady state positions of the EU15 and the EU10 are not restricted to be the same, as the analysis is done for both groups in an independent way. Specifically, the anchor for the price convergence process, i.e. the steady state of the Old Member States is excluded from the EU10 regressions The steady state positions for the EU15 and EU10 could be different, but they can also coincide.

In addition, the standard deviations are declining over time. Thus sigma convergence is confirmed, where the reduction in the price dispersion seems to be more pronounced for the broad categories.[5] After the EU enlargement, the trend parameter decreased in absolute value. Hence, sigma convergence has been slightly weaker after 2004. Again, these results are broadly confirmed in case of the EU15 and EU10 countries.

Table VI.3: Price convergence in terms of groups of basic headings

-EU25 countries

β-convergence						
	Non durables	Semi durables	Durables	Services	Equipment	Buildings
P_{t-1}	0.830 (0.063)	0.663 (0.088)	0.720 (0.056)	0.960 (0.020)	0.827 (0.065)	0.894 (0.039)
Speed	0.186	0.411	0.329	0.041	0.189	0.112
Half-life	3.7	1.7	2.1	NA	3.7	6.2
σ-convergence						
Time trend	-0.007 (0.002)	-0.012 (0.003)	-0.025 (0.011)	-0.011 (0.002)	-0.019 (0.003)	0.005 (0.001)

Note: Sample period 2000-2004, 24 countries, Luxembourg excluded. Arellano-Bond estimation for β-convergence, OLS regression for σ-convergence. Numbers in parantheses denote robust standard deviations. Basic headings are split into 69 non durables, 26 semi durables, 29 durables, 75 services, 20 for investment in equipment and 15 for buildings. 45 basic headings could not be classified. NA=A reasonable estimate cannot be reported, as the speed of convergence is close to 0.

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[5] Sigma convergence can be detected also in terms of the coefficient of variation, but only for broad categories. In the case of basic headings, the results are affected by some very low means in the original data.

Therefore price convergence can be detected both in terms of beta- and sigma convergence for the period before as well as for the period after the EU enlargement. However, while the speed of beta convergence seems to have increased, that of sigma convergence appears to have decreased. This tendency is also visible for the different subgroups of countries, see table A6 in the appendix. Due to the short time period, the long run convergence trends might be interfered with short run fluctuations. For example, price dispersion might increase in the early years of an economic recovery. Moreover, the business cycles in the EU member countries are not fully synchronized yet (see Artis, Krolzig and Toro, 2004). However, a longer time span is needed to arrive at more robust conclusions.

As a rule, convergence should be faster for tradables. It might be also expected for non tradables, albeit at a slower pace, as non tradables may include sizeable shares of tradable inputs. Hence, disaggregation could provide additional conclusions. Therefore, the basic headings for consumer products are split into non durables, semi durables, durables and services. On the investment side, basic headings for equipment and buildings are distinguished. The convergence tests are carried out for these groups, see Table IV.3 for the EU25 results.

According to the empirical evidence, the speed of convergence rises with the tradability of the product. As a consequence, shocks are expected to be removed by 50 percent after 2.1 years in case of durables, compared to 3.7 years for non durables. For investment, convergence turns out to be faster for equipments. although equipment and buildings converge at a similar speed to (probably different) steady states in more homogeneous EU15 and EU10 samples (see Table A7 in the appendix). The impact of shocks appears to be longer for non tradables, such as services. Sigma convergence can be established for most categories.

VI.4 Determinants of price convergence

After establishing the presence of price convergence, insights into their determinants are provided. In particular, CPLs for broad categories and basic headings are regressed on a number of explanatory variables, i.e. the catching up factor and competition variables. As in the analysis of β- and σ-convergence, the number of cross sections is equal to the

product of countries times the number of prices. The panel regressions are estimated both for broad categories and basic headings using OLS with fixed effects. The results are displayed in Table VI.4.

All variables are estimated with the expected signs. While catching up has a positive impact, competition exerts a negative effect on relative prices. Price controls are marginally significant in the analysis of the broad categories, but insignificant for the basic headings. However, this reflects the opposite effects of this variable in the EU15 and EU10 subsamples, see Table A8 in the appendix. In fact, the abolishment of price controls has a negative impact for the Old Member States, but a positive one for the New Member States. Over the catching up period, regulations will be reduced in the EU10, and this will reinforce convergence. The subsamples also indicate that catching up is a phenomenon especially linked to the price evolution in the New Member States. More or less, the basic headings analysis confirms the results obtained at the level of broad categories, see Table VI.4.[6]

Table VI.4: Determinants of relative prices (CPLs)

-EU25

	Broad categories	Basic headings
Catching up	0.109 (0.004)	0.111 (0.004)
Import penetration	-0.040 (0.003)	-0.001 (0.0003)
Price controls	0.012 (0.006)	-0.001 (0.001)
R^2 within	0.189	0.034
R^2 between	0.608	0.447
R^2 overall	0.593	0.429
F-statistic	154.6 (0.000)	184.7 (0.000)
Hausman statistic	43.2 (0.000)	20.5 (0.001)

Note: Sample period 1999-2005 for broad categories, 2000-2004 for basic headings. 24 countries, Luxembourg excluded. Panel models estimated with two way fixed effects. Numbers in parantheses denote robust standard deviations. 6,888 observations for broad categories (24 countries×41 indices×7 years), 32,280 observations for the basic

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[6] To avoid possible simultaneity bias due to endogeneous regressors, all models have been estimated using instruments (first and two period lags) instead of the contemporaneous values of the catching up factor.

headings (24 countries×269 indices×5 years). The original number of basic headings (279) has been reduced by 10 outliers. Numbers in parantheses below *F*- and Hausman statistic denote *p*-values.

Finally, Table VI.5 reports evidence at the more disaggregated level. As in the convergence analysis, the basic headings for consumption are splitted into non durables, semi durables, durables and services. On the investment side, basic headings for equipment and buildings are distinguished.

