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Economic Integration in Europe and Income Divergence over EU Regions (1995 – 2006)

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Abstract

This paper tests the question whether the integration process in the EU has contributed to the often-observed growing dispersion of income over the regions of the EU, in the presence of convergence between the member states. We do this by introducing price convergence as an indicator of integration and controlling for the concentration of skilled labour and allowing for path dependency. Our main findings are in line with the expectations of the New Economic Geography School in that integration does contribute to the growing regional inequality in the EU. Price convergence is a significant explanatory variable even after the introduction of a time lag in the dependent variable.

Keywords: Economic integration, Regional inequality, European Union

JEL classification: F11, F15, F22, R11

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1. Introduction

The empirical question whether the integration process in the European Union (EU) has brought the member states and their regions closer to the same level of welfare is relevant for discussions about cohesion and for designing policies to bring this about. Although much research has been done to establish the facts about the spatial income distribution in Europe, papers that empirically test the hypothesis that the integration process explains the facts of convergence and divergence in the EU, are scarce. This paper investigates this causal relationship. We do this by using convergence of prices in the member states to the EU average as the measure for integration, instead of the development of internal trade shares, openness to regional economic transactions in trade or flows of labour and capital or institutional and social interaction. Integration of markets requires the abolition of border measures and policy-induced distortions in relative prices as well leading to lower trade costs. To the extent that markets are merged by these various measures, prices convergence. Price convergence thus measures the combined effect of policies that are otherwise difficult to lump together. We also employ the concentration of skilled labour and path dependency of regional inequalities in our study. Our main findings are that integration thus measured has indeed contributed to divergence in the distribution of income across EU regions. This result holds after controlling for concentration of skilled labour, that has an independent explanatory power for the divergence over regions and taking into account different systems of wage bargaining.

Although economic and social cohesion – the elimination of territorial disparities in economic development and in access to labour and income respectively - have been important objectives of integration in the EU (Molle 2007), a number of recent studies – including Magrini (1999), Sapir et al. (2003), Marelli (2007) - find divergence of per capita incomes over regions inside member states, in combination with a convergence of per capita incomes among member states. Neo-classical economic theories and the factor price equalization theorem in particular, posit convergence as the likely result of regional economic liberalization. On the other hand, theories in the school of geographical economics argue that integration is a stimulus of agglomeration that may lead to regional income divergence.

The debate on spatial income inequality takes place at two levels: whether convergence should be an objective, and if yes, how it should be realized. Reducing the disparities over the EU regions is defended on arguments of solidarity and by the idea that support for integration will be eroded if integration itself creates a growing income gap between the rich and poor regions. It has also been argued (Kaldor 1970) that a balanced development is necessary in order to realize the full potential of the economy concerned. An argument against a cohesion policy as such is that regional divergence is linked to structural changes in the economy and its environment, that bring the economy at a higher growth rate; introducing spatially differentiated policies for lagging areas have often been ineffective and even counterproductive (World Bank 2009). Other arguments are that the internal inequality is the prime responsibility of the members states themselves, the more so if integration enables the poorer ones to catch up.

Cohesion is pursued in the EU through policies of convergence – such policies aim at enabling target areas (regions having less than 75 per cent of EU average GDP per capita) to improve their economic performance.[1] The European Commission's 4th Report on Economic and Social Cohesion (2007) finds an aggregate convergence in the EU. However, at NUTS2 level, the effectiveness of the cohesion policies turns out to be very small. Such findings are in line with Rodriguez-Pose and Fratesi (2004) who postulate that providing hard infrastructure and assistance to firms are unlikely to increase the competitiveness of the lagging areas. In fact, concentration of economic production has been increasing within the EU. Dall'Erba (2003) finds that Ireland, though one of the richest EU members, has greater spatial concentration of economic activities compared to Greece, Spain and Portugal.

This paper does not address all these issues, but takes up the question whether integration has contributed to the combination of convergence and divergence. This causality will be studied by using price convergence as an indicator of progress in regional economic integration. We will also briefly address the preliminary question whether there is indeed this combination of divergence among national regions and convergence among the member states.

The composition of the paper is as follows. Section 2 presents a brief discussion of existing theory along with a brief survey of relevant empirical literature. Section 3 presents a calculation of the convergence and divergence in the EU and a discussion of the variables that may be used to represent the driving forces that have been identified in the literature. In section 4 we present the variables and model specifications we have used for the present study. Section 5 summarizes the results obtained while section 6 concludes.

2. A brief survey of the literature

2.1. Theoretical Background

Most of the literature that studies the effect of integration on factor prices starts from the factor price equalization (FPE) results of the Heckscher – Ohlin – Samuelson (HOS) theory. The standard HOS model considers a 2-factor 2-commodity framework and shows that under free trade the relative factor prices will be equalized across the countries under strict inter-country immobility of the factors of production. This basic model has been, over time, extended incorporating imperfect competition (Helpman and Krugman 1985) on the one hand and *n* factors – *m* commodities on the other (Dixit and Norman 1980, Woodland 1982). The FPE results seem to hold as long as there exists free and full inter-sector mobility of factors of production and the number of commodities exceeds the number of factors of production considered. However, in absence of sectoral mobility of the factors (for example, in case of specific factor models) both HOS and the Stolper – Samuelson

[1] The €236 bn Agenda 2000 of the EU included €195 bn for structural adjustments of the lagging areas, €18 bn Cohesion funds for Greece, Ireland, Portugal and Spain, €22 bn for the new member states.

results may not hold (Ruffin and Jones 1977, Kenen 1989) . FPE may not hold under a number of circumstances including the presence of scale economies (particularly IRS), trade in intermediate goods, non-tradable goods and international mobility of capital (Chipman 1966). In particular, Laing (1961) concluded that FPE does not hold under the assumptions of IRS and homothetic production functions. Under perfect competition economic integration enhances the chance of FPE to hold or at least convergence of factor prices. However, under imperfect competition and scale economies, economic integration may induce inequality in both industrial structure and income levels (Baldwin and Venables 1995). Venables (2003), using a computable general equilibrium model, shows that customs union membership will lead to convergence of income levels within a union of high income member countries and divergence within a union of low income member countries.

Venables (2005) constructs a two sectors three factors model with Cobb–Douglas preferences and technologies with one sector specific immobile factor to show that the existence of more non-traded factors of production than traded goods will lead to violation of FPE theorem. Further, if trade boosts the mobility of factors (irrespective of its cause, such as differences in patterns of factor endowment, technology or goods tradability), FPE will not hold either.

Compared to the neo-classical trade theory, the literature on economic geography has a somewhat separate but bold theoretical stand on the effects of economic integration on income distribution. This branch of literature analyzes the distribution of income on the basis of the spatial distribution of economic activities. There are two forces that guide spatial distribution of economic activities within and across nations – agglomeration and dispersion forces. Two most important agglomeration forces are demand and cost linkages[2]. The concept of demand linkage states that a firm prefers a location in a large market where it can sell large quantities of its produce. As it relocates, workers also migrate and the process makes the large market larger. The theory of cost linkage, on the other hand, suggests that a firm chooses a location with a high concentration of other firms because of cheaper and easy access to intermediate goods and services required in the production process. Such a choice of location by a firm boosts spatial concentration of economic activities. Dispersion forces include local competition, high built-up costs and congestion. However, deeper economic integration results in the weakening of the dispersion forces and strengthening of agglomeration forces. This is caused by lower trade cost, which reduces the benefits from less local competition on the one hand and enhances the benefits accruing from economies of scale on the other hand (Krugman 1991b). More spatial concentration would thus be the result of economic integration (Baldwin and Wyplosz 2009).

