Master Thesis

Economic integration in the EMU and EU:
A comparison

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Abstract

This paper examines economic integration in the European Monetary Union (EMU) as compared to that in the European Union (EU). With the introduction of the euro in 2002, transactions between participating countries have been enabled and price transparency has increased. The introduction of the euro has also lead to the perception of increased economic integration within the EMU. This paper seeks to provide statistical evidence for that perception by using several methods based on the free movement of labor and capital and is therewith the first to apply these methods to the EMU. We find that both Unions are of a high level of economic integration, but the results show no support for the a priori hypothesis that economic integration in the EMU is higher than in the EU. Nevertheless, this paper does fill a gap in the existing literature. Whereas current literature mainly focuses on the relation between the euro and trade volumes, price equalization and inflation stability, this paper concentrates on the free movement of capital and labor, which are two important freedoms of the EMU as well as the EU.

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1. Introduction

'Integration may be said to be the creation of the most desirable structure of international economy, removing artificial hindrances to the optimal operation and introducing deliberately all desirable elements of co-ordination or unification.' (Tinbergen, 1954).

Tinbergen (1954) discusses in his book how the above-mentioned definition of economic integration could be reached best. Part of reaching this goal involves the facilitation of international payment through the introduction of a world currency. Now, 60 years later, there is no world currency to be seen, but we do have the unique situation of the euro: the common currency of 18 European Union (EU) countries, henceforth referred to as the European Monetary Union (EMU).

Technically, a Monetary Union is established when countries keep their bilateral exchange rates fixed. The additional advantage of the euro is that it eliminates transaction costs on international transfers and it increases price transparency across countries that adopted the euro. Nonetheless, opponents of the euro feared that the common currency would lead to macroeconomic instability as monetary policy would be centralized at the European Central Bank instead of at the national level (Healey, 2005). According to the European Commission (2016), the euro embodies an enormous step in European economic integration with coordination of both economic and fiscal policies and a shared currency. They even state that the euro leads to higher economic integration within the EMU, which will be the main topic under investigation in this research paper.

The purpose of this study is to fill the gap in the current literature when it comes to research of economic integration in the EMU. At the moment, little research has been done on quantifying economic integration in the EMU and this research contributes to the literature by shedding light on this under-investigated topic. Existing studies have examined, inter alia, the impact of the euro on trade volumes and price convergence, but never before has economic integration within the EMU been quantified when it comes to labor and capital mobility. Therefore, the research question that this paper will seek to answer is: *'Is the EMU more integrated than the EU?'*

As mentioned, the current literature mainly focuses on the effects of the euro on trade volumes, price equalization and inflation stability. However, the results are found to be contradicting or ambiguous at the least (Baldwin, 2006; Engel & Rogers, 2005; Allington et al., 2005; Berger and Nitsch, 2008), proving that no consensus on the effects of the euro has been reached yet. Also, one could question if these studies really explain economic integration. The artificial hindrances Tinbergen (1954) refers to include more than trade, price equalization and inflation stability. Two central pillars of the EMU and EU are free movement of labor and capital, which are important hindrances when economic integration is aspired (European Commission, 2017). Nevertheless, no studies on quantification of economic integration focusing on free movement of labor and capital within the EMU have been undertaken, showing a gap in the existing literature. This paper pursues to provide empirical support for this supposedly increased economic integration in the EMU compared to the EU by taking free factor movement as a base for economic integration.

Empirical methods of economic integration have only emerged in the past years with, among others, the development of the equal-share relationship and the inverse entropy statistic. The former method assumes equal shares of factor and output for a Union country when evaluated against the entire Union. The latter measures the distance between the theoretical and actual shares of factors and output for countries within a Union, which creates a measure of integration[1]. These methods focus on the free movement of human capital and physical capital, where full economic integration is reached when all barriers to the movement of these factors are eliminated. With the Maastricht Treaty already signed in 1992, hindrances to the free movements of persons, capital, goods and services were removed, hereby pursuing an integrated EU (European Commission, 2017). Nevertheless, countries were still using their 'legacy' currency. Several European countries, however, had linked their currency to the German mark (Wyplosz, 1997)[2]. A common currency would eliminate the barriers to free movement of capital and labor even more. Even though the EMU has not reached optimal unification in the capital and labor markets, Mongelli & Vega (2006) argue that both the labor and capital market are benefitting on a slowly growing pace from the euro.

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[1] The concept of theoretical shares will be explained in the theoretical framework.

[2] Austria, Belgium, France, Ireland, Luxembourg and the Netherlands linked their currency to the German mark. Together with Germany they formed the German mark zone.

Bowen et al. (2005; 2010; 2011) developed several methods that can be used as an indicator or as measurement of economic integration that will be used in this paper. These are the equal-share relationship, Spearman rank, the rank-share distribution that exhibits Zipf's Law and the inverse entropy index. For these measurements, data on human capital, physical capital and output will be needed for both the EMU and the EU countries from 1992 until 2014. A full overview of the composition of both Unions can be found in Table 1 in the appendix. In contrast to Bowen et al. (2011) the actual composition of both unions will be used to fully grasp the true economic integration at the measured time periods.

Our results show that the shares and ranks of the factors and output of both the EU and EMU are distributed as expected in an integrated economic area (IEA). Moreover, the entropy statistic proves that both Unions are about equally integrated. Hence, we fail to prove that the EMU is more integrated than the EU.

The remainder of this paper is structured as follows: Chapter 2 provides an overview on the existing literature linked to the EMU and economic integration. Chapter 3 presents the theoretical framework where the used methods for quantifying economic integration will be presented and analyzed. In Chapter 4 we present the data and shed light on some notable observations in the dataset and in Chapter 5 a hypothesis about the research question will be formed. Chapter 6 will present the results and, finally, Chapter 7 will summarize and discuss these results to come to a conclusion.

2. Literature review

To the best of our understanding, no previous studies have focused on the effect of economic integration in the EMU or a comparison of the EMU and the EU. However, current literature is flooded with studies on the EMU and its effects and with research on economic integration. The effects of the EMU, which will be presented first, provide more insight on the macroeconomic changes created by the EMU. This will be followed by defining economic integration and the development of integration measurements, which confirm the validity of the methods to be used further on in this paper.

2.1 The effects of the EMU

The EMU is found to have numerous benefits for its member states. Among these are the removal of transaction costs due to fixed bilateral exchange rates within the union, higher price transparency and a low and stable inflation rate (Healey, 2005). Also, Healey (2005) suggests that these benefits should increase with the size of the Union, as a result of the so-called network externalities. McDonald (2005) adds to these benefits the possibility of trade creation due to the removal of trade barriers. He argues that this removal leads to an export increase from the lowest cost country to higher cost ones. Trade creation occurs when the most efficiently producing country in the EMU can also compete against lowest costs in the rest of the world. However, when another country outside the EMU can produce at even lower costs, trade diversion takes place when an external tariff increases the total costs of importing that good above the lowest-costs within the Union. In that case EMU countries keep on importing from the lowest-cost EMU country (McDonald, 2005).