Table VI.5: Determinants of relative prices (CPLs) for groups of basic headings

-EU25

	Non durables	Semi durables	Durables	Services	Equipment	Buildings
Catching up	0.080 (0.009)	0.116 (0.012)	-0.004 (0.010)	0.159 (0.009)	0.087 (0.016)	0.027 (0.014)
Import penetration	-0.002 (0.001)	-0.002 (0.002)	-0.002 (0.001)	-0.001 (0.001)	-0.002 (0.001)	-0.002 (0.001)
Price controls	0.002 (0.001)	0.001 (0.002)	-0.001 (0.002)	-0.003 (0.001)	0.001 (0.003)	0.002 (0.002)
R^2 within	0.015	0.039	0.080	0.059	0.018	0.018
R^2 between	0.481	0.342	0.146	0.662	0.213	0.576
R^2 overall	0.439	0.300	0.089	0.641	0.139	0.549
F-statistic	20.5 (0.000)	20.4 (0.000)	4.5 (0.000)	78.8 (0.000)	9.2 (0.000)	4.2 (0.001)
Hausman statistic	4.7 (0.449)	33.5 (0.000)	13.8 (0.017)	18.7 (0.000)	20.7 (0.000)	256.1 (0.000)

Note: Sample period 2000-2004, 24 countries, Luxembourg excluded. Panel models estimated with two way fixed effects. Numbers in parantheses denote robust standard deviations. Basic headings are split into 69 non durables, 26 semi durables, 29 durables, 75 services, 20 for investment in equipment and 15 for buildings. 45 basic headings could not be classified. Numbers in parantheses below *F*- and Hausman statistic denote *p*-values.

All variables are estimated with the correct signs. Again, catching up appears to be the most important regressor, especially for the New Member States (see Table A9 in the appendix). The catching up coefficient is high in case of services, and particularly low for durables. This finding is in line with the Balassa-Samuelson prediction. According to this hypothesis, catching up should be more visible for non-tradables. However, the evidence is not entirely consistent on this point: for example, the catching up coefficient for non-durables falls below the one for semi durables, which are tradable to a higher extent. Eventually, this finding is caused by conceptual difficulties with assigning prod-

ucts to the groups considered here: the classification schemes for foreign trade data and basic headings do not perfectly coincide, and some arbitrariness might have biased the results. For some groups like services, trade data is not available at all, and has been replaced by the national series.

Competition proxied by import penetration enters with a negative sign and is significant with the exception of semi durables and services. On average, competition exerts a dampening effect on prices. Price controls do not show a clear pattern, since they work differently for the Old and the New Member States, see Table A9 in the appendix. Removing price controls will lead to a decrease in relative prices in the Old, but to an increase in the New Member States. In the overall sample (Table VI.5), these opposite effects cancel out.

Catching up and competition are relevant especially for the New Member States, where significant effects can be detected in most cases. For the Old Member States, a significant contribution of competition can be detected only for non durables. In fact, competition seems to have increased especially during the 1990s, which are excluded from the period under study. Furthermore, as the New Member States account only for 5 percent of real GDP in the Internal Market, their additional impact on competition in the Old Member States might be hardly visible.

Overall, there is some evidence that price convergence takes place in the Internal Market. Due to the enlargement, the speed of convergence has increased. Both catching up and competition factors are relevant to explain the process of price convergence, especially for the New Member States. However, it should be noted that the time series dimension of the regressions is too short to arrive at definitive conclusions. This is particularly true in the case of basic headings, and might explain some inconclusive results of the analysis.

Part VII:

Conclusions

The main aim of the study is to investigate the effects of EU enlargement on price convergence. The Internal Market is expected to foster market integration and increase efficiency and welfare through a convergence of prices. Although a high degree of market integration is achieved, price dispersion in the EU has considerably increased with the enlargement in 2004. Price levels in the New Member States are substantially lower than in the Old Member States, most likely due to their lower level in per capita income. Moreover, lacks in tradability and in the reputation of goods and services produced in the New Member States may play a role. In addition, inflation rates in the New Member States exceed the average of the EU15.

Two principal forces are crucial to explain the process of price convergence in the Internal Market. On the one hand, the catching up process of low income countries leads to a rise in the price levels and higher inflation over a transition period. The increase in overall price level affects consumption and production patterns. This tendency is based on market reforms, the composition of value added and an increase in the variety and quality of goods. On the other hand, the rise in competition exerts a downward pressure on prices because of lower mark ups.

The Law of One Price (LOP) is the point of departure, as it constitutes the fundamental mechanism for price convergence to hold in a perfectly competitive market. However, the literature has clearly documented substantial deviations from the LOP even over longer periods. Not all products are tradable in the Internal Market and even tradables might contain non tradable components. Prices of non tradables are lower in the New Member States, as long as they are in the a catching up phase. Overall, the LOP should be interpreted as an equilibrium relationship for the long run. Over long time horizons, the impediments of the LOP will gradually lose their significance, i.e. price differentials cannot exist forever.

Because the LOP is not an attractor in the short and medium run, the price setting behaviour of firms has to be linked to domestic factors. In monopolistic competitive markets firms are able to charge prices that include a mark up over marginal costs. Therefore, cross country deviations in price levels may be traced to cross country differences in marginal costs or in mark ups. For the purpose of this study these determinants have been grouped into catching up and competition variables.

To overcome the disadvantages of price indices, the empirical analysis refers to comparative price levels (CPLs). These measures are calculated as the ratio between purchasing power parities (PPPs) and nominal exchange rates. PPPs are based on price levels of a comparable and representative sample of goods and services covering the various aggregates of GDP in the EU25 member states. At the most disaggregated level, PPPs rely on relative price ratios for 279 basic headings.

Distinct forces are identified to obtain insights into the impact of catching up and competition on the path of price convergence. Specifically, a factor analysis is conducted, where a catching up factor is extracted by means of principal component analysis. It is derived from a dataset comprising real GDP, real productivity of labour, and real compensation of employees. The first principal component is interpreted as the catching up factor, since it represents almost all of the variation of its ingredients.