The core-periphery (CP) model (Krugman 1991b; Martin 1999) is a cornerstone of economic geography. The CP model is driven by three forces, viz., market access effect, cost-of-living effect and market crowding effect. The market access effect postulates that firms try to locate in a big market, the cost-of-living effect describes that concentration of

[2] Also known as backward and forward linkages, Hirshman (1958).

firms in a particular location makes goods cheaper in the local market and the market crowding effect argues that competition drives away firms to a location with lower concentration of economic activities. The first two forces combine to form the agglomeration force while the third accounts for the dispersion force. With deeper integration, trade costs decline and after a "break point" freer trade results in stronger agglomeration forces over dispersion forces, leading to spatial concentration of economic activities. Moreover, such agglomeration processes may take place at an accelerating speed after passing the break point. In fact, in case of multiple equlibria, there exists locational hysteresis. Under the CP framework, the agglomeration force (created via backward and forward linkages) is self-enforcing. The mechanisms of the CP model that have been discussed include physical and human capital mobility, technology spillovers and input-output linkages (Baldwin et. al. 2003). Brülhart and Torstensson (1996) use regional data for nine EU countries and seven sectors for the period 1976 – 1985 to test their model that assumes the world to consist of three countries, two industries (of which one is characterized by increasing returns to scale) and one factor of production (labour). These authors find that a sufficient fall of internal trade cost (integration) leads to a growing concentration of the increasing returns to scale industries. They add the consideration that higher factor cost in the centre may counteract the centripetal forces which will ultimately lead to dispersion of the industry concerned.

So far, the literature on economic geography suggested that deeper economic integration will encourage agglomeration. Puga (1999) uses a general equilibrium model with a sector specific factor to address the issue of whether spatial agglomeration of industries and ensuing spatial concentration of income takes place as economic integration deepens. He observes that such causality depends on whether workers migrate (either inter-region or trans-country) in response to income differentials. He also observes that linkages lead to agglomeration of increasing returns activities as trade costs fall. Puga argues that spatial agglomeration of firms increases local wages. To the extent that workers migrate from other regions, wage differentials are reduced. However, falling trade costs encourage firms to relocate according to wage differentials and as a result, if workers are sticky in terms of migration, firms tend to disperse spatially. Puga uses his theoretical argument to explain empirical findings like rising income inequality across regions within countries and falling income inequality across countries. This explanation corroborates the results of Brülhart and Torstensson (1996). Two remarks have to be made here. First, wage differentiation over regions is prevented in some countries by centralized wage bargaining. This would hamper the dispersion of firms to peripheral regions, up to the moment that absolute scarcity of labour forces firms to relocate. This relocation will be less urgent if labour migrates from peripheral regions. Second, at the level of the EU, there is no central wage bargaining while labour mobility is rather small, due to language barriers, cultural differences and high social adjustment costs (Haaland and Norman 1995). Bentolila (1997), Faini et al. (1997) and Giannetti (2001) provide empirical evidence that during the 1980s and 1990s cross-border migration in Europe has been limited and involved almost only skilled labour. This has dampened the agglomeration process over the EU. At the same time, the degree of labour mobility is higher within member states, which reinforces the agglomeration force at the national level. This observation may partly explain the apparent

paradox of decreasing income dispersion across EU member countries and increasing income disparity across national regions of EU member countries.

2.2. Empirical Studies

The literature on income convergence in Europe is extensive and empirical studies have generated diverse results. Most of the literature deals with the issue of whether there has been convergence or divergence within and/or across European countries and/or regions. Ben-David (1993) finds convergence within the EU using standard deviations of log per capita income across countries for the period 1951 – 1985. He argues that the rapid growth of lower income countries is the main reason for this convergence. Magrini (1999) uses a time homogeneous Markov Chain process with discrete income space to analyze the cross-sectional distribution of per capita income for 122 Functional Urban Regions for the period 1979 – 1990. He finds that economic growth in the European countries during the 1980s is associated with a tendency towards divergence. He uses the same analysis for 169 NUTS2 regions and observes that a group of high income regions has the tendency to grow away from other regions which confirms the earlier finding for functional urban regions. However, the rest of the regions exhibit a tendency towards absolute convergence at a lower level. Magrini's observations for both type of administratively defined regions exhibit a pattern of high income regions converging to a higher level of income while the low income regions converging to a lower level of income.

Sapir et al. (2003) use sigma and beta convergence techniques and find a convergence in per capita income between European countries but divergence in per capita income between regions within a country for the time period 1980 – 2000.

Morrisson and Murtin (2003) use data from the Luxembourg Income Study and the European Community Household Panel to estimate a measure of income inequality for the years 1970, 1980, 1990, 1995 and 1998. They find a decrease in income inequality across countries but an increase in inequality within countries from 1980 to the late 1990s.

Marelli (2007) measures regional dispersion using coefficient of variation of regional per capita incomes for 250 NUTS2 European regions for the period 1980 – 2005. He observes a trade-off between "international convergence and inter-regional convergence" for the new EU (10) members. He uses the Krugman Specialization Index and finds a decreasing trend in specialization across European countries and regions. Such an observation is directly opposite to findings of Midelfart-Knarvik and Overman (2002). Marelli observes an absolute beta convergence for European regions as well. However, growing disparities are observed in the EU (10) countries.

Breuss (2007) uses data for EU(15) and 2 non–EU nations (Japan and the USA) over the period 1992 – 2005 to analyze the effect of free trade and foreign direct investments (FDI) on income distribution. Breuss develops a 2 × 2 × 2 CGE model and observes a decline in the labour income share as a consequence of globalization, although the impact of free trade on the income distribution is ambiguous.

Hierro and Maza (2009) use a causative transition matrix model (which is non-stationary Markov Chain process) to address the issue of the structural shifts in the dynamics of income distributions of the EU. Using data for the relative per capita income for 196 NUTS2 regions of EU(15) for the period 1980 – 2005, they find a "notorious" decline in regional disparities for the 1980 - 1993. However, for the period 1993 – 2005 they observe a "negligible" decline in the same.

Hoffmeister (2009) uses the mean logarithmic deviation of mean income levels across regions, countries and larger geographical areas of EU (25) in private household income data of the Luxembourg Income Study for the periods 1994 – 1995 and 1999 – 2000. Hoffmeister finds convergence in both average national income levels and within-country personal income inequality suggesting increase in inequality in the Scandinavian countries and a decrease in inequality in the Mediterranean countries.

Martin et al. (2009) use European Community Household Panel data for a sample of 14 countries [EU(15) excluding Sweden] with six observations (1995 – 2000) for comparable disposable money income distributions. They calculate the Gini Index for the 14 countries in aggregate. They observe a pattern of declining inequality across the EU as a whole and find sigma convergence from 1998 onwards. The most interesting observation they make is that Spain, Portugal and Greece converge to a higher steady state of inequality while the rest of the countries converge to a lower steady state of inequality.

In contrast to the papers discussed above, Giannetti (2002) tests a causal relationship between integration and convergence in the EU by assuming that regions specialized in high-tech sectors will gain more from the increased knowledge spillovers that more FDI will bring than regions specialized in traditional sectors. The increased FDI is supposed to result from economic integration. Giannetti assumes a perfectly competitive general equilibrium framework with two final goods (high-tech and traditional) and two factors of production (skilled and unskilled labour) and Cobb-Douglas production functions while empirically considering 108 NUTS2 regions in 11 countries – EU(15) excluding Austria, Finland, Sweden and Luxembourg. The effect of integration is estimated by including a dummy variable for membership of the EU for Greece, Spain and Portugal in a growth equation for the regions. The author finds support for her hypotheses. Knowledge spillovers bring convergence across regions that can competitively produce goods involving high-end technologies. As the high-tech sector contributes more to the total output, countries also converge in terms of per capita income. However, there exist regions within countries, which are dedicated to the traditional goods. Hence, disparities are amplified across the regions within a country.

