Globalization, Unification and Income Inequality in Europe: Some New Empirical Evidence

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Abstract

This paper makes an attempt to examine the impact of globalization and European unification on income inequality in 15 major European countries for the last two decades. Both traditional inequality as well as convergence analyses has observed that income inequality has decreased in Europe over the years. While several explanations are put forward by different researchers on possible causes of the observed decrease in inequality, no attempt so far has been made to examine the role of trade openness on inequality in Europe. The present paper is an attempt to bring explicitly the role of openness into the analysis. Using the Theil measure of inequality we try to explain how the process of structural changes unfolded by the forces of trade and factor movements and also the shift in consumer demand leads to a rise in income. The need to capture structural changes and the consequent dynamic shifts of the economies compelled us to move away from a simplified one sector model underlying the convergence analysis. We make an attempt in this paper to examine the structural shift by decomposing outputs into three major sectors (agriculture, manufacturing and services) and using individual Theil ratios as a powerful measure for explaining dynamic transformation in a panel of the 15 old EU countries over the last two decades. We are able to show that trade plays a major role in raising per capita GDP in all the member countries. We further observe that openness has caused rise in per capita income in a much greater speed in the lower income countries of the union in comparison with the relatively advanced ones leading to narrowing down of per capita income differences across countries. We considered other important factors as well such as German unification, government spending and private consumption expenditure in analyzing their impact on income inequality. The most important result however is that a country which improves its relative position in overall trade versus the other countries also improves its relative income position. Thus we conclude that increasing trade created by the process of globalization is the key factor that has led to observed European convergence via its differential impacts on structural changes in the member countries.

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1. Introduction

This paper makes an attempt to examine the impact of globalization and European unification on the levels of inter-country income inequality for 15 major European countries (EU-15[1] *hereafter*) over the last three decades (1971-2002). The integration and unification of the European countries has a long colorful history[2]. The positive and normative effects of integration and unification have drawn considerable attention from economists for long[3]. Among other issues, economists in recent years have attempted to analyze whether economic integration has contributed to greater cohesiveness among the European countries, where increased cohesiveness is often described as a tendency towards achieving similarities in per capita income across the members[4]. In other words, the issue being raised was whether convergence of per capita income had taken place in the European countries or not. While several studies had examined this issue from a variety of perspectives, no serious attempt has so far been made to analyze the impact of trade or openness on European convergence. The present paper is an attempt to contribute in this direction.

We organize the paper as follows: In Section I we provide a review of the empirical literature on the issue of European convergence. Methodological issues and the specification of regression equations are given in Section II and data issues are taken up in Section III. In Section IV we provide estimates of inter-country levels of inequality based on the Theil inequality index and in Section V we provide the empirical results

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[1] The EU-15 is in alphabetical order (with the year of joining the six founding states in parenthesis): Austria (1995), Belgium, Denmark (1973), Finland (1995), France, Germany, Greece (1981), Ireland (1973), Italy, Luxembourg, the Netherlands, Portugal (1986), Spain (1986), Sweden (1995) and the United Kingdom (1973).

[2] See Appendix A 1 for a brief history of the union.

[3] The positive effects concern with issues such as industrialization, growth and trade while normative effects concern with the distribution of income, functional as well as inter-personal, and well-being of the people both within as well as between the member countries. For details, see Appendix B.

[4] See Appendix C on different theoretical approaches on this issue.

corresponding to different a regression estimates. We draw our main conclusions in Section VI.

2. SECTION I

Inter-country Inequality and Convergence in EU: A Survey

There are of course several studies purporting to examine regional or inter-country inequality in Europe (Magrini, 1999, Esteban, 2000; 2004, Petrakos, 2001, Duro, 2004, Arbia et al, 2005, Ezcurra et al, 2005)[5]. While almost all such studies unequivocally agree that the per capita income in the European Union is converging[6], some studies have observed that reduction in *between-countries inequality* has been accompanied by an increase in *within-country regional inequality* in Europe (Esteban, 2004). Alternative explanations are offered to explain the regional inequality trend in Europe. For example, Esteban (2000, 2004) argues that economic integration has contributed to faster growth in the lower- income, acceding countries, contributing to convergence of per-capita income across countries, although faster growth within the countries has not been uniformly distributed. This view is also confirmed by the study by Arbia et al (2005). Petrakos et al (2005) suggest that inequality at the national and the EU levels exhibit pro-cyclical behavior in the short-run, increasing in periods of expansion and decreasing in periods of slow growth. However, long time processes tend to favor more equitable allocation of activities, leading to convergence of per capita income. Interestingly, none of these studies has considered the possible impact of openness on income convergence in Europe. In view of such lacunas, the present paper attempts to provide an explanation of convergence via the effects of trade on structural changes in these economies.

The standard convergence analysis is based on the concepts of sigma convergence[7] and beta convergence[8] developed by Barro-Sala-i-Martin (1995, p. 383), which has been extensively used in the inequality literature. In this paper we are not

[5] See Appendix D for somewhat detail findings of some of the studies.

[6] There are many studies attempted to analyze regional disparities in the European context applying the concepts of *sigma* convergence and *beta* convergence a la Barro and Sala-i-Martin (1991). Some of these studies are by Armstrong, 1995, Sala -i- Martin, 1996, Fagerberg and Verspagen, 1996, Esteban, 2000, Neven and Gouyette, 1995, Quah, 1996, Lopez Bazo et al, 1999. Since the concepts of convergence and per capita income inequality are intrinsically related to each other we therefore implicitly assume convergence as equivalent to reduction in per capita income inequality.

[7] Sigma convergence means reduction in the dispersion of regional income over time.

adopting the Barro-Sala-i-Martin analysis of convergence because this approach is not suitable for analyzing the underlying process of structural change that an economy witnesses as the forces of trade, factor movements and technical change get unfolded in response to exogenous policy changes. In order to capture structural change and the consequent dynamic shifts that might be taking place in an economy we need to move away from a simplified Solow (1956) model of growth underlying the Barro-Sala-i-Martin analysis of convergence. In contrast, we need a multi-sectoral analytical framework, which allows us to examine the structural transformation of the economies in response to changes in economic policies over time. Thus, the analysis of convergence in this paper is focused on a measure of income inequality developed by Theil (1967). We make an attempt in this paper to examine the structural shift by decomposing outputs into three major sectors (agriculture, manufacturing and services) and using *individual Theil ratios* as a powerful measure of explaining dynamic transformation in a panel of 15 European countries (EU-15) for the period 1971 – 2002. We observe a decline in the Theil index of inequality in GDP as well as in its components, industry, agriculture and services over time suggesting that a process of income convergence has taken place in EU-15 during the period under consideration. Interestingly, we have also observed that the decreasing trend in the Theil index of inequality has been accompanied by very pronounced and much higher levels of the Theil inequality index of trade. The panel results based on the individual Theil ratios clearly show that trade plays a major role in raising the per capita GDP in all the member countries. The decrease in the Theil income inequality index (convergence) and the simultaneous occurrences of trade raising the per capita income for all EU-15 can be interpreted as a phenomenon where the relatively lower income countries must have been growing at a faster rate in comparison with the relatively high income countries within EU-15, thus narrowing down the difference of per capita income across countries. We considered other important factors as well such as German unification, government spending and private consumption expenditure in analyzing their impact on income. The most important result however is that a country which improves its relative position in overall trade versus the other countries also

[8] Beta convergence implies an inverse relationship between the initial per capita income and the growth rate of income. That is, the relatively poor regions experience a faster growth rate enabling them to catch up.

improves its relative income position. This implies that an improvement of the relative trade position of the lower income countries leads to a relatively stronger growth than that of their advanced counterparts and therefore to convergence. We may hence conclude that increasing trade created by the process of globalization is the key factor that has led to observed European convergence via its differential impacts on structural changes in the member countries.