Competition is more difficult to address. It is partially, albeit not perfectly, manifested in the openness to foreign trade or the degree of import penetration, and the strength of business regulation, the latter proxied by the Fraser index. Furthermore, the latter measure can be broken down into its ingredients. For the purpose of this study, price controls are chosen as the most important subindicator. Openness and import penetration are strongly correlated and both are related to market integration. Import penetration might be more informative because it reflects the exposure of the domestic market to international competition and is therefore preferred in the analysis. As the correlation of import penetration and openness to foreign trade with price controls is rather weak, the estimation of a competition factor would be rather imprecise: a substantial part of information would be classified as idiosyncratic and dropped from the analysis. Therefore, it seems more reasonable to directly include the original variables in the regression equation of the determinants on price convergence.

The empirical analysis shows a negative relation between the initial price level and subsequent price increases. Countries with lower initial price levels tend to have higher inflation rates thereafter. Convergence of price levels will gradually occur. Convergence appears to be stronger in case for basic headings, probably as they are related to more homogeneous products. In addition, the speed of convergence seems to rise with the tradability of the product considered. Shocks are expected to be removed by 50 percent

after 2.1 years in case of durables, compared to 3.7 years for non durables. The impact of shocks is even longer for services and buildings. In addition, a decline in the price dispersion over time can be observed, as the slope coefficient in a trend regression appears to be significant in all cases.

Catching up and competition seems to be important drivers to explain the path of price convergence. Catching up appears to be the most important regressor, especially for the New Member States. The catching up coefficient is high in the case of services, and low for durables. This finding is roughly in line with the Balassa-Samuelson prediction, as catching up should be more visible for non-tradables. Probably due to classification problems, the evidence is not fully consistent on this point: for example, the catching up coefficient for non-durables falls below the one for semi durables, where the latter could be tradable to a higher extent.

Competition exerts a downward pressure on prices, most notably in the New Member States. For the Old Member States competition may have increased especially during the 1990s, which are not included in the analysis. In addition, the New Member States account only for 5 percent of real GDP in the Internal Market. Thus, their impact on competition in the Old Member States could be hardly visible. In fact, competition is insignificant in the EU15 subsample in most cases. Finally, the removal of price controls will lead to a decrease in relative prices in the Old, but to an increase in the New Member States. The opposite effects can be explained by the different degrees of price regulation in the Old and New Member States.

To sum up, there is some evidence that price convergence takes place in the Internal Market. Due to the enlargement, the speed of convergence has increased. Both catching up and competition factors are relevant to explain the process of price convergence, especially for the New Member States. However, it should be noted that the time series dimension of the regressions is too short for definitive conclusions. This is particularly true in the case of basic headings, and might explain some inconclusive results of the analysis.

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Appendix

Table A1: Relative price levels of selected product categories

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT	DK
GDP													
1995a00	107	119	107	116	105	110	113	72	80	87	78	69	130
1999a00	105	112	104	110	103	104	110	80	82	103	90	73	126
2004a00	100	103	106	106	103	100	112	80	87	115	99	81	130
2005a00	100	103	105	106	103	101	113	81	89	116	100	82	131
Total goods													
1995a00	105	114	108	109	105	109	107	83	84	88	80	82	133
1999a00	103	108	106	102	105	105	103	90	85	103	92	83	131
2004a00	99	103	105	98	107	103	109	86	91	119	97	86	128
2005a00	100	103	103	99	105	103	109	87	91	120	99	86	128
Consumer goods													
1995a00	106	106	108	104	100	111	126	88	88	97	87	90	133
1999a00	105	102	105	96	101	104	117	93	86	106	98	90	132
2004a00	101	102	101	97	101	102	113	87	87	116	105	92	131
2005a00	102	102	100	98	100	102	112	88	88	115	105	92	131
Non-durable goods													
1995a00	104	107	106	100	97	111	124	80	85	96	91	85	136
1999a00	103	101	107	93	95	103	118	89	84	109	102	88	135
2004a00	101	104	103	96	104	102	113	82	81	121	104	89	133
2005a00	102	105	102	97	103	102	112	82	82	121	104	88	132
Semi-durable goods													
1995a00	113	107	112	117	101	107	124	103	90	91	82	88	115
1999a00	114	105	103	109	106	106	109	101	91	89	94	84	113
2004a00	103	102	96	104	91	105	109	95	98	99	106	90	116
2005a00	104	101	96	104	88	104	108	99	99	95	107	90	115
Durable goods													
1995a00	106	103	108	106	110	116	135	102	96	109	81	114	146
1999a00	102	102	101	95	113	107	122	100	90	117	94	100	142
2004a00	101	95	100	97	103	101	117	101	98	117	105	111	142
2005a00	102	95	99	97	103	100	115	102	99	116	106	112	143
Capital goods													
1995a00	104	126	108	116	111	106	85	76	78	76	70	69	132
1999a00	101	117	107	112	111	105	88	85	83	100	83	75	131
2004a00	96	104	112	99	115	105	104	84	95	121	88	77	123
2005a00	99	104	108	100	112	106	104	85	95	126	90	77	125
Total services													
1995a00	109	126	106	128	106	111	120	63	77	85	75	59	129
1999a00	108	118	102	121	102	104	119	72	80	103	89	64	124
2004a00	102	105	106	120	102	98	119	75	83	119	101	78	137
2005a00	102	104	106	120	102	98	119	76	85	119	102	78	138
Consumer services													
1995a00	109	121	116	114	109	110	128	70	79	89	75	52	129
1999a00	109	113	111	110	106	102	129	79	82	107	88	59	121
2004a00	104	101	113	106	104	96	126	81	87	125	98	75	139
2005a00	103	100	113	105	103	96	125	81	90	124	99	76	138
Government services													
1995a00	110	132	97	145	104	112	113	54	75	81	76	67	131
1999a00	107	126	94	137	98	107	109	62	77	100	92	73	129
2004a00	100	110	100	135	100	101	112	68	79	112	106	81	135
2005a00	101	110	99	136	100	102	113	69	80	114	107	82	138