3. Spatial Income Distribution and integration

Economic integration lowers trade cost of transactions among the member states, which encourages agglomeration forces in order to exploit economies of scale. This leads to spatial concentration of economic activities. At the start and the early stages of integration, the EU economies were still separated from each other by a host of market access barriers. This resulted in a level of specialization of national economies that was at a lower level

than comparable regions in the US (Krugman 1991a). The Internal Market Programme was introduced to completely abolish these trade barriers. Interestingly, Midelfart-Knarvik and Overman (2002) found, using the Krugman Specialization Index, that all the EU (15) countries except the Netherlands have become more specialized and are diverging from the average EU industrial structure. Indeed, the economic core of the EU consists of Western Germany, the Benelux countries, North-eastern France and South-eastern England – a zone consisting of 1/7th of the land, 1/3rd of the population and half of the economic activities of Europe.

3.1. Convergence and divergence

We use the dispersion of GDP Per Capita (PPP) of member states (regions) as a percentage of the EU (national) average as a measure of income inequality among the member states or the regions as the case may be. The coefficient of variation is used to measure dispersion. This measure has the advantage that it can be used over unequal quantities. In this paper we study the issue of convergence in the EU over the period 1980 to 2006 for the EU of 15 member states and their regions. This makes our results comparable to earlier studies and enables us to use data for a sufficient number of observations. Convergence occurs if there is a falling dispersion of GDP per capita over the member states (regions). This result is driven by Luxembourg. This country had a higher GDP Per Capita initially and over time this difference with other member states has grown. If we exclude Luxembourg, we find a decreasing dispersion of GDP Per Capita across the member states of EU(15) over the same time period (figure 1).

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Here Figure 1. Dispersion of GDP per capita over EU(15) member states excluding Luxembourg

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The dispersion of income across the regions (NUTS 2) within countries is shown in figure 2. We find more or less constant values of income dispersion with the exception of Austria, Belgium and Greece, where there was a slight fall of inequality. In contrast to the other member states, the UK shows a higher and increasing level of income disparity. Taking all regions (NUTS 2) together, and calculating dispersion with respect to the EU average, we find an increasing dispersion in regional incomes (figure 3). Our results confirm the earlier papers that there is a trend to more equality of income per capita among the EU(15) member states, while there is a trend of divergence over the regions of the EU. The next step is to find out whether integration has contributed to this development.

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Here Figure 2. Dispersion of Regional Income (Across NUTS2 Regions) within Countries
Figure 3. Dispersion of Regional income over all NUTS 2 Regions

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Our calculations mostly confirm the finding of convergence among member states and increased within-country inequality among regions that was reported by Ben David (1993), Morrison and Martin (2003), Sapir (2003) and Martin et al. (2009), and show that these

processes have continued after 2000. The next question is whether integration explains the divergence of income over regions.

3.1. Economic Integration

Economic integration is a multi-faceted phenomenon and goes much deeper than free trade in goods, services and factor mobility. The establishment of fair competition involves policy harmonization in numerous areas of policy making. This makes the measurement of integration a difficult task. Although there is a need for a system of indicators of regional integration, this is non-existent at the moment (De Lombaerde and Van Langenhove 2005). Capannelli c.s. (2009) develop a set of indicators to measure integration in Asia. This set encompasses economic indicators such as trade openness, the share of intra-trade in total trade, flows of foreign direct investment, financial integration, output correlation and income gaps between countries and socio-political indicators (social interaction, number of regional political fora, density of trade agreements etc.). Such a set of integration measures resembles the proposed measures for integration at the global level (Dreher 2006; Heshmati 2006; Kearney 2006). In order to arrive at one indicator, a composite measure may be constructed. However, such a measure has methodological problems if used in statistical analyses, such as time series and panel analyses using OLS or fixed effects.
Empirical research often uses one, directly measurable factor. This maybe one of the above mentioned variables such as intra-trade or the flow of FDI or the convergence of price levels. We take a closer look at two of them.

Trade shares

During the early stages of economic integration of the 1960s tariffs and quantitative restrictions on intra-EU trade were abolished. As a result, there was a relative shift of the origin of imports of the EU members: the share of imports coming from the other member states rose from 30 per cent in 1958 to almost 50 per cent in 1970 (Baldwin 2009). Hence, the intra-EU trade share for the member states could be considered as an indicator of economic integration. With deepening of economic integration trade costs will decrease further, thus increasing demand for EU goods in the member states. This would increase the intra-trade share even more. However, except for Denmark, Luxembourg, the Netherlands and the UK, the rest of EU (15) countries exhibit a similar trend of rising intra-EU trade share (total) from 1995 –1999 and a sharp fall from 1999 onwards. Denmark and the Netherlands exhibit a more or less constant intra-EU trade share over the period 1999 – 2006. For Denmark and UK the trend is an increasing one till 2002 and decreasing from 2003 onwards. Except for Belgium and Luxembourg we have considered the time period of 1995 – 2006 and for these two countries we have data only from 1999 onwards. The reason for the variation in the development of intra-EU trade shares probably is that they depend not only on the volume and prices of intra-EU trade but also on the volume and prices of trade with the rest of the world. Hence, the results depend on the overall trade pattern of a particular EU member state. One important factor here is the dependence of member states on external energy imports. Rising and falling energy prices will lower and increase the intra-trade share. For the EU as a group, there is a substantial correlation

between the share of intra-imports in total imports and the price of crude oil.[3] Moreover, structural break analysis of total trade share for the EU(15) member states over the period 1980 – 2006 yield no specific pattern with Austria, Denmark, Greece, Luxembourg and Netherlands exhibiting structural breaks in their intra-EU trade shares during the period 1995 – 2006.

Baier and Bergstrand (2001) estimate a cross-section gravity equation and conclude that income growth and tariff reduction are the propelling factors behind the phenomenal growth of intra – EU trade from 1950's to late 1980's. Badinger and Breuss (2004) find that intra – EU trade has increased by 1200 per cent in real terms during the period 1960 – 2000. They use a panel data approach to a gravity model based on Baier and Bergstrand (2001) for 182 bilateral trade flows over the period 1960 – 2000. They observe that income growth has been the major driving force behind increased bilateral trade volumes along with tariff reduction and increased income similarity. Both these works, however, suggest that reductions in transport cost play virtually no role behind the phenomenal growth of intra – EU trade during 1960 – 2000. Wang, et. al. (2010) develop an extension of the original gravity model by incorporating research and development (R&D) and FDI for a panel data analysis of 19 OECD countries for the period 1980 – 1998. They argue that the domestic R&D stock, R&D similarity, inward FDI and inward FDI stock are important causes of increased trade flows. They incorporated transport cost into the gravity model for the same sample but interestingly found a negligible but negative relation between trade flows and transport costs for the period 1980 – 1998.

The conclusion we draw is, that the share of intra-trade in the member states' total trade is indeed determined to some extent by economic integration. However, there are many other forces at work, which make the intra-trade share a less-than-perfect measure for integration.

Prices

Economic integration leads to the merging of both commodity and factor markets making suppliers in all member states each other's competitors. Such integrated and competitive markets will lead to a convergence of prices across the member states, in particular for traded goods. The same effect is likely for non-traded goods as proposed by the Balassa-Samuelson hypothesis (Rogers 2007). According to the 1990 report of the European Commission "One Market, One Money", the euro would deepen integration by lowering exchange-rate risks, diminishing uncertainty/ volatility, lowering transaction costs leading to a saving in the tune of 1 per cent of EU(15) GDP. In its 1996 report the European Commission while sticking to its earlier view on the single currency added that it would increase price transparency and increase competition, which in turn would reduce price discrimination in national markets. During the launch of the euro on 1st January 1999, the European Commission (1999) proclaimed that it would "squeeze price dispersion in EU markets".