3. SECTION II

Methodological Issues

We now turn to the methodological issues involved in our empirical analysis to examine the role of international trade on inter-country inequality. First of all, we use the Theil inequality index as defined below to measure the levels of inter-country inequality over time. Second, we propose a panel regression analysis based on the *individual Theil ratios* for evaluating the impact of trade on income and income inequality among the member countries.

3.1 The Theil Index of Inequality

In order to measure regional inequality for the EU-15 we shall use the Theil index of inequality which is defined as follows:

` $$T_y = \sum y_i \log (y_i / p_i) \qquad [1]$$

where y is an indicator such as gross domestic product (y). Thus, [1] is a measure of inter-country inequality in gross domestic product (or income) where p_i is country i's share in total population in EU-15 and y_i is country i's share in total gross domestic product in EU-15. We can define in the same way the levels of inter-country inequality in components of the gross domestic product such as manufactures, agriculture and services. Therefore, replacing y by m, a, and s as indicators representing manufactures, agriculture and services respectively we can define T_m, T_a, T_s as the inequality measures of inter-country inequality in manufactures, agriculture, and services respectively in a given year.

The inequality measures $T_{y,}$ $T_{m,}$ T_a, and T_s take non-negative values. An equal distribution is denoted by $T_y = 0$, which happens when every country's population share and its share in the particular indicator (gross domestic product or any of its component) are equal. A rise in the value of T_y over time means that GDP inequality is rising over

time. Similarly, an extremely unequal distribution shall implies that $T_y = \log (P/P_i)$ where a single country owns all income while all other countries have zero income.

The index T_y is often called *"entropy"*, which is an information-theoretic measure based on prior and posterior probabilities. In the measures T_y, p_i, y_i, can be regarded as prior and posterior probabilities, because $\sum y_i = \sum p_i = 1$[9].

3.2 Regression Analysis on Theil Ratios

The entropy measure apart from giving an average index of inequality, which we called the Theil index of inequality, also provides information on the relative position of a region in the sample as described in terms of the ratios, y_i/p_i. We interpret these ratios as *"Theil Ratios"*, which give the relative ranking of the status of a country at a point in time. For instance, if the value of this ratio is unity then it tells us that the share of a country's income in the total income of the group (EU-15, say) is exactly equal to the share of the country's population in the total population of EU-15. So it can be taken as the benchmark of perfect equality if all countries have this share equal to unity. Therefore, a value less than unity for a country means that the country is lagging behind another country which has a value exceeding unity. Now it is interesting to observe how the position of the country changes over time in terms of these ratios.

Thus, while the Theil inequality index gives an idea of the average levels of inequality for a group countries, there is no way we can find any information from the index how different countries have reacted to exogenous shocks due to policy changes. However, individual data on countries' experience give a much clearer picture. To assess which factors do individually influence the position of a single country in relation to the others', we estimate a fixed effects panel model of the individual countries' Theil ratios on a number of explanatory factors.

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[9] One advantage of this measure is that it is independent of size-variations among regions as has been shown by Azad (1992). Further, the entropy captures all moments of the distribution, whereas the commonly used measures such as coefficient of variation or disparity ratio are based upon mean and dispersion only. Moreover, while the coefficient of variation is an average index of inequality for all the regions, the entropy measure apart from giving an average index also provides information on the relative position of a region in the sample as described in terms of the ratios, y_i/p_i, which we call "Theil Ratios'. These are the reasons for our preference of the entropy index of inequality over other similar measures for measuring inter-country income inequalities in Europe.

$$theil\_gdp_{it} = \alpha_i + \beta\, theil\_trd_{it} + \gamma X + \varepsilon_{it} \qquad [2]$$

$$dtheil\_gdp_{it} = \alpha_i + \beta\, dtheil\_trd_{it} + \gamma X + \varepsilon_{it}, \qquad [2']$$

where i denotes the country, t the year and X a number of further explanatory variables or dummies as described later on. We use a fixed effects panel regression, so that we can capture country fixed effects and dummies which describe policy changes. Furthermore, we estimate the model in levels [2] and in first differences [2']. It turns out that in the regression on levels the existence of a spurious regression problem cannot safely be ruled out. Therefore the system is estimated in first differences as well.

To assess the effect of openness, we use the Theil ratio on trade as an explanatory variable. The Theil ratio is more meaningful here than a plain trade-to-GDP ratio, as we are concerned with the relative position of the country vis-à-vis its peers. The regressor gives evidence on the improvement in per capita income a country can attain if it increases its openness relative to that of its peers.

4. SECTION III

Data Issues

We take all our data from the World Bank World Development Indicators 2005. The data on GDP and consumption are all in constant year 2000 US Dollars. For the remaining time series (sectoral shares of production, trade, government consumption etc.) the ratios to GDP have been taken from the database and applied to GDP to derive overall volumes.[10] We use data on the EU-15 for the years 1971 – 2002.

In the panel regressions, we also include dummy variables indicating whether a country was a member of the European Community (after 1992 European Union) in that particular year (EU) and another dummy indicating whether the country was a member of the common currency (EURO) in a particular year. For Germany, we include a unification dummy (UNI), having a value of 1 for the years from 1990 onwards.

[10] Time series on the absolute values of e.g. sectoral production are also available. Unfortunately, due to rescaling (cf. World Bank (2005), Table 4.1, About the Data) the sum of the sectoral production values is frequently different from the overall level of GDP as given in a separate time series and used here. Moreover, the sectoral shares as implied in the sectoral time series are strongly distorted. For this reason we use the procedure as described above.

5. SECTION IV

Trends of Theil Inequality Index

We start by considering the development of the Theil index of inequality for the EU-15 during the period 1971 – 2002. In Table 1 we provide the calculated Theil Inequality indices using [1] for the period of 1971 – 2002 for Gross Domestic Product (GDP) and its components, agriculture (AGR), industries (IND) and services (SER).