	SW	UK	CZ	ES	CY	LA	LI	HU	MT	PO	SV	SL
GDP												
1995a00	112	83	36	36	80	31	24	41		41	69	38
1999a00	119	109	43	51	85	44	40	44	64	46	72	40
2004a00	116	105	51	55	84	47	46	57	65	47	70	50
2005a00	115	105	55	57	84	48	48	58	67	53	70	51
Total goods												
1995a00	110	88										

1999a00	116	114	59	74	87	67	62	63	78	62	81	59
2004a00	117	107	68	74	92	66	66	74	80	60	78	70
2005a00	118	107	73	74	92	67	68	76	82	68	77	72
Consumer goods												
1995a00	113	89										
1999a00	116	114	59	68	94	65	60	61	85	60	85	53
2004a00	116	104	71	71	100	65	65	74	87	62	83	71
2005a00	112	103	75	72	101	65	66	75	88	70	83	72
Non-durable goods												
1995a00	118	92										
1999a00	119	113	52	62	83	59	54	55	79	55	83	47
2004a00	119	107	64	65	98	59	59	68	80	58	79	65
2005a00	115	107	68	67	100	60	60	70	81	66	79	67
Semi-durable goods												
1995a00	105	83										
1999a00	114	111	70	76	101	72	69	66	83	70	91	63
2004a00	114	95	89	84	98	80	81	84	89	70	93	82
2005a00	111	93	92	86	97	77	80	86	89	76	94	85
Durable goods												
1995a00	103	89										
1999a00	112	120	86	88	130	95	82	87	109	81	87	78
2004a00	108	105	87	84	109	83	83	89	115	79	89	86
2005a00	104	104	90	81	109	82	80	89	115	87	87	87
Capital goods												
1995a00	105	87										
1999a00	115	114	59	85	77	72	67	68	68	64	75	67
2004a00	119	113	64	78	80	67	69	74	69	57	71	70
2005a00	125	114	70	77	80	68	74	78	72	65	70	72
Total services												
1995a00	115	79										
1999a00	123	106	30	35	81	28	26	30	54	34	63	25
2004a00	118	102	37	41	76	35	31	43	55	36	64	34
2005a00	116	103	40	43	76	35	32	44	55	41	64	36
Consumer services												
1995a00	124	79										
1999a00	132	107	32	47	82	36	31	34	58	40	63	27
2004a00	119	99	38	52	74	43	37	46	55	42	63	38
2005a00	116	99	41	54	75	44	39	48	56	48	64	40
Government services												
1995a00	108	79										
1999a00	116	105	29	26	82	22	22	26	50	28	63	24
2004a00	116	106	36	33	78	28	26	40	55	31	65	30
2005a00	115	107	40	34	79	28	27	42	55	36	65	32

Note: Raw data from Eurostat, in percent of EU12 average (=100). BL=Belgium, GE=Germany, FR=France, LU=Luxembourg, NL=Netherlands, AT=Austria, FN=Finland, GR=Greece, SP=Spain, IR=Ireland, IT=Italy, PT=Portugal, DK=Denmark, SW=Sweden, UK=United Kingdom, CZ=Czech Republic, ES=Estonia, CY=Cyprus, LA=Latvia, LI=Lithuania, HU=Hungary, MT= Malta, PO=Poland, SV=Slovenia, SK=Slovakia.

Table A2: Relative price levels of main GDP expenditure categories

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT	DK
GDP													
1995a00	107	119	107	116	105	110	113	72	80	87	78	69	130
1999a00	105	112	104	110	103	104	110	80	82	103	90	73	126
2004a00	100	103	106	106	103	100	112	80	87	115	99	81	130
2005a00	100	103	105	106	103	101	113	81	89	116	100	82	131
Individual consumption													
1995a00	108	116	107	116	104	112	124	74	81	90	80	70	131
1999a00	107	110	104	107	101	104	119	81	82	105	93	74	127
2004a00	101	103	104	110	102	100	118	80	85	119	103	84	136
2005a00	101	102	104	110	101	100	118	81	87	119	103	84	136
Gross fixed capital formation													
1995a00	104	126	108	116	111	106	85	76	78	76	70	69	132
1999a00	101	117	107	112	111	105	88	85	83	100	83	75	131
2004a00	96	104	112	99	115	105	104	84	95	121	88	77	123
2005a00	99	104	108	100	112	106	104	85	95	126	90	77	125
Machinery and equipment													
1995a00	99	116	116	102	108	95	103	106	83	95	74	93	129
1999a00	95	110	109	98	104	93	103	110	87	102	86	99	117
2004a00	97	102	103	95	100	99	104	106	96	110	96	108	115
2005a00	99	101	104	94	98	98	102	107	97	107	98	105	113
Construction													
1995a00	107	131	102	126	118	111	73	61	75	66	66	56	132
1999a00	104	122	106	125	125	112	78	69	81	100	78	59	143
2004a00	99	108	116	98	127	111	103	71	92	124	81	59	135
2005a00	101	109	109	100	127	114	106	72	93	135	83	61	138
Final consumption expenditure													
1995a00	108	117	107	118	104	111	122	72	80	89	79	69	131
1999a00	107	112	103	110	102	104	118	79	82	104	93	73	127
2004a00	101	103	104	112	102	100	117	79	85	118	103	83	135
2005a00	101	103	104	112	101	100	117	80	86	118	103	83	136
Household final consumption expenditure													
1995a00	107	112	111	109	104	111	127	78	82	93	81	70	131
1999a00	107	107	108	101	103	103	122	86	83	106	93	73	126
2004a00	102	101	106	101	102	99	119	84	88	121	101	84	134
2005a00	102	100	106	102	102	99	118	85	89	120	102	84	135
Government final consumption expenditure													
1995a00	110	132	97	145	104	112	113	54	75	81	76	67	131
1999a00	107	126	94	137	98	107	109	62	77	100	92	73	129
2004a00	100	110	100	135	100	101	112	68	79	112	106	81	135
2005a00	101	110	99	136	100	102	113	69	80	114	107	82	138