[3] For the period 1980 to 2008, the correlation between this intra-trade share and crude oil prices (in constant dollars) was -0.60.

Empirical research confirms these expectations. Faber and Stokman (2004) give a detailed account of price movements in Europe for the period 1960 – 2003. They analyze the trend of price dispersion across the European countries for the said period using aggregate data on consumer prices (scaled harmonized indices of consumer prices - HICP) and found strong evidence of price convergence in the EU and mention cost convergence, harmonization of trade and taxes and exchange rate stability as the causal factors. Allington et. al. (2005) find considerable evidence of price convergence in the EMU region for 115 tradable goods for the period 1995 – 2002. Beck and Weber (2006) report a decline in initial relative price dispersion by 80-90 per cent using both aggregated and disaggregated data for 86 European cities (in Germany, Austria, Switzerland, Italy, Spain and Portugal) and for seven categories of goods over 1991 – 2004. Rogers (2007) compares price dispersion between the USA and the EU, using local prices of consumer goods and services in 25 European cities and 13 US cities between 1990 and 2004. This author finds strong evidence of price convergence in the EU, most of which occurred in the first years of his research period, when the Internal Market was completed. The price convergence was close to that in the USA.

Using the method of Faber and Stokman (the absolute deviation of all-commodity HICP for the EU(15) average for each year and for each member state) we have calculated price dispersion in the EU(15) from 1996 to 2008. Prices have converged monotonically till 2005. In later years some dispersion took place.

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Here Figure 4. Price dispersion across EU (15) during 1996 – 2009

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Price convergence or divergence may occur due to several other reasons than economic integration. Particularly in the short run, prices may diverge due to such factors as home-product bias, exchange rate volatility, asymmetric shocks, business cycles and various other reasons (Allington et al. 2005). However, over time the law of one price will prevail to the extent that markets and policies are integrated. Thus, convergence of prices is a good approximation for economic integration as it considers the product, services and factor markets. Price dispersion is measured by the absolute deviation of all-commodity HICP from the EU(15) average for each year and for each member state.

Euro

The Euro was officially launched on 1st January 1999, first for interbank transactions and for accounting purposes. The common currency was brought into circulation in 2002. This step was likely to fasten the process of price convergence among the Euro-using member states[4]. In this study we consider time dummies for different phases of introduction and

[4] Denmark, Sweden and UK are not a part of the Euro Zone. Greece joined in 2001. The other 11 countries joined in 1999.

circulation of the euro so as to capture any change in trend/pattern in price levels. In particular we consider three time dummies –

i) T_1 for pre 1999 years
ii) T_2 for the period 1999 – 2002
iii) T_3 for post 2002 years

Centralization of wage bargaining

Price convergence is a good measure for integration because it takes up a host of integration measures, such as integration through the abolition of internal borders and the unification or coordination of seemingly unrelated areas like consumer and environmental protection policies. However, other forces than integration affect divergence of regional incomes as well. First, agglomeration is dependant on the relative wage developments of the regions concerned, as explained in section 2. If wages are flexible over regions, agglomeration will lead to rising wages compared to the periphery, thus making the latter region more attractive to invest. There are remarkable differences among the member states in terms of the negotiations of wages. In some members negotiations on wages take place at firm or plant level, while in others this takes place at the industry level maybe coordinated at the national level (OECD 2004). In the latter case, the same wages are paid in all regions, which will be conducive to agglomeration, as peripheral regions will not become more attractive for investors as a result of lower wages. The expectation is, that the degree of centralization of wage bargaining is thus positively related to the income inequality over regions. The OECD scores countries on a 1 to 5 scale of wage bargaining centralization. At the lowest scores, company and plant level negotiations are predominant, while at score 3 this applies for the industry level. If there is coordination between the industry negotiations countries get a score of 4 or 5 (OECD 2004: 151). As there are no annual data given in OECD (2004) – and if they were available would probably be highly constant, as they represent national traditions – our panel regressions do not allow us to include this variable. We will therefore separate the countries in two groups, one where wage bargaining is decentralized (scores up to 3) and one where this centralized (scores 3 and higher).

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Here Table 1

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Dispersion of skilled workers

Second, regions will have different specializations which means that they are likely to differ in intensity of skilled labour used in production. This will also have an impact on the dispersion of income over regions. We would like to have used specialization data at NUTS2 regions, but these are not available. Average per capita incomes over regions will diverge with the distribution of skilled workers, as more income will be generated in regions having higher concentration of skilled labour force. We use the dispersion of labour force with education level 3 – 6 (ISCED) as a percentage of total national labour force. We

find an increasing dispersion of this variable when we consider regional (NUTS 2) data for EU(27) member states. However, data for this measure is available only from 1999.

Figure 5. Dispersion of Employment by Education (ISCED) in NUTS2

Path dependency

Third, agglomeration is often characterized by path dependency. Once an agglomeration has arisen, it has created its own forces for its continuation. Being a big market, having a large pool of workers and institutions that create knowledge give existing agglomerations a natural lead over potential new agglomerations and clusters. As a result the divergence of incomes over regions within countries can be explained to some extent by the dispersion of regional income in the past.

4. Variables and Model Specifications

Before proceeding to the model specifications, we first explain the measures used. Suppose there are *n* NUTS2 regions within the *i* th country and the number of years being *t*. $DI_{i,t}$, the dispersion of GDP Per Capita (PPP) as a percentage of national average, has been used to measure distribution of income. The higher the value of $DI_{i,t}$ is, the more dispersed is income distribution. The dispersion of regional income (*DI*) is calculated by first taking PPP per capita income as a percentage of EU average, for each region within a country for a given year. Then we calculate coefficient of variation (CoV) across all the *n* regions for the *i*th country for *t*th year. Hence for each country *i* we get $DI_{i,t}$ for each year *t*.

$$DI_{i,t} = CoV\left(\frac{\text{PPP per capita of the nth region}}{\text{EU average PPP per capita}}\right)$$

$DEVABS_{i,t}$, the absolute deviation of all-commodity HICP from the EU(15) average, has been used to approximate the degree of economic integration. The lower is the value of $DEVABS_{i,t}$, the higher is the degree of economic integration with the highest level of economic integration being achieved when the value of $DEVABS_{i,t}$ is zero. *DEVABS* is calculated by starting from the HICP (all items) for each NUTS2 region within each country for each year. Then we measure coefficient of variation (CoV) across all the *n* regions for the *i*th country for *t*th year. The next step is to calculate HICP (all items) for each country for each year and calculate the CoV for each year across all the countries to arrive at the EU average. Finally we take the absolute mean deviation for each regional value from the EU average to arrive at $DEVABS_{i,t}$.

$$DEVABS_{i,t} = \left| MD\{CoV(HICP_i) - CoV(HICP_n)\} \right|$$

$TSHARE_{i,t}$ is the total intra-EU trade share of each of the EU(15) member countries except for Luxembourg. We arrive at the trade share index (*TSHARE*) by first calculating the total intra–EU trade for a given year and then constructing TSHARE for the *i*th country as total trade (exports + imports) of the *i*th country with the rest of the EU members as a ratio of total intra-EU trade for a given year *t*.

$$TSHARE_{i,t} = \left(\frac{\text{ith country's total trade with rest of the EU}}{\text{Total intra-EU trade}}\right)$$