Table 1: Theil Index of Inequality, EU 1971 - 2002

YEAR	GDP	AGR	IND	SER
1971	2.85	6.86	3.57	4.16
1972	2.64	7.16	3.18	3.89
1973	2.50	7.91	2.85	3.95
1974	2.36	7.87	2.47	3.83
1975	2.46	7.17	2.50	3.90
1976	2.47	6.73	2.59	3.83
1977	2.46	7.21	2.62	3.78
1978	2.50	7.54	2.86	3.69
1979	2.60	7.68	3.09	3.60
1980	2.49	8.30	2.99	3.36
1981	2.51	8.13	2.97	3.26
1982	2.56	8.14	3.06	3.26
1983	2.67	8.44	3.18	3.36
1984	2.77	8.64	3.43	3.36
1985	2.78	9.18	3.42	3.34
1986	2.80	7.98	3.54	3.32
1987	2.70	8.36	3.41	3.25
1988	2.60	7.24	3.19	3.17
1989	2.45	6.73	2.99	2.99
1990	2.38	6.81	2.97	2.84
1991	2.32	7.51	3.00	2.73
1992	2.32	7.11	3.03	2.63
1993	2.37	6.56	2.95	2.71
1994	2.44	6.99	3.09	2.75
1995	2.39	6.69	2.95	2.68
1996	2.36	6.18	2.92	2.64
1997	2.33	6.80	2.92	2.60
1998	2.30	7.22	2.79	2.62
1999	2.31	7.19	2.77	2.62
2000	2.32	7.28	2.77	2.61
2001	2.27	7.36	2.55	2.59
2002	2.26	7.43	2.58	2.57

GDP = Gross Domestic Product; AGR = Agriculture; IND= Industries; SER = Services

It can be seen from the **Table 1** that the inter-country inequality in general has been decreasing for GDP, industries and services while for agriculture there seems to be no trend as such. We also calculate the Theil index of inequality with respect to exports (EX), imports (IM), total trade (TRD) and also in household consumption expenditure and government expenditure (**cf. Table 2**) and it is obvious from **Table 2** that there are clearly discernible decreasing trends in all of these.

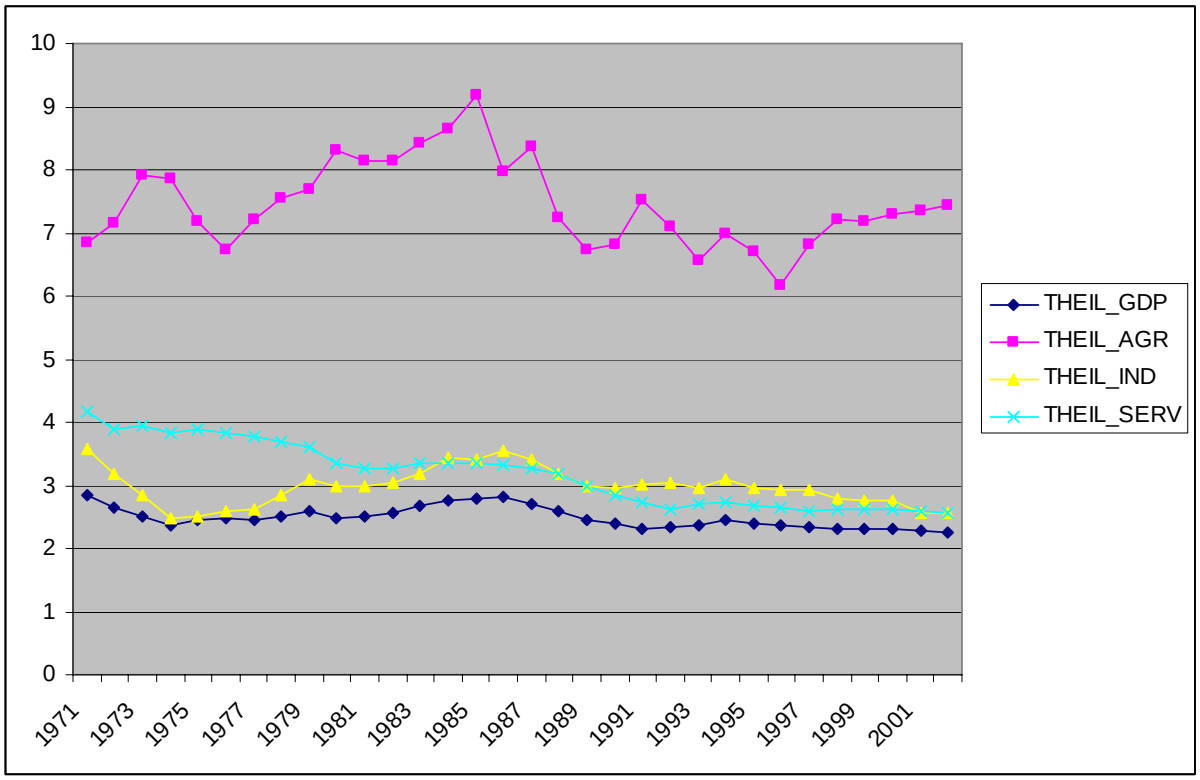
Table 2:
Theil Index of Inequality, EU, in Trade, Consumption and Government Expenditure

Year	TRD	IMO	EXP	CON	GOV
1971	12.54	12.15	13.13	2.91	6.92
1972	11.17	10.37	12.12	2.87	6.73
1973	11.46	10.43	12.70	2.80	6.80
1974	11.06	9.71	12.82	2.60	6.97
1975	10.65	9.57	11.98	2.63	7.30
1976	10.35	8.98	12.02	2.62	7.30
1977	9.92	9.19	10.87	2.65	7.10
1978	9.76	9.66	10.05	2.77	6.99
1979	10.10	9.92	10.49	2.83	6.96
1980	9.54	8.75	10.70	2.63	6.85
1981	9.37	8.56	10.57	2.62	6.40
1982	9.77	8.81	11.03	2.71	6.45
1983	9.98	9.16	10.99	2.76	6.20
1984	10.29	9.71	11.02	2.90	6.25
1985	10.33	9.85	10.92	2.90	5.93
1986	10.48	10.35	10.69	2.99	5.95
1987	9.98	9.52	10.51	2.82	5.52
1988	10.38	9.57	11.37	2.74	5.32
1989	10.54	9.45	11.85	2.47	4.81
1990	10.42	9.23	11.82	2.35	4.50
1991	10.86	9.63	12.26	2.24	4.24
1992	10.25	9.09	11.57	2.18	4.26
1993	9.86	9.25	10.65	2.31	4.33
1994	9.70	9.15	10.39	2.38	4.48
1995	9.31	8.73	10.04	2.38	4.44
1996	9.73	9.45	10.20	2.41	4.49
1997	9.73	9.43	10.17	2.36	4.36
1998	9.90	9.40	10.55	2.32	4.32
1999	10.20	9.35	11.21	2.34	4.29
2000	10.55	9.43	11.84	2.35	4.04
2001	10.73	9.71	11.92	2.42	4.03
2002	10.93	9.82	12.24	2.46	4.22