A common thought of the EMU effects was the increase in trade between the member countries. Increased trade should again lead to higher economic integration within the Union. In his controversial paper, Rose (1999) quantifies the trade increase in a single currency union by using an extended gravity model. An increase of 300 percent is found, meaning that countries within a currency union trade three times more compared to when they have different currencies. According to Rose (1999), this can be partly explained by both the ‘Home Bias’, stating that trade within a Union is intensified compared to trade between the Union and the outside world, and the eliminated deadweight loss of currency exchanges. Yet, the real explanation of this huge increase in trade remains unknown.

In his paper, Lane (2006) explains that the euro has not yet brought all the good things it was supposed to bring yet. One of which is a greater product and factor market integration among the member countries. In theory, the euro decreases trade barriers, which should lead to higher trade volumes between member countries. Both, Baldwin (2006) and Micco et al. (2003) estimate this increase in trade roughly to be between 5 and 16 percent. However, Berger and Nitsch (2008) claim that trade between the euro-countries had been higher for years, hereby nullifying that the euro was the main cause. Furthermore, the creation of a single market should lead to price equalization. Engel and Rogers (2005) however, find that price differences decreased after the 1992 Maastricht Treaty, but have not significantly decreased further after the introduction of the euro. On the other hand, Allington et al. (2005) show that consumer price differences have declined after 2002 for the euro-countries, whereas this is not the case for the EU-countries that are not part of the EMU. This price conversion appeared to be strongest for the most-tradable goods. Lane (2006) concludes to say that it cannot be said with certainty that the euro has increased price convergence, and if so, this convergence has been modest. This evidence implies that economic integration in the euro-zone is not necessarily higher when it comes to trade and equal prices.

2.2 Economic integration

The concept of economic integration is decades old and can, according to Tinbergen (1954), be explained by the human urge for international collaboration, which consistently portrays itself in human society. The European Monetary Union and the European Union are extreme examples of this urge for integration.

Balassa (1961) defines economic integration as follows: *'We propose to define economic integration as a process and as a state of affairs. Regarded as a process, it encompasses measures designed to abolish discrimination between economic units belonging to different national states; viewed as a state of affairs, it can be represented by the absence of various forms of discrimination.'* The discrimination Balassa (1961) refers to can take on different forms and shapes. It includes for example tariffs, decentralized macroeconomic policies and barriers to trade in goods and free movement of labor and capital. This leads to five different levels of economic integration (McDonald, 2005):

1. A Free Trade Area (FTA): an economic group where barriers to goods trade are eliminated;
2. A Customs Union (CU): A FTA with a shared external tariff;
3. A Common Market (CM): a CU including free movement of labor and capital;
4. An Economic Union: a CM including harmonized (macro)economic and social policies;
5. Economic and Monetary Union: An Economic Union including a shared monetary policy.

Following this classification, the EMU would be of the highest order of economic integration: An Economic and Monetary Union. The EU, on the other hand, would be an Economic Union, which is by definition of a lower level of integration.

2.3 Measuring economic integration

It is remarkable that quantifying economic integration has only emerged in the past decade. Even though known economic concepts and econometrical properties are used in these measurements, no measurements of integration based on factor mobility seem to have existed before. Since this paper seeks to provide insights in economic integration in the EMU, it is important to know and understand what the existing measures for economic integration are.

The literature on economic integration is extensive, especially when it comes to its relation with trade or FDI flows (see e.g. Brenton et al., 1999; Sapir, 2000; Rondeau, 2007). An often used method is a gravity model with, e.g., bilateral FDI flows as dependent variable and a dummy variable that should tell if a country is a member of a preferential trade agreement (PTA), thus reflect economic integration (e.g. Brenton et al., 1999). The pitfall of this dummy variable is its implicit assumption that being part of a PTA leads to a higher level of integration, whereas economic integration entails much more than freer trade. Rondeau (2007) found another way to establish the relation between trade and European economic integration. He uses a Fully-Modified Ordinary Least Squares (FM-OLS) method with economic integration as the dependent variable. Economic integration is in this case measured as the sensitivity of output between European countries, which shows how a country's output reacts to a change in output in the rest of Europe. The findings show ambiguous results, with some countries' output being more reactive to increased trade than others (Rondeau, 2007). Besides the fact that above-mentioned measurements of economic integration may not capture the exact definition, they are also used to compare between countries, whereas we are, in order to find an answer to the research question, more interested in the differences between IEA's.

Current literature is flooded with globalization indices that also cover economic integration. These indices measure globalization per country based on different categories such as economic integration. Andreev et al. (2013) provide an overview and critical assessment of seven of these indices and we will focus on their economical parts. As for the data used, all indices include trade flows and most of them also use FDI flows to define economic integration. However, only two indices, the KOF Globalization Index and the Global Index by TransEurope Research Network, take restrictions, such as import barriers and tariffs, into account. These restrictions are expected to have a negative effect on integration and are therefore important to include. Andreev et al. (2013) put the top-20 ranking countries on globalization in a table for each index, showing great differences between them[3]. Moreover, it appears that within a short time period, great differences are found in the top-20 when using the same index, which portrays high volatility. Even though these indices are not meant to solely measure economic integration, the fluctuating results for global integration and the different economic proxies used for integration show that there is no consensus yet on how to measure it.

Andersen and Herbetsson (2003) notice that the current literature on international integration mainly focuses on trade as a measure of integration. They argue that the concept of international integration should be viewed from a broader perspective than just trade and provide an example of such a measure: 'The foreign Policy Globalization Index' from A.T. Kearney. However, according to Andersen and Herbetsson (2003), this measure suffers from some serious flaws, like failing to control for country size and using ambiguous variables as proxy for integration. Therefore, they developed a new globalization index focused on economic integration. Factor analysis, including multiple variables linked to economic integration, is used to create this measure. Each country's factor scores are translated into ranks, which provides a relative integration measure. The authors themselves come up with several downsides of this index, including small-sample problems and sensitivity to new observations. Furthermore, the newly developed measure can merely be called a 'measure' since the ranks provided only have meaning when putting them in context, i.e. one could see if a country is more or less integrated than another country, but it does not provide a measure of how integrated a country itself is.

Bowen et al. (2005) are the first to quantify economic integration. In their paper, the equal-share relationship, which will be profoundly discussed in the theoretical framework, was introduced and weakly tested with the Spearman rank. According to the equal-share relationship, shares of human capital, physical capital and output should equalize when countries have identical technologies and barriers to factor mobility are removed. The Spearman rank measures the correlation between ranks assigned based on a country's share of physical capital, human capital and output. However, since the Spearman rank uses ranks instead of real shares, the results are more of an indicative nature. Additionally, Bowen et al. (2010) propose to use the symmetric Kullback-Leibler divergence (SKLD) as a measure of economic integration. This measure is based on the divergence between real and theoretical shares of a country's physical capital,

[3] Table 2 in the appendix shows the findings of different indices (Andreev et al., 2013).

human capital and output[4]. Smaller divergence, a lower SKLD value, indicates a higher level of economic integration. To make it more logical, the inverse of the SKLD (iSKLD) provides a level of integration rather than diversion. Unfortunately, the statistical characteristics of the measured values are unknown, which means that no meaningful judgement can be made about the difference in values between regions. Also, the iSKLD does not say what value should be obtained when perfect integration is reached, which makes it difficult to interpret the obtained values of integration.