Finally, $DSKL_{i,t}$, the dispersion of higher skilled workers as a percentage of total national labour force, is included to explain the dispersion of regional income. *DSKL* is calculated by taking the population with education level ISCED 3 – 6 as a ratio of total working population for each region within a country for a given year. Then we calculate coefficient of variation (CoV) across all the *n* regions for the *i*th country for *t*th year. This gives for each country *i* the $DSKL_{i,t}$ for each year *t*.

$$DSKL_{i,t} = CoV\left(\frac{\text{Population with ISCED 3-6 in the nth region}}{\text{Total working population in the nth region}}\right)$$

Specification I

For regional analysis we estimate the following equation by using both fixed and random effect panel regressions. The regional (NUTS 2) data cover the period 1995 – 2006.

$$DI_{i,t} = \beta_1 + \beta_2 DEVABS_{i,t} + \beta_3 DSKL_{i,t} + \beta_4 T2 + \beta_5 T3 + \varepsilon_{i,t} \quad \ldots\ldots\ldots \quad (1)$$

This is our basic equation that explains income inequality over EU regions from integration, the dispersion of skilled workers and the introduction of the euro.

Specification II

As an alternative measure for integration, intra-EU trade shares of the member states can be used. Hence, an exercise of re-running the panel regressions incorporating an index of intra-EU trade share instead of the price convergence variable can check for the robustness of the already estimated model. We incorporate TSHARE for the following equation

$$DI_{i,t} = \beta_1 + \beta_3 DSKL_{i,t} + \beta_4 TSHARE_{i,t} + \beta_5 T2 + \beta_6 T3 + \varepsilon_{i,t} \quad \ldots\ldots\ldots \quad (2)$$

We run both fixed and random effect panel regressions on the above equation using regional (NUTS 2) data over the period 1995 – 2006.

Specification III

If there is hysteresis (path dependency) in the convergence or divergence of the spatial income distribution over regions, the dependent variable *DI* will have a positive and significant correlation with its previous values. That is, while regressing DI_t on its own

lagged values (DI_{t-1}, DI_{t-2} and so on), the coefficients corresponding to DI_{t-s}(where s<t) will be positive and statistically significant. Hence, to check whether such path dependency exists or not, we run dynamic panel regression for the following equation –

$$DI_{i,t} = \beta_1 + \beta_2 DI_{i,t-1} + \beta_3 DEVABS_{i,t} + \beta_4 DSKL_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots\ldots \quad (2)$$

This has been done so as to check whether there exists any hysteresis or not. We follow the GMM estimation procedure following Arellano and Bond (1999).

Specification IV
Finally, the countries are split in two groups: depending on the centralization of the wage bargaining. Group 0 has decentralized wage bargaining, in group 1 this is centralized. We expect that centralization of wage bargaining leads to a stronger agglomeration effect than is the case for decentralized wage bargaining, and that there will be a stronger effect on the dispersion of incomes over regions.

5. Results

The results of the regressions are summarized in table 2. So far the first specification is concerned, for both fixed and random effects models we observe a negative relation between the dispersion of regional incomes and price convergence (DEVABS). The probabilities, as given in the parentheses, indicate statistically significant results at the 5% level for both models. This negative relationship does imply an increased dispersion in regional distribution of income as a result of the ongoing economic integration over the years 1995 to 2007. These results largely confirm the theoretical expectations of the New Economic Geography School (Brühlhart and Torstenson 1996 and Martin 1999).

Table 2: Summary of Results

	Model I		Model II		Model III	Model IV	
	FE	RE	FE	RE		FE	RE
DI(-1)					0.53220 (0.0000)*		
DEVABS	-0.0033774 (0.029)**	-0.0030619 (0.043)**			-0.001752 (0.0104)**	0.0005 (0.680) #	0.0006 (0.623) #
DSKL	-0.1429171 (0.001)*	-0.119564 (0.003)*	-0.112613 (0.009)*	-0.935085 (0.018)**	-0.083309 (0.0033)*	- 0.0608 (0.002) *	- 0.0594 (0.002) *
TSHARE			-0.469691 (0.611)#	-0.449256 (0.623)#			
T_2	0.0002292 (0.967)#	Dropped due to Collinearity	-0.006537 (0.16)#	-0.0053588 (0.240)#		0.0051 (0.079) **	0.0053 (0.059) **
T_3	Dropped due to Collinearity	-0.0009869 (0.858)#	Dropped due to Collinearity			Dropped due to Collinearity	
Hausman	3.14(0.2084)		2.73(0.2558)			1.23 (0.7457)	
J-statistic					10.64585		

FE – Fixed Effects Model, RE – Random Effects Model
* Significant at 1% level of significance
** Significant at 5% level of significance
*** Significant at 10% level of significance
# Statistically not significant

The dispersion of skilled labour is also a significant explanatory variable with the expected negative sign: a higher concentration of skilled labour will lead to higher dispersion of income distribution. However, the time dummies used to capture the effect of the introduction of the euro on prices yield no significant results in our study. This might be explained by the pre-EMU phase, during which the member states that would like to access the EMU were all in the exchange rate mechanism (ERM) that brought a large degree of exchange rate stability. Hence, the introduction of the euro was only the last step in the monetary integration that only brought minor extra advantages in terms of transparency and competition. Finally, the Hausman Test results implied estimates being equally consistent under both random and fixed effects models.

In the second specification we have rerun the model excluding the *DEVABS* variable and including *TSHARE* as a measure for integration. In that case we again find negative relations between *DI* and integration under fixed and random effects modeling, in accordance with our expectations. However, the results for *TSHARE* turn out to be statistically insignificant. The dispersion of skilled labour remains significant. Including both *DEVABS* and *TSHARE* (not reported in the table) does not change the sign of DEVABS but lowers its significance to the 10% level; TSHARE gets a positive sign and does not get significant. In both cases the Hausman test reveals that both random and fixed effects models produce equally consistent estimates.

The dynamic panel regression results show that there exists path dependency. Both *DEVABS* and *DSKL* remain negatively and significantly related to *DI* as before – be it with a somewhat smaller coefficient - while the lagged dependent variable is also significant. This result is in line with the theory that existing agglomerations have a tendency to persist and to outperform other regions. It might be argued that agglomeration will attract more skilled labour and hence, a reverse causality may exist. However, the GMM procedure we followed in specification III makes it clear that in our model such reverse causality does not exist.

As to specification IV, the number of observations for the decentralized wage bargaining countries, group 0, is too small to produce reliable results. We therefore only report the outcomes for the countries in group 1. For this set of countries we observe a positive relation between *DI* and *DEVABS*, though, the results are statistically insignificant. This means that we do not find a confirmation of our expectation that in these countries the effect of integration on the dispersion of income would be stronger than in the group at large. The coefficients for DSKL have the expected signs and are statistically significant. Interestingly, one of the time dummies (the one for the transition period) *T2* exhibits positive relation with *DI* and the results are statistically significant at 10% level of significance. For this subset of countries, during the years prior to the introduction of the euro in 2002, particular forces increased the income dispersion over regions. Hausman

test reveals that both fixed and random effects models produce equally consistent results. For the countries that are characterized by decentralized wage bargaining the number of observations became too small for meaningful results.

6. Conclusions

The main objective of the present study has been to find out whether integration explains the perceived income divergence among EU regions, in the presence of convergence among the member states of the EU. Answering this question is not only relevant from a theoretical perspective but is also important for the discussions on the need for a common regional policy and how to design such a policy. This issue is put in a different light if it is established that integration itself contributes to more inequality among regions.
Integration is measured by price convergence. This is a good approximation of economic integration as it captures the direct and indirect effects of various integration measures directed at product and factor markets. We argue that intra-trade shares are less suitable as measure for integration. These intra-trade shares are determined by such forces as prices of crude oil and income growth of the member states besides integration, which make this variable a less-than-perfect measure for integration.