	SW	UK	PO	ES	LA	LI	SK	HU	CZ	SL	CY	MT
GDP												
1995a00	112	83	41	36	31	24	38	41	36	69	80	
1999a00	119	109	46	51	44	40	40	44	43	72	85	64
2004a00	116	105	47	55	47	46	50	57	51	70	84	65
2005a00	115	105	53	57	48	48	51	58	55	70	84	67
Individual consumption												
1995a00	115	83										
1999a00	121	110	44	47	42	38	36	40	40	71	87	66
2004a00	118	103	46	52	46	44	47	54	48	71	86	67
2005a00	115	103	52	54	47	45	49	55	52	71	86	68
Gross fixed capital formation												
1995a00	105	87										
1999a00	115	114	64	85	72	67	67	68	59	75	77	68
2004a00	119	113	57	78	67	69	70	74	64	71	80	69
2005a00	125	114	65	77	68	74	72	78	70	70	80	72

Machinery and equipment

1995a00	94	93										
1999a00	98	106	80	87	79	83	89	80	80	94	91	89
2004a00	97	99	85	94	86	86	96	91	87	92	107	97
2005a00	98	98	93	91	87	85	97	93	93	91	103	99

Construction

1995a00	117	84										
1999a00	134	122	49	80	63	53	49	58	43	59	64	51
2004a00	148	126	43	67	55	57	53	63	49	57	66	54
2005a00	161	128	49	67	57	65	55	68	55	56	68	58

Final consumption expenditure

1995a00	114	82										
1999a00	121	109	43	45	39	36	34	39	39	70	87	64
2004a00	118	103	44	50	44	42	45	53	47	70	84	65
2005a00	115	103	50	52	45	43	47	54	51	70	85	66

Household final consumption expenditure

1995a00	118	84	43	39	36	29	37	41	38	71		
1999a00	123	110	50	56	50	45	40	46	45	74	89	70
2004a00	117	101	51	61	53	51	53	59	53	73	87	70
2005a00	114	101	58	62	54	52	55	61	56	72	88	71

Government final consumption expenditure

1995a00	108	79										
1999a00	116	105	28	26	22	22	24	26	29	63	82	50
2004a00	116	106	31	33	28	26	30	40	36	65	78	55
2005a00	115	107	36	34	28	27	32	42	40	65	79	55

Note: Raw data from Eurostat, in percent of EU12 average (=100). BL=Belgium, GE=Germany, FR=France, LU=Luxembourg, NL=Netherlands, AT= Austria, FN=Finland, GR=Greece, SP=Spain, IR=Ireland, IT=Italy, PT=Portugal, DK=Denmark, SW= Sweden, UK=United Kingdom, CZ=Czech Republic, ES=Estonia, CY=Cyprus, LA=Latvia, LI=Lithuania, HU=Hungary, MT= Malta, PO=Poland, SV=Slovenia, SK=Slovakia.

Table A3: Relative price levels of main COICOP categories

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT	DK
Individual consumption													
1995a00	108	116	107	116	104	112	124	74	81	90	80	70	131
1999a00	107	110	104	107	101	104	119	81	82	105	93	74	127
2004a00	101	103	104	110	102	100	118	80	85	119	103	84	136
2005a00	101	102	104	110	101	100	118	81	87	119	103	84	136
Alcoholic beverages, tobacco and narcotics													
1995a00	112	106	105	97	109	116	189	77	69	161	89	75	159
1999a00	107	99	115	84	102	104	164	85	71	163	104	76	146
2004a00	100	100	114	88	104	98	137	83	78	185	100	83	124
2005a00	99	103	110	89	102	98	130	82	78	179	101	83	123
Alcoholic beverages													
1995a00	115	95	107	105	117	116	229	94	76	194	82	81	154
1999a00	105	92	111	94	107	107	192	99	76	179	101	80	136
2004a00	93	95	94	91	103	100	169	100	84	198	111	112	132
2005a00	96	95	94	93	103	99	162	104	84	199	113	111	130
Tobacco													
1995a00	112	120	105	91	104	117	153	70	64	141	93	71	170
1999a00	110	108	119	79	99	103	138	79	69	154	105	73	157
2004a00	114	109	147	84	107	97	115	73	73	185	92	68	124
2005a00	109	116	138	85	105	99	109	69	72	174	94	68	122
Clothing and footwear													
1995a00	117	107	117	130	96	106	124	107	90	92	83	95	110
1999a00	118	108	100	120	103	109	104	102	91	81	95	82	101
2004a00	104	102	92	106	86	105	110	96	98	94	109	90	108
2005a00	104	101	92	107	84	104	110	101	100	91	111	90	108
Housing, water, electricity, gas and other fuels													
1995a00	109	131	115	120	103	100	122	73	69	79	66	40	130
1999a00	103	120	112	125	106	93	119	77	72	110	80	39	126
2004a00	105	104	110	111	109	84	116	74	85	128	92	70	134
2005a00	103	102	110	111	110	86	116	74	89	125	93	70	133
Household furnishings, equipment and maintenance													
1995a00	107	112	112	113	102	114	119	82	89	88	82	73	117
1999a00	104	105	110	99	114	104	102	87	86	102	93	75	121
2004a00	103	96	105	104	95	100	110	93	98	114	105	88	123
2005a00	104	96	105	105	94	99	111	94	99	111	105	88	123
Health													
1995a00	113	128	95	130	111	117	120	50	74	80	81	65	137
1999a00	108	122	90	116	93	108	111	60	79	104	101	69	131
2004a00	97	99	98	115	100	99	126	75	84	116	122	84	144
2005a00	97	99	97	116	99	101	128	77	84	119	122	85	147