Later, Bowen et al. (2011) published a new paper comparing economic integration in the EU with that of the United States using three different measurements, the equal-share relationship, a rank-share distribution that exhibits Zipf's Law and the entropy index. Economic integration in the EU was thought to be incomplete, leading the authors to benchmark the EU integration against that of the US, which is considered to be complete. The results showed that the 14 EU countries from the sample are not inferior to the 51 US states when it comes to economic integration. Bowen et al. (2011) chose to use 14 European countries, of which three only became an EU-member in 1995. Results are provided from 1960/1965 onwards with an interval of 5 years and keeping the 14 countries constant, even though the composition of the EU and its predecessors changed over time. This would be the main difference with this paper, where for both the EMU and the EU changing composition is used, reflecting the true actual members of both unions in a specific year.

3. Theoretical framework

As mentioned in the Literature Review, quantification of economic integration has first been done by Bowen et al. (2010). Their methods mainly focus on free movement of physical and human capital due to harmonized policies within integrated economic areas.

We start with the equal-share relationship and the Spearman rank. According to the equal-share relationship, the factor and output shares of a country should equalize when being a member of an IEA. The equal-share relationship is based on countries within an IEA undertaking

[4] The concept of theoretical shares will be explained in the theoretical framework.

harmonized policies. However, random shocks can affect a country's shares, which causes the shares to evolve randomly. If this is the case, the rank-share distribution characterizes the relationship between the shares and assigned ranks. In addition, Zipf's Law is a specific case of the rank-share distribution and it even further specifies this relationship by defining the ratio of the shares among countries. When Zipf's Law is present, the so-called theoretical shares can be obtained when the size of the IEA is known. These shares represent the shares for each country under perfect economic integration in the IEA and can later be evaluated against the observed shares in the IEA. Last, based on the theoretical and observed shares, the inverse entropy statistic will provide an overall measure of integration within an IEA. Apart from this statistic using the theoretical shares that can only be obtained by applying before mentioned methods, it is a rather self-contained measure.

Subsections 3.1-3.3 provide above-mentioned methods that will show if the physical capital and human capital shares of the countries within an IEA move as is expected in an IEA. Section 3.4 provides with the (inverse) entropy statistic an overall measure for economic integration.

3.1 The Equal-Share Relationship and Spearman Rank

In several publications, Bowen et al. (2005; 2010; 2011) use the equal-share relationship to see if the factor and output shares behave as expected in an IEA. Also, Bowen et al. (2012) introduce a simplified version, which will be followed here. This simplified version assumes identical technologies and perfect mobility of factors between member states. When policies between member states are perfectly harmonized, which is a characteristic of an IEA, one can assume that differences between countries are minimized. This validates the assumption of identical technologies and perfect factor mobility.

In the model, the EU and EMU are assumed to be integrated economic areas for which a Cobb-Douglas function reflects the production of a single homogenous good (Bowen et al., 2012):

$$Y_{nt} = A_{nt} K_{nt}^{\alpha_n} H_{nt}^{1-\alpha_n} \qquad \text{n = 1,…, N.} \qquad (1)$$

In this equation Y_{nt} reflects output, or GDP, at time t for each country n, K_{nt} reflects the physical capital stock at time t and H_{nt} reflects the human capital stock at time t. A_{nt} represents each country's technology parameter and α_n represents the physical capital share of total output.

Since we assumed similar technologies for all countries and perfect factor mobility between countries, taking the first order derivative of (1) leads to (Bowen et al., 2012):

$$\frac{Y_{1t}}{K_{1t}} = \cdots = \frac{Y_{it}}{K_{it}} = \cdots = \frac{Y_{Nt}}{K_{Nt}} = \frac{\sum_{n=1}^{N} Y_{nt}}{\sum_{n=1}^{N} K_{nt}} \text{[5]}. \tag{2}$$

This equation suggests that the share of a country's output over physical capital should be equal for all countries within the IEA. By taking the derivative of (1) with respect to H_{nt}, the same relation between a country's output and a country's human capital can be acquired (Bowen et al., 2012):

$$\frac{Y_{1t}}{H_{1t}} = \cdots = \frac{Y_{it}}{H_{it}} = \cdots = \frac{Y_{Nt}}{H_{Nt}} = \frac{\sum_{n=1}^{N} Y_{nt}}{\sum_{n=1}^{N} H_{nt}}. \tag{3}$$

Equations (2) and (3) can be combined in a ratio to come to the following relationship (Bowen et al., 2012):

$$\frac{H_{1t}}{K_{1t}} = \cdots = \frac{H_{it}}{K_{it}} = \cdots = \frac{H_{Nt}}{K_{Nt}} = \cdots = \frac{\sum_{n=1}^{N} H_{nt}}{\sum_{n=1}^{N} K_{nt}}. \tag{4}$$

Last, the equal-share relationship is obtained by combining (2) and (4) (Bowen et al., 2012):

$$\frac{Y_{it}}{\sum_{n=1}^{N} Y_{nt}} = \frac{K_{it}}{\sum_{n=1}^{N} K_{nt}} = \frac{H_{it}}{\sum_{n=1}^{N} H_{nt}}. \tag{5}$$

This relationship implies that a country's share of output, human capital and physical capital should equalize at all times, assuming perfect factor mobility and similar technologies. This is in line with the common theory that in the absence of barriers, factor flows will be observed from the low return country to the high return country until the point where the marginal products are equalized.

For the equal-share relationship to hold in absolute form, all three shares within a country should be equal for all countries. Since this is a very precise relationship, it is unlikely to hold. A Spearman rank correlation, which tests whether the rank a country's share scores compared to other countries is equal, can be used. Due to the use of shares rather than nominal values, the Spearman rank is only a weak form to test for conformity of the shares. The correlation coefficients obtained range from 0 to 1. 0 meaning that there is no conformity of ranks within the

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[5] $\frac{Y'_{nt}}{K'_{nt}} = \alpha A K_{nt}^{\alpha_n - 1} H_{nt}^{1-\alpha_n} = \frac{\alpha_n A_{nt} K_{nt}^{\alpha_n} H_{nt}^{1-\alpha_n}}{K_{nt}} = \alpha_n \frac{Y_{nt}}{K_{nt}}.$

Union and economic integration is non-existent. A value of 1 indicates perfect conformity between ranks and a perfectly integrated economic area (Bowen et al., 2012).

Another result of the equal-share relationship is that implementing harmonized policies will not lead to different shares across countries. Harmonized policies, such as fiscal and industrial policies, lead to countries reacting the same to shocks impacting the shares of both factors and output. This, in turn, will cause the shares across countries to stay the same over time[6]. If, however, shares do change over time, this can be thought of as a random event. This random evolution appears to be distributed according to a rank-share distribution, which will be discussed next (Bowen et al., 2011).