After having confirmed the observed trends of income divergence among regions while member states converge, we analyze the causality of divergence over all EU (NUTS 2) regions. The results we get in our panel regressions imply that deeper integration has indeed contributed to divergence in the distribution of income across the European regions (NUTS 2) over the period 1990 to 2005. In line with our arguments that price convergence is a better indicator for convergence compared to intra-trade shares, we find that the latter variable is insignificant if it used instead of price convergence.
So far dispersion of skilled labour is concerned, the results obtained imply higher spatial concentration of skilled labour will increase dispersion of regional incomes. Dynamic panel regression results exhibit existence of hysteresis. But even in presence of path dependency, the major regressors remain statistically significant implying negative effect of economic integration (as captured by *DEVABS*) and dispersion of skilled labour (as measured by *DSKL*) on distribution of regional income. There are no signs of reverse causality, that is, deeper regional integration leading to higher degree of spatial agglomeration and finally affecting the dispersion of skilled labour.

Our results largely confirm the theoretical expectations of the New Economic Geography School (Krugman 1991, Martin 1999). Authors in this line of thinking use other data sets and tested different variables, such as general equilibrium models with limited number of sectors to map the effect of integration on disparities in income via the specialization of countries and regions (Brühlhart and Torstenson 1996, Puga 1999) or estimate growth equations for regions (Giannetti 2002). While we included a more encompassing integration variable than Giannetti (2002) or Puga (1999) much could be gained if better data for regional specialization and the use of factors of productions could be used to test more refined models.

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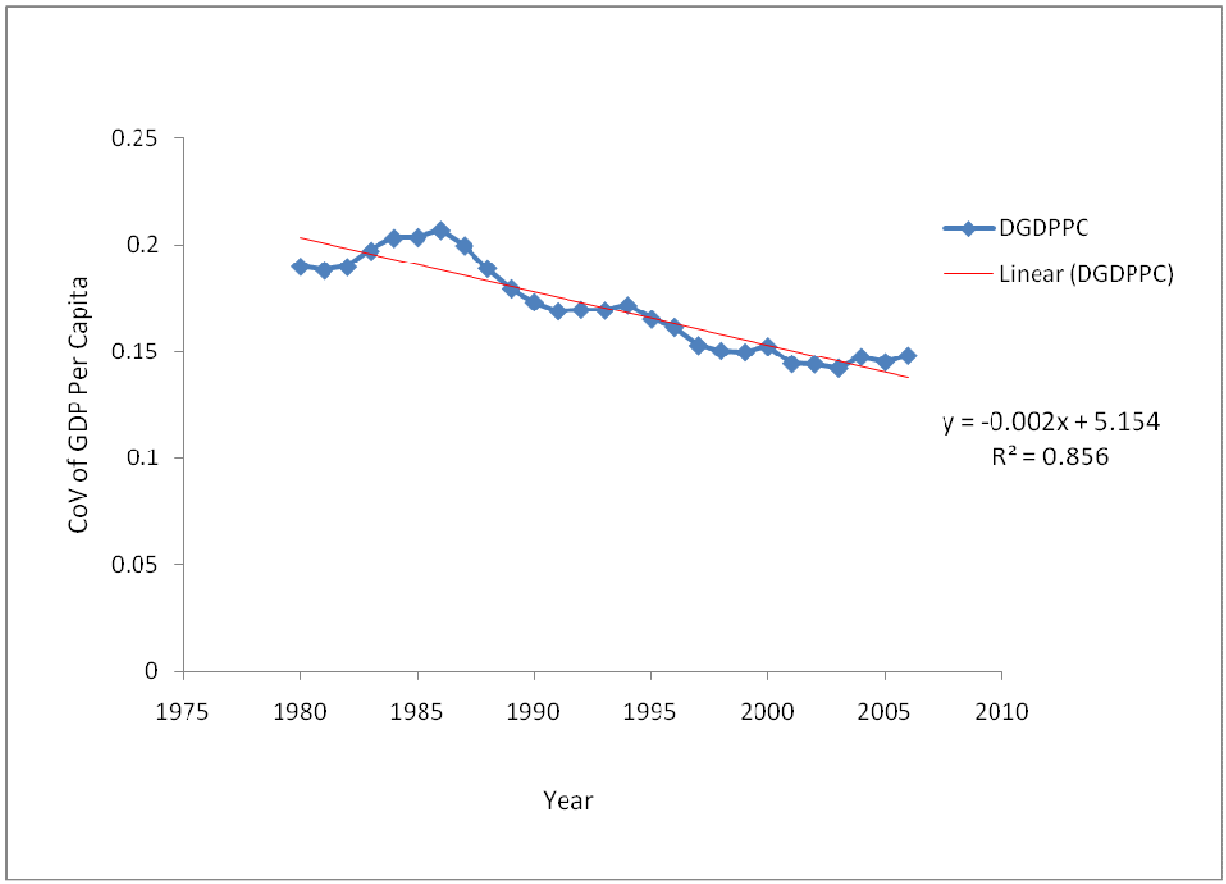
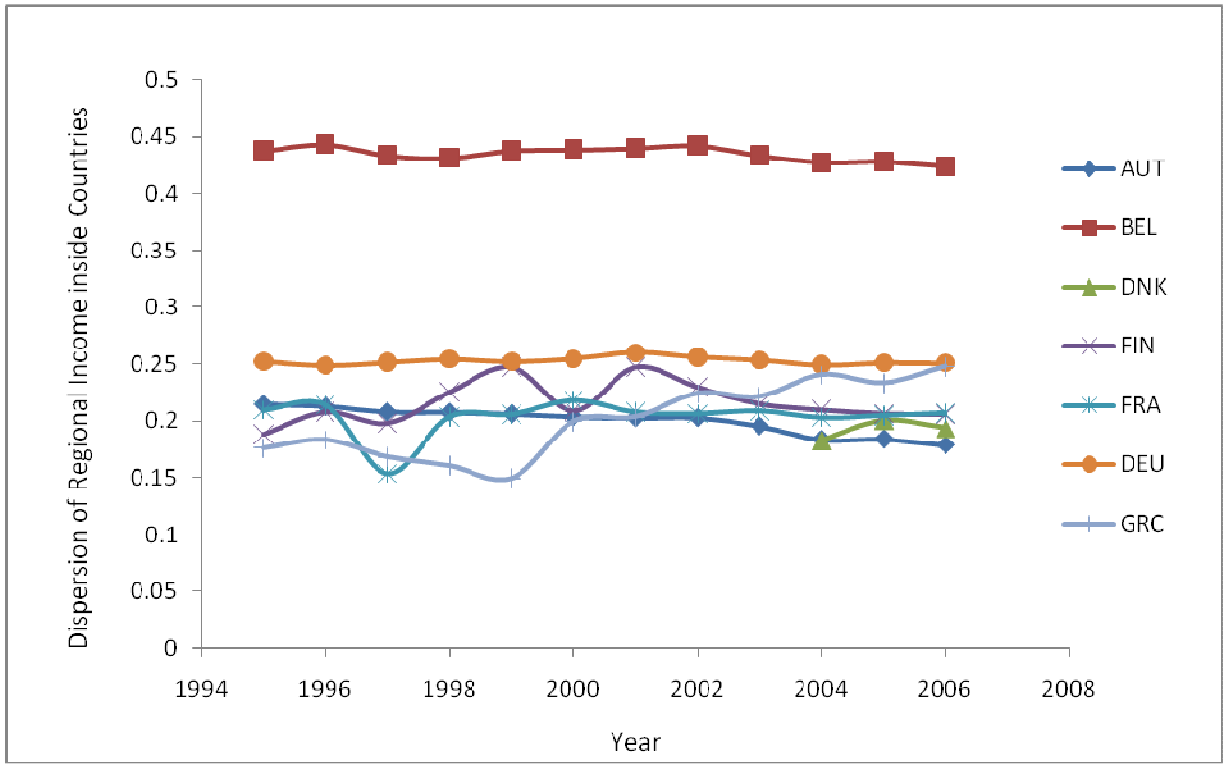
Figures and tables