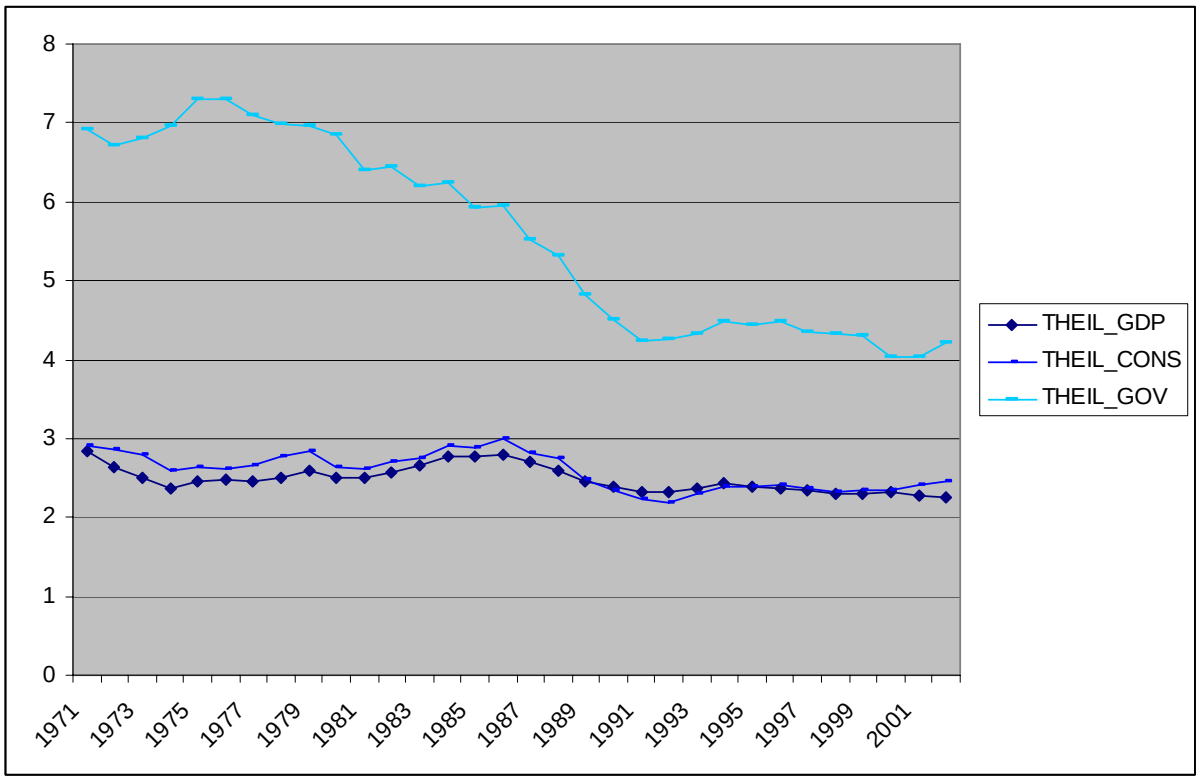
TRD= Total Trade; EX= Exports; IM = Imports; CON = Consumption Expenditure; GOV = Government Expenditure

Graph 1 below shows the inequality levels for GDP and its various components. Interestingly, it can be seen that the levels of inequality is the highest for agriculture and the lowest for GDP. Similarly, Graph 2 gives the inequality trends in government expenditure, household consumption expenditure and GDP. It is obvious from Graph 2 that the decline in inequality in government expenditure is much more pronounced while inequality in household consumption expenditure is quite in line with GDP inequality.

Graph 1
Sectoral Inequalities



Graph 2
Inequality in consumption and Government expenditure



We attempt to estimate the linear trend for the inequality indices and the results are given in Table 3. The results show that the Theil inequality indices have shown a negative trend in all cases. However, the coefficients are significant only in case of Gross Domestic Product (gdp), Services (ser), Household Consumption Expenditure (con) and Government Expenditure (gov) and marginally significant in respect of the variables relating to trade, Exports (exp), Imports (imp) and Total Trade (trd).

Table 3

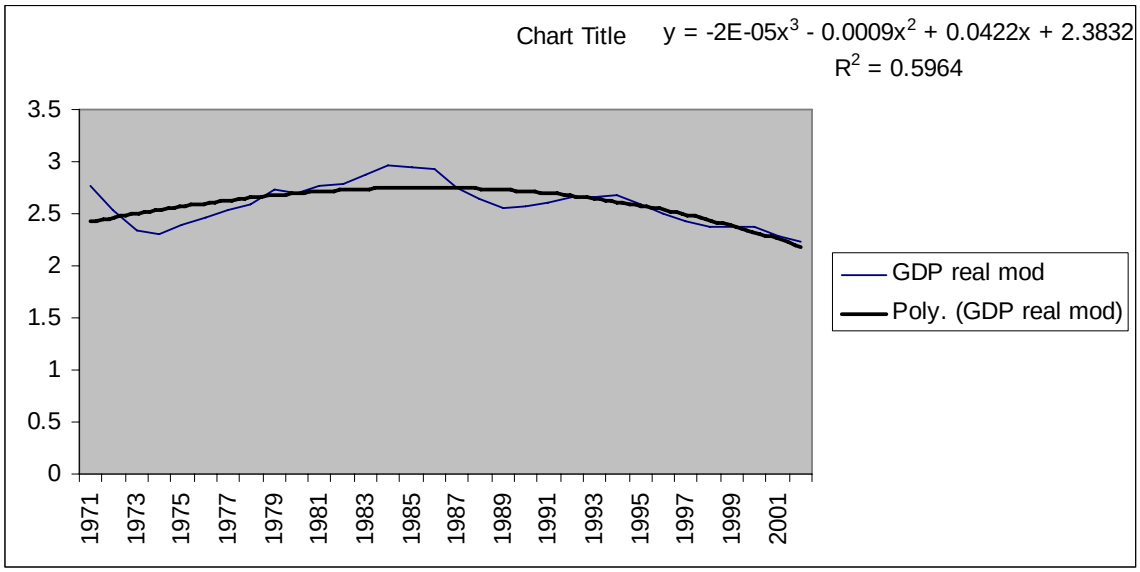
Theil Inequality Trends for 15 EU, (1971-2002)

Inequality Index T_y	**Average Annual Growth Rate**	**t-value**	**Adj. R-squared**
T_{gdp}	-.0101	-4.04	0.33
T_{agr}	-.0217	-1.7	0.06
T_{ind}	-.0051	-0.9	0.006
T_{ser}	-.0525	-21.96	0.93
T_{trd}	-.0357	-1.94	0.08
T_{exp}	-.028	-1.73	0.06
T_{imp}	-.0232	-1.93	0.08
T_{con}	-.0174	-5.51	0.48
T_{gov}	-.1212	-16.02	0.89

The results suggest that there are significant non-linearities in the trends with respect to the remaining variable and therefore we have estimated non-linear polynomial relationships of trends for all the Theil indices and we find that the coefficients of time and its higher values up to third degree are all highly significant. The graphs below provide the curves based on the regression coefficients for gdp and its various components. The graphs show that inequality in gdp and its various components are declining.