3.2 The Rank-Share Distribution and Zipf's Law

As discussed above, the shares within an IEA are expected to evolve randomly. If so, Bowen et al. (2011) argue that the shares should be distributed according to a rank-share distribution that exhibits Zipf's Law[7]. A rank-share distribution refers to the relationship between a country's share and the rank belonging to the share when evaluated against the other countries in the IEA. If the factors and output are distributed according to a ranks-share, or power-law distribution, this distribution can be presented as follows (Bowen et al., 2011):

$$S_{nl} = \gamma_l (R_{nl})^{\beta_l} \qquad n = 1, \ldots, N; \ l = y, k, h. \qquad (6)$$

In this equation, S_{nl} represents the share of variable l for country m, with output (y), physical capital (k) and human capital (h) as possible variables. γ_l denotes the share of variable l of the country with rank 1, i.e., the highest ranked country. By taking the ratios of the shares for the country that ranked one against the other countries, the following relationship is obtained (Bowen et al., 2011):

$$\frac{S_{1l}}{S_{2l}} = 2^{-\beta_l}, \ \frac{S_{1l}}{S_{3l}} = 3^{-\beta_l}, \ \frac{S_{1l}}{S_{Nl}} = N^{-\beta_l}. \qquad (7)$$

When β_l is equal to -1, which we will refer to as Zipf's Law, (7) reduces to (Bowen et al., 2011):

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[6] $\frac{\zeta Y_{it}}{\zeta \sum_{n=1}^{N} Y_{nt}} = \frac{\zeta K_{it}}{\zeta \sum_{n=1}^{N} K_{nt}} = \frac{\zeta H_{it}}{\zeta \sum_{n=1}^{N} H_{nt}}$.

[7] A rank-share distribution provides a relationship between the shares and the associated ranks of a variable. This distribution is closely related to the rank-size distribution, which uses real values rather than shares. Especially the latter method is often used in empirical papers related to city size and population (e.g. Okabe, 1978) and to firm location (e.g. Okumura et al., 2010).

$$S_{1l} = 2S_{2l} = 3S_{3l} = NS_{nl}. \quad (8)$$

In other words, the share of the country that ranks first for a variable, is twice the share of the country that ranks second, three times the share that ranks third and N times the share of the country that ranks Nth (Bowen et al., 2005).

As shown above, Zipf's Law states that the shares of the different member states relate in a specific way to one another. Bowen et al. (2011) mention that this specific relation is also well-known for city sizes when evaluated against the total country's population. This can be proved by the use of a geometric Brownian motion, or GBM, which is a random process, when equal growth among countries can be assumed[8]. A GBM simulates the distribution of the factor and output shares across the IEA for a specific time period. When the simulated shares are extracted these can be used to estimate equation 6. Then, a test to see if the β_l's are statistically different from -1 should check for the presence of Zipf's Law.

Performing a geometric Brownian motion would need simulation and econometric skills that are beyond the scope of this paper and will therefore not be implemented. However, we found it important to do acknowledge its existence and refer to Gabaix (1999) for developing the link between a rank-share distribution and the geometric Brownian motion and to Bowen et al. (2011) for its application on the output shares of the 51 U.S. states.

3.3 Theoretical Shares

Now that the relation between the countries' shares in an IEA have been specified under Zipf's Law, the so-called theoretical shares can be established. These theoretical shares are based on the relationship between a country's factor or output value compared to that of the country ranked first for that factor or output (Bowen et al., 2011). This relation can be displayed as follows:

$$\frac{V_{1l}}{V_{1l}} = \delta_{1l} = 1, \ \frac{V_{2l}}{V_{1l}} = \delta_{2l}, \ \frac{V_{nl}}{V_{1l}} = \ \delta_{nl}. \quad (9)$$

[8] A geometric Brownian motion is a stochastic process with the following properties (Ross, 1999):

1. $\text{Ln}\left(\frac{S_{k+t}}{S_k}\right)$, with $0 \leq k < \infty$, is normally distributed with the mean and variance being μ_t and $\sigma^2 t$ respectively;
2. $\frac{S_{k+t}}{S_k}$ is a random variable and is, for all positive values of k and t, not related to the other values of the variable.

The simulated shares of a GBM can be used to test for the presence of Zipf's Law. If Zipf's Law is present in these simulated shares, one can say that the GBM shares evolve as expected in an integrated economic area.

V_{nl} represents the actual value of variable l for country n. The numerical subscripts show the ranking of the actual values; the country with the highest value for variable l has subscript 1, with the second-highest value has subscript 2, etc. The following expression can be derived from this (Bowen et al., 2011):

$$V_{1l} > \delta_{2l}V_{1l} > \delta_{3l}V_{1l} > \cdots > \delta_{Nl}V_{1l}. \qquad (10)$$

This expression suggests that the total Unions value of variable l is equal to $V_{1l}(1 + \delta_{2l} + \delta_{3l} + \cdots + \delta_{Nl})$. Now that the total value of variable l within the IEA is known, the shares can also be calculated. For the country that ranks first this will be:

$$S_{1l} = \frac{V_{1l}}{V_{1l}(1+\delta_{2l}+\delta_{3l}+\cdots+\delta_{Nl})}. \qquad (11)$$

The country that ranks second will have share:

$$S_{2l} = \frac{\delta_{2j}V_{1l}}{V_{1l}(1+\delta_{2l}+\delta_{3l}+\cdots+\delta_{Nl})}. \qquad (12)$$

Finally, this can be generalized to (Bowen et al., 2011):

$$S_{Nl} = \frac{\delta_{Nj}}{1+\delta_{2l}+\delta_{3l}+\cdots+\delta_{Nl}}. \qquad (13)$$

When the distribution of shares exhibits Zipf's Law, i.e. $\beta_l = -1$, the relation between member countries' shares is already known from (8). Using this relation, the values of δ_{nl} can be calculated (Bowen et al., 2011):

$$\delta_{2l} = \frac{S_{2l}}{S_{1l}} = \frac{1}{2}, \delta_{3l} = \frac{S_{3l}}{S_{1l}} = \frac{1}{3}, \dots, \delta_{Nl} = \frac{S_{Nl}}{S_{1l}} = \frac{1}{N}. \qquad (14)$$

Knowing the values of δ_{nl} means that the theoretical shares as in (13) can be easily calculated. Since the calculation depends on N, this can only be done when the distribution is limited, i.e. the number of countries within an IEA is known (Bowen et al., 2011).

3.4 The Entropy Statistic

Last, Bowen et al. (2011) found a way to capture the level of economic integration by quantifying the distance to complete integration by extending the entropy statistic developed by

Theil (1971). This distance is based on the difference between theoretical shares as explained in subsection 3.3 and actual shares. It can therefore be seen as a diversion index. The entropy statistic can be characterized as follows (Bowen et al., 2011):

$$E(\bar{S}, S_t) = \frac{1}{3}\sum_{l=y,k,h}\left(\sum_{n=1}^{N}\bar{S}_{nl}\ ln\left(\frac{\bar{S}_{nl}}{S_{nlt}}\right)\right). \qquad (15)$$

As can be seen, each variable contributes for $\frac{1}{3}$ to the value of the statistic. Since we are more interested in the level of integration rather than diversion, we follow Bowen et al. (2011) and convert the statistic to an integration measurement. This is done by taking the inverse (Bowen et al., 2011):

$$I(\bar{S}, S_t) = \frac{1}{e^{E(\bar{S}, S_t)}} = e^{-E(\bar{S}, S_t)}. \qquad (16)$$

An inverse statistic of 0 means no integration at all, whereas a statistic of 1 indicates full integration within the IEA (Bowen et al., 2011).