	SW	UK	PO	ES	LA	LI	SK	HU	CZ	SL	CY	MT
Individual consumption												
1995a00	115	83										
1999a00	121	110	44	47	42	38	36	40	40	71	87	66
2004a00	118	103	46	52	46	44	47	54	48	71	86	67
2005a00	115	103	52	54	47	45	49	55	52	71	86	68
Alcoholic beverages, tobacco and narcotics												
1995a00	165	138										
1999a00	165	189	71	68	63	63	49	49	53	70	104	106
2004a00	137	180	58	64	55	60	66	70	64	68	136	116
2005a00	131	175	65	65	53	58	65	70	67	67	131	112
Alcoholic beverages												
1995a00	192	142										
1999a00	166	164	103	105	99	95	56	61	61	88	141	146
2004a00	163	163	92	95	98	87	79	86	85	85	165	132
2005a00	159	160	103	97	95	87	81	88	91	83	163	131
Tobacco												
1995a00	144	134										

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT
1999a00	167	211	47	44	35	31	44	41	48	58	78	82
2004a00	123	207	35	40	29	33	58	60	50	58	118	107
2005a00	115	200	39	40	27	31	56	60	52	58	112	101

Clothing and footwear

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT
1995a00	103	81										
1999a00	108	107	67	73	65	65	57	59	68	88	101	77
2004a00	110	89	70	90	80	85	83	86	96	92	100	88
2005a00	107	86	74	92	77	84	85	88	98	91	98	87

Housing, water, electricity, gas and other fuels

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT
1995a00	121	62										
1999a00	121	78	30	41	25	24	19	29	28	62	67	40
2004a00	108	75	34	47	36	30	34	37	37	57	59	34
2005a00	105	75	39	48	37	31	36	38	39	58	60	35

Household furnishings, equipment and maintenance

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT
1995a00	107	90										
1999a00	113	119	58	67	69	61	59	64	67	70	99	85
2004a00	119	109	62	70	64	65	68	68	71	79	94	97
2005a00	115	108	70	70	64	64	68	69	76	82	95	99

Health

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT
1995a00	111	81										
1999a00	112	104	29	28	24	23	26	25	28	60	88	55
2004a00	126	108	36	41	33	31	33	44	35	67	95	63
2005a00	125	109	41	43	35	35	36	46	39	67	93	64

	BL	GE	FR	LU	NL	AT	FN	GR	SP	IR	IT	PT	DK
Transport													
1995a00	103	101	109	97	115	116	129	73	90	101	86	103	142
1999a00	104	100	104	89	110	109	130	78	92	112	95	98	141
2004a00	100	103	100	92	118	110	124	80	90	113	97	91	154
2005a00	101	103	100	93	118	109	123	80	91	111	98	93	154
Personal transport equipment													
1995a00	101	95	104	99	118	116	151	118	105	129	87	137	186
1999a00	100	97	101	90	120	107	140	114	96	133	93	123	183
2004a00	99	97	97	93	116	105	126	98	98	128	101	123	187
2005a00	99	96	97	93	117	106	125	97	99	128	102	124	188
Communication													
1995a00	158	111	100	76	98	145	147	64	84	156	84	82	104
1999a00	156	111	73	74	154	134	154	74	92	109	104	93	115
2004a00	104	101	104	81	98	100	84	103	96	110	97	97	80
2005a00	106	102	105	79	95	94	76	104	97	111	98	98	79
Recreation and culture													
1995a00	104	103	108	103	94	110	121	86	92	80	90	75	120
1999a00	109	102	106	104	98	106	125	88	89	99	95	84	124
2004a00	98	102	104	107	97	100	118	87	91	110	101	87	131
2005a00	99	102	103	108	97	99	117	88	92	110	101	88	130
Education													
1995a00	112	150	95	171	101	122	115	56	78	81	73	85	130
1999a00	110	145	92	167	98	116	112	61	79	95	85	91	129
2004a00	103	128	96	163	96	105	106	62	73	112	103	95	131
2005a00	103	128	96	164	97	107	108	63	75	115	102	96	133
Restaurants and hotels													
1995a00	101	107	118	114	111	111	132	92	90	113	91	60	131
1999a00	110	97	110	105	90	100	125	107	92	120	103	83	117
2004a00	108	98	114	99	104	101	129	92	92	129	103	79	155
2005a00	109	97	113	100	104	101	129	92	94	131	103	78	155
Miscellaneous goods and services													
1995a00	103	117	106	117	106	116	120	68	76	84	71	69	133
1999a00	102	108	106	102	98	103	115	81	81	93	90	70	123
2004a00	100	101	106	104	101	105	122	77	81	118	101	88	141
2005a00	101	101	105	105	100	106	122	78	83	118	102	88	142

	SW	UK	PO	ES	LA	LI	SK	HU	CZ	SV	CY	MT
Transport												
1995a00	114	92										
1999a00	115	127	64	63	66	59	55	70	59	75	88	77
2004a00	125	118	70	68	63	65	71	83	67	82	95	89
2005a00	122	118	78	70	65	66	72	84	71	80	95	91
Personal transport equipment												
1995a00	102	94										
1999a00	107	127	86	92	105	93	79	91	89	93	152	129
2004a00	102	103	84	91	88	87	89	97	92	91	115	124
2005a00	98	103	90	84	89	81	93	97	95	86	113	122
Communication												
1995a00	123	122										
1999a00	160	161	115	77	120	89	70	81	68	58	77	127
2004a00	78	90	81	80	104	59	92	86	86	69	47	85
2005a00	73	87	92	78	97	59	96	88	100	69	44	91
Recreation and culture												
1995a00	112	84										
1999a00	126	108	56	58	50	47	43	47	45	85	101	76
2004a00	119	103	54	57	51	50	50	58	48	78	90	73
2005a00	116	102	61	59	51	51	52	60	52	79	91	74
Education												
1995a00	106	89										
1999a00	117	116	23	21	17	18	20	22	24	63	86	51
2004a00	111	115	27	25	22	20	23	35	32	64	76	52
2005a00	110	116	31	27	22	22	23	36	36	66	78	53
Restaurants and hotels												
1995a00	116	92										
1999a00	122	135	64	62	69	46	42	48	45	72	105	76
2004a00	127	120	59	63	58	56	48	61	46	67	102	71
2005a00	125	121	67	63	60	56	51	63	49	68	104	70
Miscellaneous goods and services												
1995a00	108	85										
1999a00	121	107	42	42	40	37	35	35	38	69	73	65
2004a00	125	107	45	50	42	43	46	53	46	73	85	66
2005a00	123	108	51	52	42	45	49	54	49	73	86	67