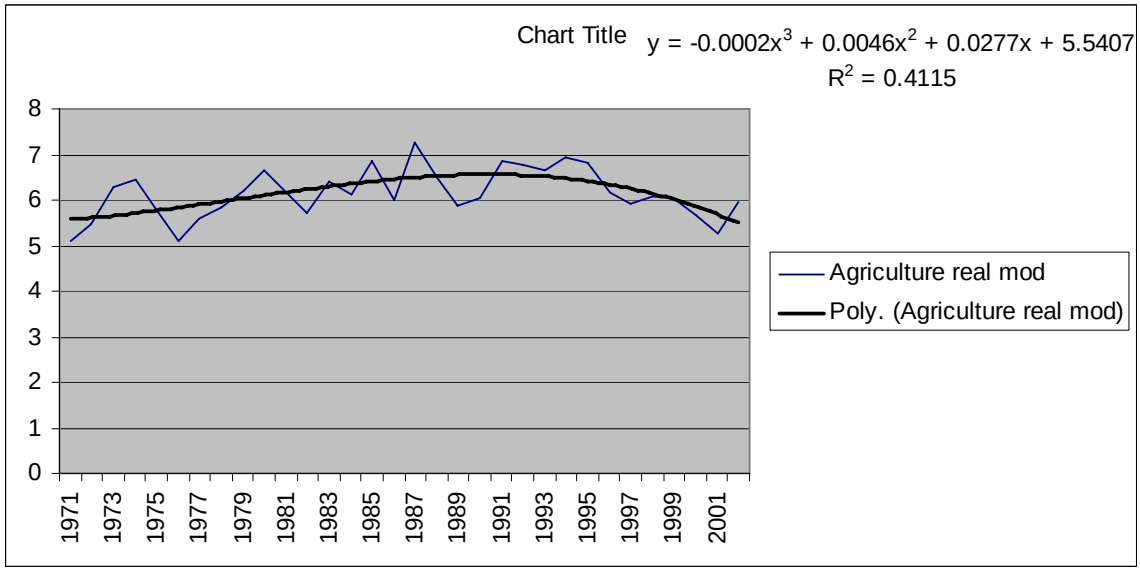
Graph 3

Non-linear trend in Theil inequality Index, GDP, EU (1971-2002)

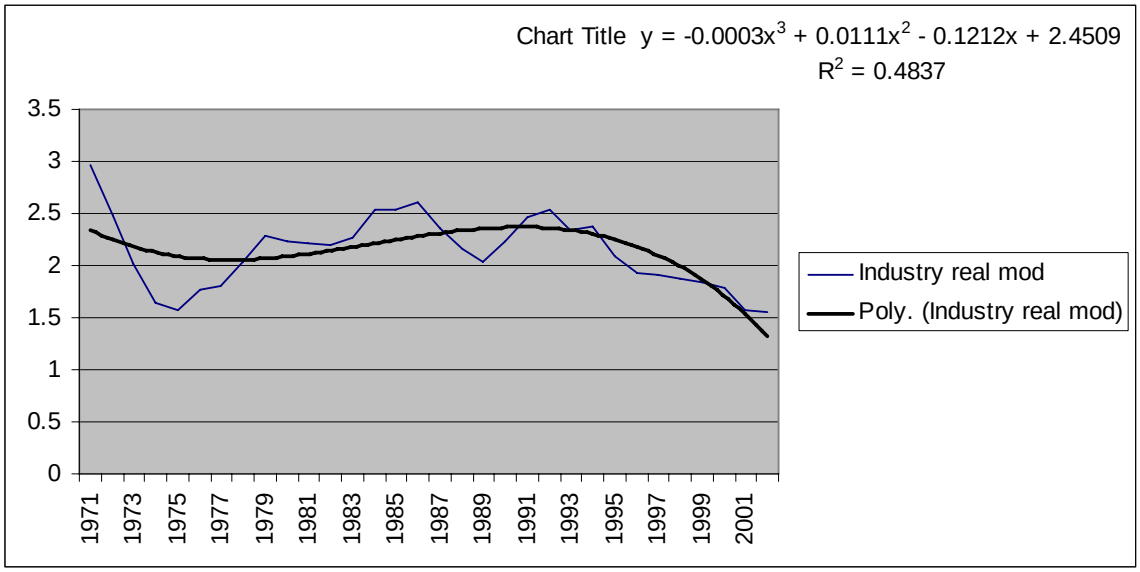


Graph 4

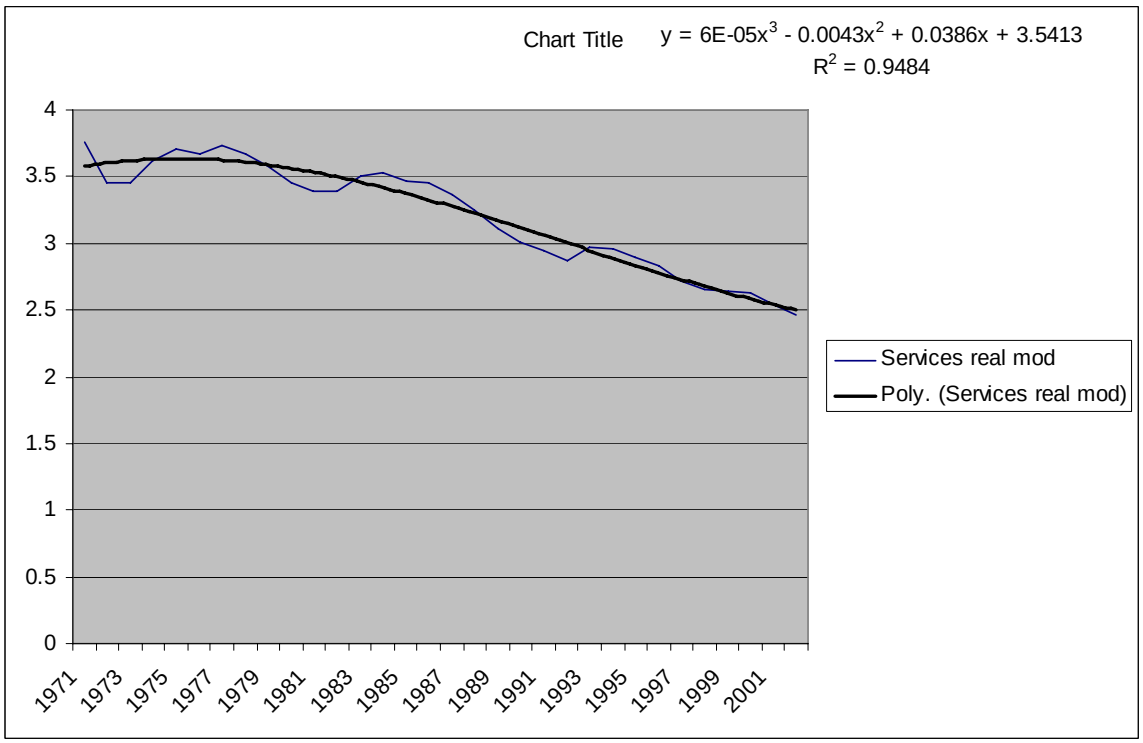
Non-linear trend in Theil inequality, Agriculture, EU (1971-2002)



Graph 5:
Non-linear trend in Theil inequality Index, Industry, EU (1971-2002)



Graph 6
Non-linear trend in Theil inequality, Services, EU (1971-2002)