4. Data description

Our dataset consists of data on human capital, physical capital and output for every EMU and EU country and is obtained from the World Bank[9]. The World Bank provides this data on a yearly basis, wherefore we will do yearly calculations from 1992, the year the Maastricht Treaty was signed, until 2014. The euro was only introduced in 2002, however we choose to also perform all EMU calculations from 1992 onwards to see if integration rises when preparing for the introduction.

As mentioned, the necessary data is extracted from the World Bank database. However, not all data for human capital is available. Since other databases, e.g. Penn World, are not able to provide this data either, the available World Bank data was used to extrapolate and fill the

[9] Source: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on.

missing data points[10]. Human capital is measured as the amount of people with secondary or tertiary education[11]. This comes down to:

$$\frac{\%\,secondary + \%\,tertiary}{100} * total\ labor\ force. \qquad (17)$$

Where the percentage of secondary and tertiary educated people is calculated relative to the total labor force[12].

Physical capital is measured as the gross capital formation in U.S. dollars, which we think captures physical capital very well, and output as a country's GDP in U.S. dollars[13]. Both these variables are measured in U.S. dollars so no adjustments for exchange rates have to be calculated and a fair comparison between the countries using different currencies can be made.

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[10] Penn World has an index as human capital variable (http://www.rug.nl/ggdc/docs/human_capital_in_pwt_90.pdf), which would not be of any meaning in this research. Besides, they have five-yearly data available and extrapolate the missing years as well.

Countries with missing data points are: Austria, Finland, France, Germany, Ireland, Luxembourg, the Netherlands and the United Kingdom. Simple OLS regressions are run for each country separately, after which the missing data points can be estimated. See Graphs 1 in the appendix.

[11] World Bank definition labor force with secondary education: *'Labor force with secondary education is the share of the total labor force that attained or completed secondary education as the highest level of education.'*

World Bank definition labor force with tertiary education: '*Labor force with tertiary education is the share of the total labor force that attained or completed tertiary education as the highest level of education.'*

[12] World Bank definition total labor force: *'Total labor force comprises people ages 15 and older who meet the International Labor Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part-time workers, in general the labor force includes the armed forces, the unemployed, and first-time job-seekers, but excludes homemakers and other unpaid caregivers and workers in the informal sector.'*

[13] World Bank definition gross capital formation: '*Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are in current U.S. dollars.'*

World Bank definition GDP: '*GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.'*

Since our dataset comprises of 28 countries at the most (for the EU) and 23 years, only the first and last years for both IEAs and the descriptive statistics of both datasets will be provided[14]. Nevertheless, the dataset shows some remarkable observations that will be discussed here.

First, it stands out that Germany consistently ranks first for all variables and all years in both the EMU and the EU dataset. This means that Germany has the highest share of human capital, physical capital and output compared to the other countries in the union. Furthermore, the EMU data contains more countries that score the same rank for all observations: France with rank 2 and Italy with rank 3. The Netherlands and Spain score a 4 and 5 respectively, but switched ranks for human capital in 1992. With changing ranks over time, Malta still manages to score the same rank for all variables. Last, Greece shows a lower score on physical capital from 2011 onwards whereas the ranks for human capital and output stay the same. This could be due to the Greek debt crisis.

In the EU dataset, most remarkable is the entrance of Bulgaria, the Czech Republic, Hungary, Poland and Romania. These countries all score high on human capital compared to the other two variables. This causes a disruption in the share distribution as it causes countries like Ireland, the Netherlands and Portugal to move down a few ranks. Also, just like in the EMU, Malta scores the same rank for all variables while showing changing ranks over time.

5. Hypothesis

As written in the Literature Review, a Monetary Union is thought to take economic integration to a higher level compared to an Economic Union. The empirical statistics we use to measure integration depend on the free movement of human capital and physical capital. Any differences in integration would occur when one of these factors would face some obstacles to free movement, like the use of different currencies across countries. A common currency decreases transaction costs and enables price transparency across the EMU-members, although Chapter 2

[14] Tables 3 and 4 in the appendix provide this data for the EMU and EU respectively. Tables 5-10 show the descriptive statistics for the EMU and the EU.
The whole dataset can be obtained from the author upon request.

shows that now consensus on that has been reached yet. This brings us to the following hypothesis:

'Economic integration in the EMU is higher than in the EU.'

This hypothesis is not only consistent with the ordering of economic integrated areas as provided in the literature, it also, if found true, affirms the European Commission's statement that the EMU took integration in Europe to a higher level (European Commission, 2016).

Our hypothesis will be tested by applying the empirical methods as discussed in the theoretical framework to both the EMU and the EU dataset.

6. Results

In this chapter we discuss the theoretical methods presented in the theoretical framework and we will evaluate the results. First, the conformity of ranks within the IEAs for all three variables will be examined. This will be followed by the rank-share distribution and Zipf's law after which the theoretical shares will be presented. Last, the entropy statistic should provide a full measurement of economic integration in both our IEAs.

6.1 The Spearman Rank

As mentioned, the Spearman rank tests for conformity of ranks between a country's share of human capital, physical capital and output. Since it uses ranks rather than real shares, this is only a weak form of testing.

Table 11 and Graph 2 in the appendix show the Spearman rank correlation coefficients, which are all statistically significant at the 5 percent level, over time for the pairwise variables of the EMU. As can be seen from both figures, the correlation stays well over 94 percent at all times, which suggests that the ranks for the three different variables do not vary much within the EMU's countries. Notable is the increase in correlation between human capital and physical capital in 2006, indicating more stable shares within the countries. In the year 2009, however, human capital & physical capital and human capital & output show a decline. The ranks show some imbalance between human capital & physical capital and human capital & output, but the ranks within countries do not differ by more than 2.

Table 12 and Graph 3 in the appendix show the Spearman rank correlations coefficients for the EU over time, which are also statistically significant at the 5 percent level. When looking at these results, the increased range of coefficients for human capital & output and human capital & physical capital immediately stand out. For both of them, we observe a 'breakpoint' around 2004, the year that 10 countries entered the EU of which the majority was eastern-European. This indicates an increased difference in ranks from 2004 onwards between human capital & output and human capital & physical capital. Since physical capital & output still show a steady correlation of above 95 percent, this suggests that the human capital stock is the variable that causes this imbalance. Let us take the example of the Netherlands, which scores a steady 6 for all variables from 1993 onwards. From 2004 onwards, the Netherlands still scores a steady 6 on both physical capital and output, however, human capital decreases to a 7 until 2007 and from then on to an 8. This can be explained by the entrance of Poland into the EU, which has a high human capital stock and scores a 4 from 2004-2013 and a 5 in 2014. This leads the other countries, amongst others the Netherlands, to decrease by one rank. Since Poland's stock of physical capital and output score between rank 7 and 10, which alone causes an imbalance, these countries do not lose on these ranks, which only amplifies the differences in ranks.