Note: Raw data from Eurostat, in percent of EU12 average (=100). BL=Belgium, GE=Germany, FR=France, LU=Luxembourg, NL=Netherlands, AT= Austria, FN=Finland, GR=Greece, SP=Spain, IR=Ireland, IT=Italy, PT=Portugal, DK=Denmark, SW=Sweden, UK=United Kingdom, CZ=Czech Republic, ES=Estonia, CY=Cyprus, LA=Latvia, LI=Lithuania, HU=Hungary, MT= Malta, PO=Poland, SV=Slovenia, SK=Slovakia.

Table A4: Mean and standard deviation of variables, 1999-2005

	EU25		EU15		EU10	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
CPL	1.488	0.087	1.536	0.039	1.420	0.091
GDP	-0.507	0.723	0.021	0.301	-1.246	0.437
PRO	-0.555	0.696	-0.041	0.280	-1.275	0.407
COM	-0.607	0.761	-0.047	0.273	-1.391	0.482
ER	2.520	2.317	2.771	2.321	2.170	2.266
PEN	3.807	1.605	3.043	1.367	4.878	1.264
OPEN	3.657	1.633	3.153	1.605	4.362	1.395
CONTROL	0.917	0.268	1.021	0.210	0.771	0.273

Note: Raw data from Eurostat. All variables are in logarithms and, apart from the exchange rate (ER), also in relative terms (EU12=100). PRO=Labour productivity, COM=Compensation of employees, PEN=import penetration (share of imports in production), OPEN=Openness to foreign trade (sum of exports and imports divided by GDP). CONTROL=Degree of price controls.

Table A5: Correlation matrix of explanatory variables, 1999-2005

EU25

	GDP	PRO	COM	ER	PEN	OPEN
GDP	1.00	0.99	0.99	-0.09	-0.47	-0.26
PRO	0.99	1.00	0.99	-0.07	-0.46	-0.25
COM	0.99	0.99	1.00	-0.06	-0.48	-0.29
ER	-0.09	-0.07	-0.06	1.00	-0.04	-0.03
PEN	-0.47	-0.46	-0.48	-0.04	1.00	0.94
OPEN	-0.26	-0.25	-0.29	-0.03	0.94	1.00
CONTROL	0.43	0.41	0.37	-0.06	-0.13	0.04

EU15

	GDP	PRO	COM	ER	PEN	OPEN
GDP	1.00	0.95	0.92	-0.70	0.19	0.38
PRO	0.95	1.00	0.96	-0.65	0.25	0.43
COM	0.92	0.96	1.00	-0.66	0.25	0.38
ER	-0.70	-0.65	-0.66	1.00	-0.13	-0.28
PEN	0.19	0.25	0.25	-0.13	1.00	0.96
OPEN	0.38	0.43	0.38	-0.28	0.96	1.00
CONTROL	0.56	0.50	0.47	-0.53	0.02	0.14

EU10

	GDP	PRO	COM	ER	PEN	OPEN
GDP	1.00	0.98	0.96	-0.12	-0.09	-0.16
PRO	0.98	1.00	0.97	-0.14	-0.07	-0.14
COM	0.96	0.97	1.00	-0.11	-0.16	-0.23
ER	-0.12	-0.14	-0.11	1.00	0.31	0.51
PEN	-0.09	-0.07	-0.16	0.31	1.00	0.96
OPEN	-0.16	-0.14	-0.23	0.51	0.96	1.00
CONTROL	-0.28	-0.36	-0.42	0.29	0.37	0.39

Note: Raw data from Eurostat. All variables are in logarithms and, apart from the exchange rate (ER), also in relative terms (EU12=100). PRO=Labour productivity, COM=Compensation of employees, PEN=import penetration (share of imports in production), OPEN=Openness to foreign trade (sum of exports and imports divided by GDP). CONTROL=Degree of price controls.

Table A6: Price convergence in terms of broad categories and basic headings

EU15

	Broad categories	Basic headings
β-convergence		
CPL_{t-1}	0.931 (0.011)	0.578 (0.008)
Dummy*CPL_{t-1}	-0.054 (0.022)	
Speed of convergence	0.07	0.24
Half-life	9.8	2.9
σ-convergence		
Time trend	-0.032 (0.001)	-0.207 (0.005)
Dummy*Time trend	0.016 (0.001)	

EU10

	Broad categories	Basic headings
β-convergence		
CPL_{t-1}	0.935 (0.005)	0.703 (0.065)
Dummy*CPL_{t-1}	-0.048 (0.018)	
Speed of convergence	0.07	0.15
Half-life	10.3	4.5
σ-convergence		
Time trend	-0.064 (0.002)	-0.013 (0.001)
Dummy*Time trend	0.028 (0.003)	

Note: Sample period 1999-2005 for broad categories, 2000-2004 for basic headings, Luxembourg excluded. Dummy is equal to 1 from 2004 onwards, 0 elsewhere. Arellano-Bond estimation (β-convergence), OLS regression (σ-convergence). Numbers in parentheses denote standard deviations. 6.888 observations for broad categories (24 countries×41 indices×7 years), 32.280 observations for the basic headings (24 countries×269 indices×5 years). The original number of basic headings (279) has been reduced by 10 outliers.