Figure – 1: Dispersion of GDP per capita over EU(15) member states excluding Luxembourg



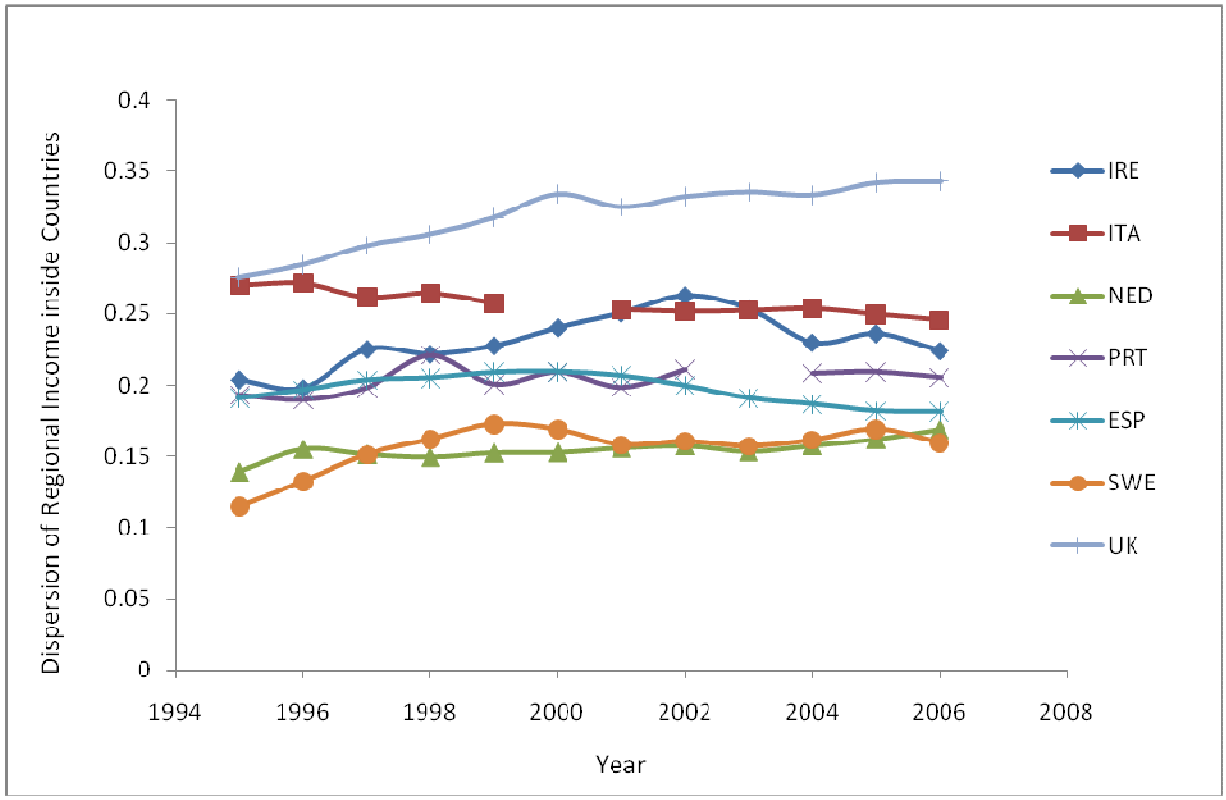
Data Source: WITS
Measure: Coefficient of Variation
Statistic: GDP Per Capita
Time Period: 1980 – 2006
Countries: EU(15) excluding Luxembourg

Figure – 2a: Dispersion of Regional Income Across NUTS2 Regions (within Countries)



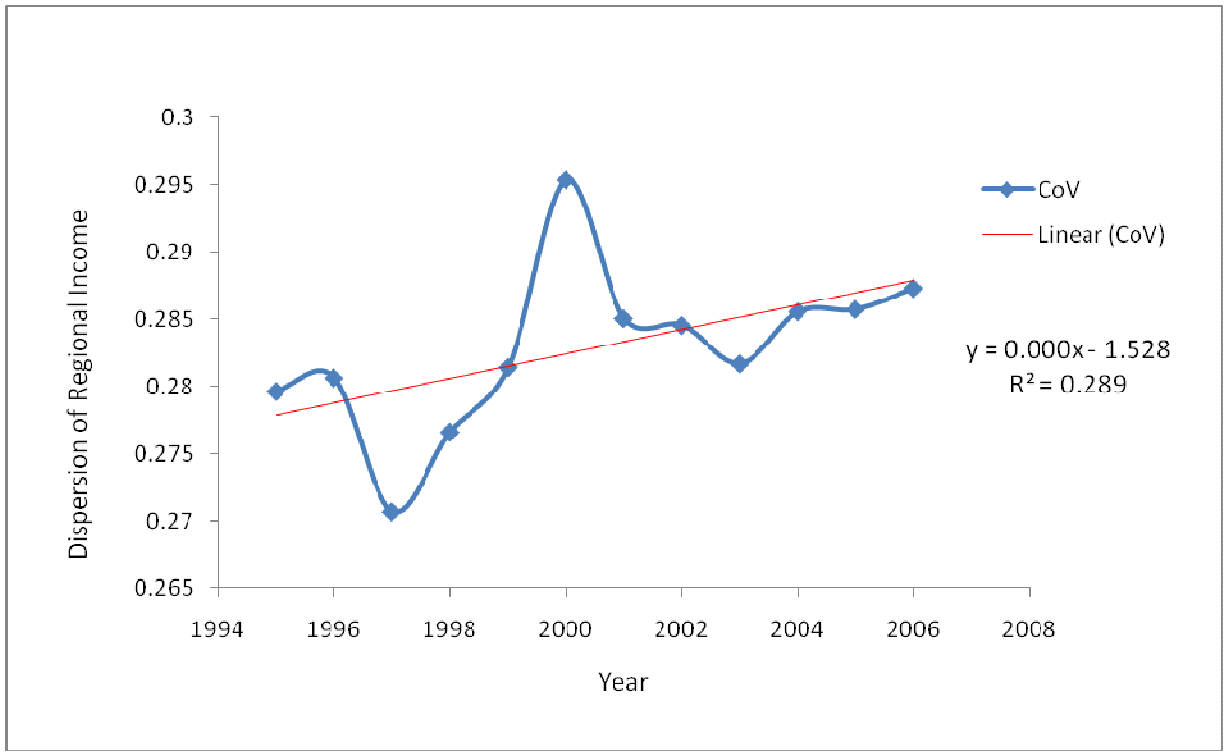
Data Source: Eurostat Cronos
Measure: Coefficient of Variation
Statistic: PPP per capita (as % of EU average) of NUTS2 regions
Time Period: 1995 – 2006
Countries – Austria, Belgium, Denmark, Finland, France, Germany and Greece.