It must be said once more, that the Spearman rank is only a weak form of testing, so no clear statements can be made about the economic integration within the EMU. However, the analysis above does provide some insights on the relationship between human capital, physical capital and output.

6.2 The Rank-Share Distribution and Zipf's Law

Equation 6 shows the relationship between the share of a country's variable and its rank when the shares are distributed according to a rank-share distribution. This formula can be modified to make it easier to work with (Bowen et al., 2011):

$$ln(S_{nl}) = \theta_l + \beta_l \ln(R_{nl}) + \varepsilon_{nl}, \qquad n = 1, \dots, N; l = h, k, y. \qquad (18)$$

In this equation, θ_l equals $\ln(\gamma_l)$ and ε_{nl} is the error term. With this formula, a regression analysis can be performed to obtain the values of β_l for each year and each variable. The results for both the EMU and EU are provided in Tables 13 to 18 in the appendix.

According to Gabaix and Ioannides (2004), this type of regression is prone to underestimate β_l when using small samples like we do. A Monte Carlo simulation is therefore necessary to find this bias and correct for it. This simulation is run for all different N countries that occur over time and uses artificial data from a power law distribution that exhibits Zipf's Law to estimate the bias[15]. In the light of the constraints we are facing, performing a Monte Carlo simulation is beyond the scope of this paper. Therefore, the biases obtained in Bowen et al. (2011) for N=14 and N=51 are inter- and extrapolated to obtain the biases for our results. All slope values are found to be statistically significant at the 5 percent level.

Gabaix and Ioannides (2004) also argue that the slope error terms are underestimated as the use of ranks causes correlation between the residuals. The true standard error can therefore be approximated by $-\hat{\beta}_l\sqrt{2/N}$. This approximation will be used when calculating the Z-score provided in the tables in the appendix. The Z-statistic tests if the bias-corrected slope is significantly different from -1 (Zipf's Law).

Looking at the 5 percent significant level (z = -1.96), we fail to reject the null hypothesis for all Z-scores and for both the EMU and the EU. This means that the bias-corrected slopes are not significantly different from -1 and the shares of human capital, physical capital and output follow a rank-share distribution that displays Zipf's Law. This provides strong evidence for the harmonization of policies within the EMU as well as the EU, which causes the shares to change randomly over time. Moreover, the Adjusted R^2 provided in the tables shows a strong relationship between the ranks and shares of the factors and output for both economic regions.

It must be noted that the Z-scores for the EMU have decreased steeply from 2008 onwards, especially for physical capital and output. However, they are still statistically significant at the 5 percent level so a later research should evaluate if this downward trend continues into the rejection area.

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[15] For a Monte Carlo simulation, N independent and identically distributed variables are drawn from the exact power law distribution with β_l= -1 and changed into sizes. Ranks can be assigned to these sizes after they are converted to shares. With these ranks and shares, regression 17 can be run. Gabaix & Ioannides (2004) perform 20,000 regressions and Bowen et al. (2011) perform 100,000 regressions for each N. The results will most likely provide an average β_l smaller than the -1 from the exact power law. The difference between the average and -1 is the slope bias for that amount of countries.

6.3 The Equal-Share Relationship

As discussed in the theoretical framework, the equal-share relationship states that the shares of human capital, physical capital and output for a country within an IEA should be equal. This would mean that the slope estimates (β_l) as calculated from (18) should exhibit homogeneity. This can be tested with a χ^2-test for homogeneity. This test does not only test for homogeneity across both factors and output, but also across years. For both, the EMU and the EU, the null hypothesis cannot be rejected, meaning that the distribution of shares conforms to a power law distribution[16].

To see if the equal-share relationship holds for the highest ranked country, the χ^2-test for homogeneity is also performed on the intercept values of both factors and output as obtained from (18). These intercept values are the natural logarithm of the share of the highest ranked country. By testing for homogeneity between these shares, we can see if the shares of the highest ranked country in both IEAs support the equal-share relationship[17]. Again, for both the EMU and EU, the null hypothesis cannot be rejected, meaning that the shares of the first ranked country are statistically equal for both factors and output[18].

We have established for both IEAs that the shares of the first ranked country, Germany, and the $\beta's$ show homogeneity for all years. These results show strong support for the equal-share relationship.

6.4 Theoretical Shares

When the distribution of shares is limited, the theoretical shares can be calculated using equation 14 and 13[19]. These represent the shares that ideally would occur when the distribution exhibits Zipf's Law. Now that we have obtained the theoretical shares, we can evaluate how they relate to the observed true shares.

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[16] The χ^2-test for the EMU provides a value of 0.128, which lies well within the rejection area of 60.481. This leads us to conclude that the null hypothesis cannot be rejected at the 5 percent level.
The χ^2-test for the EU provides a value of 0.307, which lies well within the rejection area of 60.481. This leads us to conclude that the null hypothesis cannot be rejected at the 5 percent level.

[17] For the EMU and the EU and for both factors and output, Germany ranks first.

[18] The χ^2-test for the EMU provides a value of 2.034, which lies well within the rejection area of 60.481. This leads us to conclude that the null hypothesis cannot be rejected at the 5 percent level.
The χ^2-test for the EU provides a value of 3.263, which lies well within the rejection area of 60.481. This leads us to conclude that the null hypothesis cannot be rejected at the 5 percent level.

[19] The theoretical shares can be found in Table 19 in the appendix.

A simple correlation coefficient shows the correlation between the actual and theoretical shares for each year for both factors and output. As can be seen from Table 20 in the appendix, the coefficients for the EMU fall within the 0.874 and 0.942 range and for the EU they fall within the 0.864 and 0.936 range. This means that the true and theoretical shares for human capital, physical capital and output show high correlations for all years.

The high correlation coefficients are not an indicator that both shares come from the same distribution. To test for this, a two-sample Kolmogorov-Smirnov test is performed and the results and their critical values are shown in Table 21 in the appendix[20]. The D-statistics show significance at the 5 percent level for both factors and output, for all years and for both the EMU and EU, which means that the H_0 that both samples come from the same distribution cannot be rejected. This is strong evidence that the actual share distribution depends only on the number of countries within the IEA.

6.5 The Entropy Statistic

Last, the entropy statistic should provide a single measurement for economic integration in the EMU and the EU for every year by measuring the distance between the observed and the theoretical shares and convert this into an index.