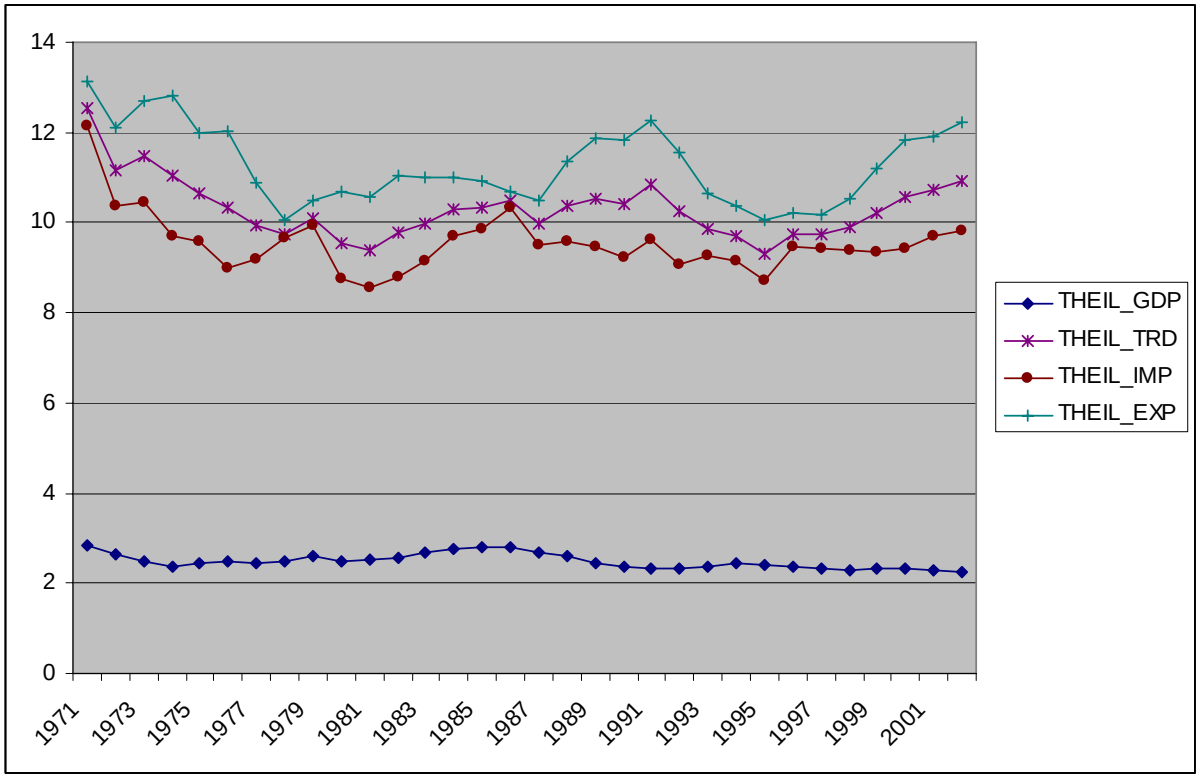


The cyclical developments in the inequality relations have interesting structural change underpinnings which are not reflected in the trend results. Thus, as the number of

countries grow into industries and others are maturing from it in the end, cyclical relations are bound to occur. It could be interpreted in such a way that as soon as *all* the countries had left their industrialized phases behind them, inequality in industrial production started to decline. Inequality in services declined as countries at all income levels seem to have a rising share in services, although at a smaller rate if income p.c. rises. So here the relation to structural change should become somewhat clearer

As can be seen from Table 3, inequality in exports, imports and total trade is still quite pronounced, there is hardly a clear trend to be inferred from the data. If anything, inequality seems to have been rising within the last years (from 1997 onwards), mainly because of an increase in inequality in exports. Importantly, inequality levels of trade are much higher than the inequality levels in GDP. Graph 7 below provides a graphic representation of the inequalities in trade variables against the GDP inequality for the sake of comparison.

Graph 7
Inequality inTrade



6. SECTION V

Regression Estimates on Theil Ratios

The Theil ratios y_i/p_i as discussed above provides information on the relative position of a country in the sample. A value of this ratio equal to unity simply states that the share of a country's income in the total income of the group (EU-15, say) is exactly equal to the share of the country's population in the total population of EU-15. Thus, if the value of this ratio for any country falls short of unity then it can be said that the particular country is performing worse than the average country performance. Consequently, it can be said to be the benchmark of perfect equality where all countries have a value equal to unity.

Two elements which are of interest for us are (1) the effects of the sectoral composition of an economy and (2) the effects of trade on the relative income position of a country. Equation [2] depicts the effects of trade and other variables on the income position of a country. As concerns the sectoral composition of the economy, we take the sectoral shares of GDP for two of the three sectors to see how the transition of countries from a mainly agricultural base to industry and services influences its relative well being.

As further control variables to capture other characteristics of the countries under consideration we also include the Theil ratio of government expenditure (*theil_gov*) and the Theil ratio of urbanisation (*theil_urb*), to control for government policies and general structural differences of the economies. The panel regression results for equations [2] and [2'] are given below respectively.

Panel Regression Estimates Equation [2]:

```
Fixed-effects (within) regression          Number of observation     = 480
Group variable (i): code                   Number of groups                  = 15
R-sq: Within     = 0.8538                  Observation per group: min        = 32
      : Between = 0.7636                   Average                           = 32.0
      : Overall   = 0.7683                 Max                               = 32
                                           F (3,462)                 = 899.36
Correlation (u i, Xb) = -0.3676            Prob. > F                         = 0.0000

------------------------------------------------------------------------------
  theil_gdp |      Coeff.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------------------------------------------------------------
  theil_trd |   .1903089   .0056589    33.63   0.000     .1791886    .2014293
  theil_urb |  -.0081282   .0379947    -0.21   0.831    -.0827921    .0665356
  theil_gov |   .2818247   .0247452    11.39   0.000     .2331977    .3304518
      _cons |   .4407817   .0320665    13.75   0.000      .3777675     .503796
------------------------------------------------------------------------------
    sigma_u |  .17253532
    sigma_e |  .03517651
        rho |  .96009179   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(14, 462) =    187.81           Prob > F = 0.0000
```

Panel Regression Estimates Equation [2']:

```
Fixed-effects (within) regression          Number of observation     = 465
Group variable (i): code                   Number of groups                  = 15
R-sq: Within          = 0.2364             Observation per group: min        = 31
      : Between = 0.7791                         Average                     = 31.0
      : Overall         = 0.2688                 Max                         = 31
                                                 F (3,447)                   = 46.12
Corr. (u_i, Xb)  = 0.1914                        Prob > F                    = 0.0000
------------------------------------------------------------------------------
 dtheil_gdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------------------------------------------------------------
 dtheil_trd |   .1004943   .0086561    11.61   0.000     .0834826    .1175059
 dtheil_urb |  -.1976169   .2343809    -0.84   0.400    -.6582423    .2630084
 dtheil_gov |   .0198938   .0311993     0.64   0.524    -.0414217    .0812093
     _cons |    .0021168   .0008698     2.43   0.015     .0004075    .0038261
------------------------------------------------------------------------------
    sigma_u |  .00609187
    sigma_e |  .01743399
        rho |  .10881202   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(14, 447) =     2.85           Prob > F = 0.0004
```

The most important result is that a country which improves its relative position in overall trade versus the other countries also improves its relative income position. Interestingly, the additional dummies used in alternative specifications as described in the data section turned out to be of no significance.