Table A7: Price convergence in terms of groups of basic headings

EU15

β-convergence

	Non durables	Semi durables	Durables	Services	Equipment	Buildings
P_{t-1}	0.585	0.344	0.343	0.832	0.727	0.739
	(0.016)	(0.009)	(0.008)	(0.008)	(0.012)	(0.008)
Speed	0.54	1.07	1.07	0.18	0.32	0.30
Half-life	1.3	0.7	0.6	3.8	2.2	2.3
σ-convergence						
Time trend	-0.211	-0.208	-0.210	-0.199	-0.221	0.179
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)

EU10

β-convergence

	Non durables	Semi durables	Durables	Services	Equipment	Buildings
P_{t-1}	0.725	0.243	0.714	0.997	0.764	0.794
	(0.091)	(0.111)	(0.074)	(0.010)	(0.188)	(0.055)
Speed	0.32	1.42	0.34	NA	0.27	0.23
Half-life	2.2	0.5	2.1	NA	2.6	3.0
σ-convergence						
Time trend	-0.015	-0.012	-0.022	-0.008	-0.025	-0.016
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)

Note: Sample period 2000-2004, 24 countries, Luxembourg excluded. Arellano-Bond estimation (*β*-convergence), OLS regression (*σ*-convergence). Numbers in parentheses denote standard deviations. Basic headings are split into 69 non durables, 26 semi durables, 29 durables, 75 services, 20 for investment in equipment and 15 for buildings. 45 basic headings could not be classified. NA=A reasonable estimate cannot be reported, as the speed of convergence is close to 0.

Table A8: Determinants of relative prices (CPLs)

EU15

	Broad categories	Basic headings
Catching up	0.0003 (0.001)	0.025 (0.004)
Import penetration	-0.011 (0.001)	-0.004 (0.001)
Price controls	-0.003 (0.002)	-0.003 (0.001)
R^2 within	0.150	0.158
R^2 between	0.413	0.142
R^2 overall	0.379	0.160
F-statistic	27.8 (0.000)	14.7 (0.000)
Hausman statistic	132.1 (0.000)	44.6 (0.000)

EU10

	Broad categories	Basic headings
Catching up	0.016 (0.001)	0.065 (0.004)
Import penetration	-0.009 (0.001)	-0.007 (0.001)
Price controls	0.006 (0.002)	0.019 (0.002)
R^2 within	0.309	0.477
R^2 between	0.224	0.301
R^2 overall	0.228	0.330
F-statistic	122.0 (0.000)	135.2 (0.000)
Hausman statistic	3.4 (0.949)	7.9 (0.080)

Note: Sample period 1999-2005 for broad categories, 2000-2004 for basic headings. 24 countries, Luxembourg excluded. Panel models estimated with two way fixed effects. Numbers in parentheses denote standard deviations. 6.888 observations for broad categories (24 countries×41 indices×7 years), 32.280 observations for the basic headings (24 countries×269 indices×5 years). The original number of basic headings (279) has been reduced by 10 outliers. Numbers in parentheses below *F*- and Hausman statistic denote *p*-values.

Table A9: Determinants of relative prices (CPLs) for groups of basic headings

-EU15

	Non durables	Semi durables	Durables	Services	Equipment	Buildings
Catching up	0.023 (0.011)	0.002 (0.017)	0.010 (0.014)	0.041 (0.007)	-0.111 (0.037)	0.080 (0.045)
Import penetration	-0.004 (0.002)	-0.002 (0.002)	-0.001 (0.001)	-0.002 (0.002)	-0.005 (0.003)	-0.005 (0.003)
Price controls	-0.005 (0.002)	-0.013 (0.004)	-0.009 (0.003)	-0.001 (0.002)	-0.010 (0.004)	-0.000 (0.006)
R^2 within	0.048	0.157	0.124	0.020	0.024	0.026
R^2 between	0.230	0.603	0.179	0.190	0.206	0.210
R^2 overall	0.230	0.432	0.172	0.120	0.212	0.234
F-statistic	3.1 (0.025)	3.9 (0.009)	3.4 (0.018)	12.7 (0.000)	2.4 (0.028)	1.5 (0.193)
Hausman statistic	14.4 (0.000)	15.3 (0.000)	6.3 (0.150)	5.9 (0.189)	5.8 (0.192)	0.0 (—)

-EU10

	Non durables	Semi durables	Durables	Services	Equipment	Buildings
Catching up	0.067 (0.010)	0.119 (0.011)	0.043 (0.008)	0.063 (0.005)	0.112 (0.011)	0.023 (0.013)
Import penetration	-0.004 (0.003)	-0.007 (0.002)	-0.007 (0.001)	-0.003 (0.002)	-0.002 (0.001)	-0.000 (0.001)
Price controls	0.007 (0.006)	-0.002 (0.003)	0.004 (0.003)	0.017 (0.003)	0.011 (0.004)	-0.010 (0.007)
R^2 within	0.024	0.114	0.092	0.114	0.125	0.050
R^2 between	0.205	0.101	0.253	0.452	0.398	0.135
R^2 overall	0.209	0.112	0.290	0.384	0.415	0.201
F-statistic	17.1 (0.000)	26.6 (0.000)	23.4 (0.000)	56.2 (0.000)	40.0 (0.000)	2.0 (0.113)
Hausman statistic	36.1 (0.000)	4.6 (0.430)	4.3 (0.452)	17.4 (0.000)	8.0 (0.067)	0.0 (—)

Note: Sample period 2000-2004, 24 countries, Luxembourg excluded. Panel models estimated with two way fixed effects. Numbers in parentheses denote standard deviations. Basic headings are split into 69 non durables, 26 semi durables, 29 durables, 75 services, 20 for investment in equipment and 15 for buildings. 45 basic headings could not be classified. Numbers in parentheses below *F*- and Hausman statistic denote *p*-values.