As can be seen from Table 22 in the appendix, economic integration for the EMU, looking at the inverse entropy statistic, ranges from 0.813 to 0.918 and it shows an overall average of 0.887. From 1992 to 2001, economic integration rises slowly but steadily. It is highly remarkable that after 2001, when the euro came into effect, economic integration in the Union slowly decreased at first, followed by a steeper decline and at last a period of stabilization from 2011 onwards. Looking at the inverse entropy statistics of the individual variables, the first rise can be largely attributed to physical capital, which shows a steeper increase than the other two variables during that period. After the introduction of the euro, the inverse entropy for output stays stable with only small fluctuations and the statistic for human capital increases at a slow pace. The index for

[20] The two-sample Kolmogorov-Smirnov test measures for observations from two different samples how far the pairwise observations differ. This difference is calculated for cumulative shares. De D-statistic is equal to the largest difference between cumulative shares and is evaluated against the critical value. The 5% critical value is obtained by the following formula: $1.36 * \sqrt{N_1 + N_2 / N_1 * N_2}$. A D-statistic higher than the critical value rejects the H_0 that the actual and theoretical shares come from the same distribution.

physical capital shows a small decline at first, followed by a steeper one. Again, the change in the overall economic integration, the swift decline after 2001, can be largely attributed to human capital.

The inverse entropy statistic for the EU ranges from 0.858 to 0.925 and has an average of 0.894. The first thing that stands out when looking at the inverse entropy statistics for the EU is the large rise in 1995, the year that 3 countries joined the EU, followed by a slow decline until the next expansion in 2004. In 2004 the EU faced its biggest enlargement with 10 countries joining the EU at the same time. This expansion goes along with a steep decline from 0.914 to 0.858 in the overall index, which can be largely assigned to the big drop in the output index, even though both factors also showed a decline. This sudden fall in economic integration is followed by a smooth rise until an ostensible steady last phase is reached from 2008 onwards.

Overall we can say that both unions have reached high levels of economic integration and that differences between both unions are limited. As Bowen et al. (2011) note, no statistical meaning can be attributed to the changes in index values over time, nor to the differences between the EMU and EU. This results from the unknown statistical characteristics of the entropy statistic.

7. Conclusion

This paper analyzes the development of economic integration in the EMU and compares this with integration in the EU. For this purpose, three strong theoretical measurements and one weaker one developed by Bowen et al. (2011) are closely studied and used. These measurements are then applied to an EMU dataset consisting of all EMU countries from 1992 to 2014 and an EU dataset, consisting of all EU countries for that same time period. By doing so, we are the first to truly quantify the extend of economic integration in the EMU and also the first to use a changing dataset over time.

All measurements drive on the notion that the shares of human capital, physical capital and output within a country, that is a member of an integrated economic area, should equalize. This is deducted from a Cobb-Douglas function where identical technologies and perfect factor mobility within a Union are assumed.

The Spearman rank starts off with a weak test of the equal-share relationship. This weak form depends on the ranks assigned to a country's share of both factors and output. Subsequently, the differences in the pairwise ranks should indicate if the equal-share relationship holds in its weak form. In general, both Unions under investigation score high values, which indicates that the shares of output and human and physical capital behave as expected in an integrated economic area. It must be noted, however, that the coefficients for the EU dropped steeply after 2003, most likely caused by its eastern-European expansion. This suggests that the shares of both factors and output behave less like expected, but the correlation is still strong.

Next, it is tested if the factor and output shares conform to a rank-share distribution that exhibits Zipf's Law. According to the rank-share distribution the shares and ranks between countries within a Union conform to a specific pattern. This is analyzed by using a simple regression analysis where the coefficient is expected to take on value -1 (Zipf's Law). Tested at the 5 percent significance level, the null hypothesis cannot be rejected for any of the observations, showing strong support for the existence of Zipf's Law in the share distributions.

The equal-share relationship can now be tested in a stronger form by testing for homogeneity between the factor and output coefficients from previous obtained results. Again, the null hypothesis cannot be rejected which indicates homogeneity across the factors and output for all years and proves the existence of the equal-share relationship in our datasets.

To test if the theoretical shares as obtained in the theoretical framework are from the same distribution as the actual shares, a Kolmogorov-Smirnov test is used. Failure to reject the null-hypothesis leads us to conclude that the theoretical and actual shares come from the same distribution and therefore only depend on the amount of countries within the economic union.

Last, a full measure of economic integration is provided; the inverse entropy index. This index is based on the difference between the actual and theoretical shares and ranges between 0 and 1. Overall, both unions show high levels of integration with only small differences between them. However, these differences have no statistical meaning, inducing us to conclude that both unions are highly integrated.

These results lead us to conclude that no statistical differences in integration between the EMU and the EU can be found. The used methods show that the shares in the EMU as well as in the EU behave as expected in an IEA (i.e. the shares within the countries equalize) and the measured levels of economic integration are extremely high in both Unions. Moreover, the results show no evidence that factor mobility in the EMU is freer than in the EU, which we define as the basis of increased economic integration.

By failing to prove that economic integration in the EMU is higher than in the EU, we must also conclude that the discrimination Balassa (1961) refers to does not include the use of different currencies. Also, it makes us question the difference between level 4 (an Economic Union) and 5 (an Economic and Monetary Union) as described by McDonald (2005) when it comes to economic integration.

Moreover, there are a few concerns in this study that cannot be properly addressed and therefore need further research. First of all, some countries miss a few data points for human capital. This data is created by extrapolating the available observations. Even though this is a more often used method, it does cause a difference between the true and estimated values and it might be the reason that Spain and the Netherlands switched rank for human capital in 1992. Also, the measurements used for economic integration are based on the free movement of labor and capital, or human and physical capital. However, economic integration in the European Union is based on four freedoms. These are free movement of labor, capital, services and goods. The measures as defined by Bowen et al. (2011) are the only one in its kind at the moment, but could be further extended by also including the free movement of services and goods (e.g. trade). Last, as Bowen et al. (2011) have already pointed out, the weight assigned to each factor and output in the entropy statistic is equal, meaning 1/3 each. One could question if this fair division also represents reality. We are not implying that it does not exemplify reality, but it is an assumption that needs further research.

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Appendix

Table 1, Composition of the EU/EMU

Year of entrance	EMU countries	Year of entrance	EU countries
2002	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain	1992	Belgium, The Netherlands, Luxembourg, France, Germany, Italy
			Denmark, Ireland, The UK
2007	Slovenia		Greece
2008	Cyprus, Malta		Denmark, Ireland, The UK
2009	Slovakia		Greece
2011	Estonia	1995	Austria, Finland, Sweden
			Cyprus, Czech Republic, Estonia, Hungary, Latvia,
2014	Latvia	2004	Lithuania, Malta, Poland, Slovakia, Slovenia
2015	Lithuania	2007	Bulgaria, Romania
		2013	Croatia