The effect of trade on GDP could be interpreted in different ways: it could be the result of a general trade liberalisation, but it could also be due to purely export promoting

mercantilist trade policies. The improvement in the relative position in GDP could then rather result from an improvement of the trade balance, not from an increase of trade as a whole. To control for this, we include the trade balance to GDP ratio as an additional explanatory variable.[11] The results in levels and first differences show some minor significance of this variable, but importantly it does not reduce the general effect of trade on GDP per capita which we observed.

The regression in levels still entails the danger of spurious regression results especially with respect to Ireland (a regression of theil_gdp on theil_trd for Ireland alone yielding an $R^2 = 0.9808$). As a test for robustness we have re-estimated the model omitting Ireland, without any substantial change occurring.

7. SECTION VI

Structural Changes of the Economies

To get further insight into the structural changes of economies, we consider how the sectoral shares change with changes in per capita income. For this we took a pooled regression of the GDP shares of agriculture, industry and services as

$$share\_xxx_{it} = \alpha + \sum_j \beta_j (\ln\_gdp\_pc_{it})^j + \gamma X + \varepsilon_{it}, \qquad [3]$$

with xxx being the sector in question, $j = 1,2$ or $j = 1,2,3$ and X a vector of additional explanatory variables, in our case population and population squared. We have also made a fixed effects panel regression of sectoral shares which yield broadly the same results. We therefore concentrate on the results of the pooled regression model employing second order polynomials.

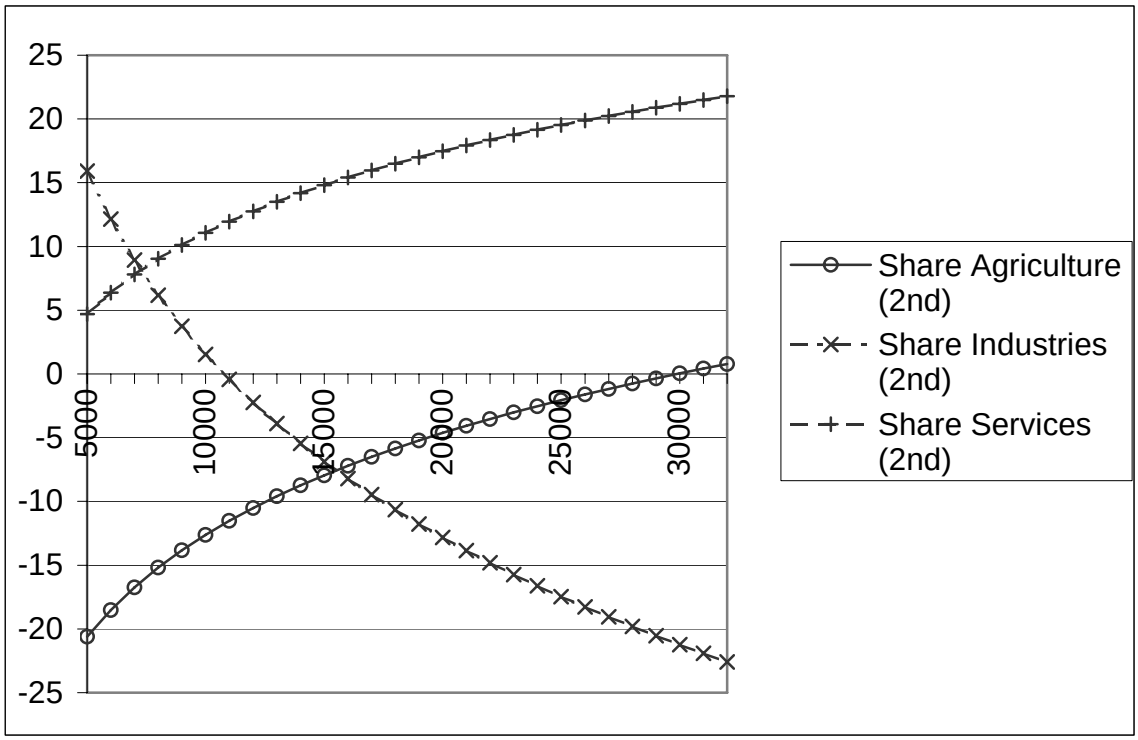
The β_i obtained were used to calculate semi-elasticities of sectoral shares with respect to changes in per capita income. It is interesting to see that the share of agriculture is reduced with changes in income per capita over the whole range, while there seems to be a gradual structural conversion in the economies leading to an increase in the share of

[11] This choice obviously has a number of drawbacks, as in contrast to the Theil ratios, which we use in general, this variable only captures the development of the variable in single country, not taking into account the changes occurring in other countries. We are however unable to calculate meaningful Theil ratios for this variable, as the trade balance for individual countries as well as the (gross) trade balance for the countries together is negative for a number of years.

industrial production until a certain level of income has been reached (about 11,000 USD p.c.), after which an expansion of the service sector sets in.

Graph 8

Semi-elasticities of sectoral shares with respect to income p.c., using a second order polynomial



8. CONCLUSION

In conclusion, we can say that our results of income convergence among the 15 EU countries are in line with the findings of other studies on income convergence that there is a tendency towards income convergence in Europe. However, in contrast to the other studies we are able to provide an explanation of the causes of such convergence. By rejecting the one sector model underlying the standard convergence analyses we have focussed on the existence of more than one sector in an economy which allows us to examine how the transition of an economy from primary to industry to service affects income generation. That is, we have succeeded in incorporating the effects of structural changes via its impact on the shift in consumer demand in explaining the rise in income. Further, trade has accentuated this structural change process as we have shown that a country which improves its relative position in overall trade versus the other countries also improves its relative income position. This result coupled with our result on income convergence indirectly lends some support to our contention that openness has caused rise in per capita income in a much greater speed in the lower income countries of the union in comparison with the relatively advanced countries. As a result, we observe narrowing of per capita income differences across countries. So we conclude that opening

up of an economy leads to fair income distribution across countries. We also considered other important factors as well such as German unification, government spending and private consumption expenditure in analyzing their impact on income inequality. However, the effects of opening up the economies over shadow the effects of other factors.