Figure – 2b: Dispersion of Regional Income Across NUTS2 Regions (within Countries)



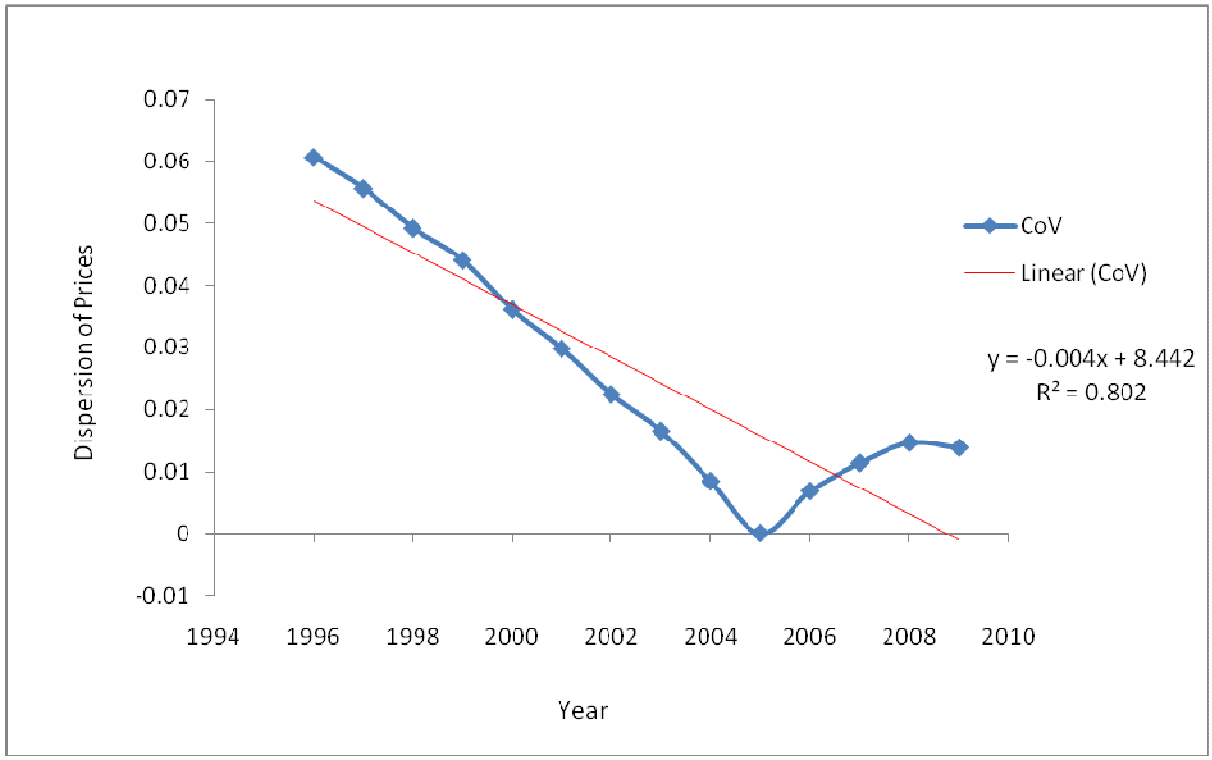
Data Source: Eurostat Cronos
Measure: Coefficient of Variation
Statistic: PPP per capita (as % of EU average) of NUTS2 regions
Time Period: 1995 – 2006
Countries – Ireland, Italy, The Netherlands, Portugal, Spain, Sweden and United Kingdom.

Figure – 3: Dispersion of Regional Income (Across all NUTS2 Regions)



Data Source: Eurostat Cronos
Measure: Coefficient of Variation
Statistic: PPP per capita as a percentage of EU Average
Time Period: 12 Years (1995 – 2006)
NUTS2 Regions: 272

Figure – 4: Price dispersion across EU (15) during 1996 – 2009



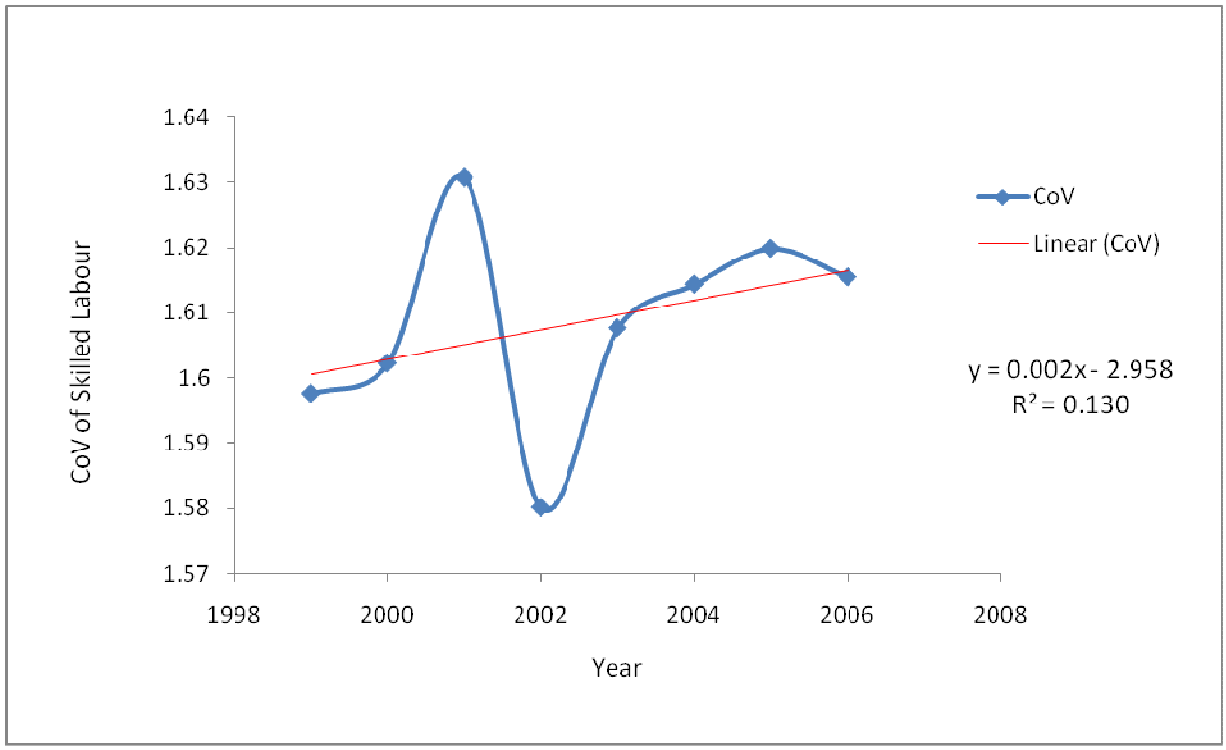
Data Source: Eurostat Cronos
Measure: Coefficient of variation
Statistic: All commodity HICP (base year 1995)
Time: 1996 – 2009
Countries: EU(15)

Table – 1: Centralization of wage bargaining (1995-2000)

Country	Score	Group*
Austria	3	1
Belgium	3	1
Czech Republic	1	0
Denmark	2	0
Finland	5	1
France	2	0
Germany	3	1
Hungary	1	0
Ireland	4	1
Italy	2	0
Netherlands	3	1
Poland	1	0
Portugal	4	1
Slovak Republic	2	0
Spain	3	1
Sweden	3	1
United Kingdom	1	0

* 0=decentralized wage negotiations predominant; 1= centralized wage negotiations predominant.
Source: OECD (2004).

Figure – 5: Dispersion of Employment by Education (ISCED) in NUTS2



Data Source: Eurostat Cronos.
Measure: Coefficient of Variation
Statistic: Skilled Labour (ISCED 3 – 6) as a percentage of National Population
Time Period: 7 Years (1999 – 2006)
Number of NUTS2 Regions: 210