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Appendix A: A brief history of the European Union (EU)

The European Economic Integration started in 1951 with the formation of the European Coal and Steel Community (ECSC). The six founding countries - Germany, France, Italy, the Netherlands, Belgium and Luxembourg - decided to establish the European Economic Community (EEC) in 1957 by the Treaty of Rome, which came into effect in 1958. The economic goal was to create a European Common Market. The Common Market project started in 1987 aimed at the abolition of the still existing non-tariff barriers to trade, to liberalize trade in services and to dismantle restrictions on labor and capital mobility within five years. So the four basic rules of freedom - the free mobility of goods, services, people and capital was guaranteed by 1992. This real integration in goods and factor markets was accompanied by a monetary integration which started slowly but got momentum after German unification. The European Monetary System between 1958 and 1973 was part of the Bretton- Woods System. After its breakdown in 1973 it took five years to establish a new monetary system for the European countries. It was based on fixed exchange rates between the EU-member-countries and a joined float vis-à-vis non-member-countries. This new European monetary system was in existence from 1978-1998, when it was substituted by the Euro currency zone.

The Commission tried early to complete the common market by a monetary union, but most European countries were really not ready to abolish their own currencies. Only after the German unification in 1990 political priority shifted and a common European currency became a political option. For France it was a chance to get rid of the German Mark whose strength dominated the European monetary system. Germany on the other hand was ready to give away its own prestigious currency in order to document its political will to integrate firmly into Western Europe. So the Maastricht Treaty was signed in 1992. Therein the EU-member-countries agreed to establish a monetary union with the Euro as its common currency not later than 1999. So in 1999 the European monetary union came into existence. It started with eleven countries, Greece joined one year later. The UK, Sweden and Denmark do not take part.

Parallel to the real and monetary deepening of the European integration several enlargements took place. With the Western Enlargement in 1973 UK, Ireland and Denmark became members. Greece, Spain and Portugal joined the Union between 1981 and 1986, in the so called Southern Enlargement. The Northern Enlargement took place in 1995 after the fall of the iron curtain, making Sweden, Finland and Austria members of the Union. Finally with the Eastern Enlargement in 2004 eight Eastern European Countries and the two Mediterranean islands (Malta and Cyprus)joined so that the European Union consists today of twenty-five member countries. With a population of 460 million people the EU is larger than the US (300) and Japan (127).

Appendix B

The creation of the common market and the monetary union were expected to increase trade among the member countries which may lead to both inter- industry and intra-industry specialization in production which in the long run may contribute to technical change and higher growth. Further, economic liberalization shall increase direct investments in member countries and increase labour mobility and technology transfers. All this leads to the standard static and dynamic gains from trade and specialization. Closely related to this are issues concerning the distribution of income both within and between countries.

The gains are the larger the lower the transport cost, the higher the demand and supply elasticities and the more flexible the goods and labour markets are. Low transport cost, high elasticities and the well diversified production structure with its high potential for intra-industry specialisation were the main reasons for the enormous economic success of the European economic integration. There is no integration area up to now, which shows a comparable economic (and political) success.

Appendix C

Taking from the perspective of the *neoclassical trade theory* it can be said that trade under certain assumptions may lead to factor price equalization among the member countries and increase per capita income. But it cannot be inferred from the theory that trade equalises per capita incomes among the countries. However there are good reasons to expect that small countries will benefit more than big countries from increase in trade due to their relatively higher trade shares and also their ability to overcome the small size of the domestic markets. Thus, newly liberalising countries should be able to close the per capita income gap between countries which started opening up their markets earlier. So, with the three enlargement rounds of the European Union when mostly small countries (with on average lower per capita

incomes than the old members) were integrated should have resulted in a declining per capita income inequality in Europe.

In addition, *neoclassical growth theory* would also argue that income inequality should have declined in Europe. The theory based on the work of Solow (1956) and its empirics a la Barro-Sala-i-Martin (1995) demonstrate that with internationally identical production functions, saving rates and population growth in efficiency units, the steady state per capita income will be the same everywhere. Consequently the countries starting from different per capita income levels will approach their common steady state and by that the income inequality will disappear. However with international differences in productivity, saving rates and efficiency population growth the steady state per capita incomes will not be the same and convergence of per capita incomes cannot be expected. Furthermore if productivity growth is not exogenous but endogenous per capita income differences may be rising because growth rates need not be the same everywhere. However, one could argue that because of the only small differences between the European countries in technology, preferences and population growth some convergence should be expected.

Against the neoclassical convergence hypothesis, there are others who have developed the idea that trade increases income differences between regions [Myrdal (1957), Prebisch (1959) and Perroux (1964)]. Myrdal's *"cumulative causation"* mentions two effects why income differences may increase: First, agglomeration in central places and second, capital and labour flows may be complementary which means that both labour and capital are attracted by high income possibilities in the centres. So the peripheral regions will loose their factors and their attractiveness.

Developments of that kind cannot be excluded. However there are also countervailing powers at work. Transport costs and factor price differentials may work in the other direction so that the total outcome is not clear. This is even more so if a policy of diminishing regional disparities steps in. Recent surveys on agglomeration and public policy are given by Fujita -Thisse (2002) and Baldwin et al. (2005).

Finally, there are economists who by drawing on insights from *economic geography* try to explain the distribution of economic activity in space. economic geography combines in a specific way the returns of production, the technological diffusion and the structural change. Decreasing returns to capital slow down the agglomeration speed and contribute to more income equality in space. Increasing returns on the other hand induce concentration processes and increase the regional income differences. The regions may be different in their ability of generation and adaptation of new technological knowledge and this may influence the catch up processes. Depending on the speed of creation of new knowledge and the adaptation of existing knowledge increasing or decreasing income equality may result. Krugman (1991) combined in an ingenious way increasing returns to scale and imperfect competition to develop small illustrative models of the interaction of centripetal and centrifugal forces.

Whether convergent or divergent forces finally dominate the European development can only be resolved by empirical analysis.

Appendix D:

Petrakos-Rodriguez-Rovalis (2005) present evidence for eight European countries that between 1981-1997 inequalities within countries has risen with economic upswings, has fallen with the level of GDP per capita and shows no clear relation to openness. The big countries experienced higher inequality, the small countries lower inequality, when opening their economies. Across countries the authors observe a considerable decrease in inequality between the EU 15. However openness has no effect on inequality. Summarizing the authors say that in the short run divergent tendencies, in the long run convergent developments occur. The argument of the EU Commission (1999) that growth is equalizing is rejected.

Arbia-Dominicis-Pirer's (2005) study (period 1977-2002, including the new member countries in Eastern Europe) finds a rising inequality between countries in the first half of the nineties. Later on inequality between countries falls and inequality within countries rises, which seems to be a clear effect of the enlargement. However the authors do not include a trade measure for explanation.

Ezcurra et al. (2005) study the contribution of structural, regional and allocative factors to explain regional inequalities in productivity. Structural change does not contribute much, the main influence comes from regional peculiarities. This seems to be a bit surprising, given the tremendous structural change from opening the markets. Trade, especially inter-industry seems to play no role here in changing inequalities.

Galbraith-Garcilazo (2005) departs from measures of income inequality and focus instead on pay inequality in Europe 1995-2000. The chosen time period allows them to incorporate monetary union effects. They also include in their sample of 16 countries some eastern European countries. The authors

find convergence between countries and no clear trend for changing pay inequalities within countries. The first effect is mainly driven by UK, where pay starts rising from below average and Germany, where pay fall from above average. An additional finding is that inequality between wealthy regions is lower than inequality between poor regions.