Table 2. Globalization indices

	Maastricht Index 2008	KOF 2010	A.T. Kearney/Foreign Policy 2006	Warwick 2004	Ernst & Young 2012	TransEurope 2002	Global Enabling Trade Index s.d.
1	Ireland	Belgium	Singapore	Singapore	Hong Kong	Ireland	Singapore
2	Belgium	Austria	Switzerland	Belgium	Singapore	Singapore	Hong Kong
3	Switzerland	The Netherlands	USA	Canada	Ireland	Hong Kong	Denmark
4	The Netherlands	Switzerland	Ireland	UK	Belgium	Sweden	Sweden
5	France	Sweden	Denmark	USA	Switzerland	Belgium	New Zealand
6	Austria	Denmark	Canada	Austria	The Netherlands	Switzerland	Finland
7	Kuwait	Canada	The Netherlands	Sweden	Sweden	Denmark	The Netherlands
8	UK	Portugal	Australia	Switzerland	Denmark	The Netherlands	Switzerland
9	Germany	Finland	Austria	France	Hungary	Finland	Canada
10	Denmark	Hungary	Sweden	Denmark	UK	UK	Luxembourg
11	Spain	Ireland	New Zealand	Ireland	Germany	Israel	UK
12	Israel	Czech Republic	UK	Germany	Slovakia	Austria	Norway
13	Italy	France	Finland	Italy	Finland	USA	Germany
14	Sweden	Luxembourg	Norway	Malaysia	France	Canada	Chile
15	Estonia	Spain	Israel	Finland	Canada	Malta	Austria
16	Saudi Arabia	Slovakia	Czech Republic	Australia	Israel	New Zealand	Iceland
17	Czech Republic	Singapore	Slovenia	The Netherlands	Taiwan	France	Australia
18	Jordan	Germany	Germany	New Zealand	Czech Republic	Germany	Japan
19	Republic of Korea	Australia	Malaysia	Russia	Austria	Hungary	United Arab Emirates
20	Norway	Norway	Hungary	Republic of Korea	Spain	Norway	France

Table 3, Short data overview EMU

EMU	Year	Share Human Capital	Share Physical Capital	Share Output	Rank Human Capital	Rank Physical Capital	Rank Output
Austria	1992	0.030	0.033	0.029	7	7	7
Belgium	1992	0.033	0.034	0.035	6	6	6
Finland	1992	0.022	0.015	0.017	9	10	9
France	1992	0.211	0.199	0.211	2	2	2
Germany	1992	0.395	0.342	0.318	1	1	1
Greece	1992	0.024	0.019	0.017	8	8	8
Ireland	1992	0.009	0.006	0.008	11	11	11
Italy	1992	0.125	0.181	0.197	3	3	3
Luxembourg	1992	0.001	0.002	0.002	12	12	12
Netherlands	1992	0.069	0.054	0.054	4	5	5
Portugal	1992	0.014	0.017	0.016	10	9	10
Spain	1992	0.067	0.097	0.094	5	4	4
Austria	2014	0.031	0.039	0.033	7	7	7
Belgium	2014	0.033	0.046	0.040	6	6	6
Finland	2014	0.019	0.021	0.020	10	8	8
France	2014	0.203	0.239	0.212	2	2	2
Germany	2014	0.302	0.287	0.289	1	1	1
Greece	2014	0.030	0.010	0.018	8	11	10
Ireland	2014	0.015	0.021	0.019	11	9	9
Italy	2014	0.141	0.136	0.160	3	3	3
Luxembourg	2014	0.002	0.005	0.005	17	13	13
Netherlands	2014	0.057	0.061	0.066	5	5	5
Portugal	2014	0.021	0.013	0.017	9	10	11
Spain	2014	0.116	0.102	0.103	4	4	4
Slovenia	2014	0.007	0.004	0.004	13	14	14
Cyprus	2014	0.004	0.001	0.002	15	17	17
Malta	2014	0.001	0.001	0.001	18	18	18
Slovak Rep.	2014	0.005	0.008	0.008	14	12	12
Estonia	2014	0.004	0.003	0.002	15	16	16
Latvia	2014	0.008	0.003	0.002	12	15	15

Table 4. Short data overview EU

EU	Year	Share Human Capital	Share Physical Capital	Share Output	Rank Human Capital	Rank Physical Capital	Rank Output
Belgium	1992	0.0280	0.0323	0.0307	7	7	7
Netherlands	1992	0.0586	0.0536	0.0465	5	6	6
Luxembourg	1992	0.0008	0.0022	0.0021	12	12	12
France	1992	0.1801	0.1890	0.1830	2	2	2
Germany	1992	0.3366	0.2912	0.2758	1	1	1
Italy	1992	0.1067	0.1604	0.1709	4	3	3
Denmark	1992	0.0236	0.0174	0.0198	8	9	8
Ireland	1992	0.0078	0.0070	0.0073	11	11	11
UK	1992	0.1686	0.1183	0.1532	3	4	4
Greece	1992	0.0207	0.0174	0.0151	9	8	9
Spain	1992	0.0568	0.0949	0.0817	6	5	5
Portugal	1992	0.0118	0.0163	0.0140	10	10	10
Belgium	2014	0.020	0.033	0.029	11	9	9
Netherlands	2014	0.035	0.047	0.047	8	6	6
Luxembourg	2014	0.001	0.003	0.003	27	20	20
France	2014	0.126	0.175	0.153	3	2	3
Germany	2014	0.187	0.199	0.209	1	1	1
Italy	2014	0.088	0.099	0.116	4	4	4
Denmark	2014	0.011	0.019	0.019	19	11	11
Ireland	2014	0.009	0.015	0.014	20	13	13
UK	2014	0.138	0.140	0.161	2	3	2
Greece	2014	0.018	0.008	0.013	14	17	14
Spain	2014	0.072	0.082	0.074	6	5	5
Portugal	2014	0.013	0.010	0.012	16	16	15
Austria	2014	0.019	0.027	0.024	13	10	10
Finland	2014	0.012	0.015	0.015	18	14	12
Sweden	2014	0.022	0.035	0.031	10	7	7
Cyprus	2014	0.003	0.001	0.001	26	27	27
Czech Rep.	2014	0.026	0.016	0.011	9	12	16
Estonia	2014	0.003	0.002	0.001	25	25	26
Hungary	2014	0.020	0.008	0.007	12	18	18
Latvia	2014	0.005	0.002	0.002	23	26	25
Lithuania	2014	0.007	0.002	0.003	22	24	24
Malta	2014	0.001	0.000	0.001	28	28	28
Poland	2014	0.087	0.033	0.029	5	8	8
Slovak Rep.	2014	0.013	0.006	0.005	17	19	19
Slovenia	2014	0.005	0.003	0.003	24	23	23
Bulgaria	2014	0.015	0.003	0.003	15	21	22
Romania	2014	0.036	0.013	0.011	7	15	17
Croatia	2014	0.008	0.003	0.003	21	22	21

Table 5. Descriptive Statistics EMU, Human Capital

Country	Mean	Minimum	Maximum	St. dev.
Austria	3.21E+06	2.27E+06	3.81E+06	4.21E+05
Belgium	3.25E+06	2.50E+06	4.01E+06	4.70E+05
Finland	2.04E+06	1.69E+06	2.36E+06	2.16E+05
France	2.00E+07	1.61E+07	2.46E+07	2.48E+06
Germany	3.33E+07	3.00E+07	3.69E+07	2.16E+06
Greece	2.97E+06	1.84E+06	3.71E+06	5.97E+05
Ireland	1.28E+06	6.92E+05	1.76E+06	3.75E+05
Italy	1.33E+07	9.50E+06	1.71E+07	2.40E+06
Luxembourg	1.45E+05	6.89E+04	2.22E+05	4.74E+04
Netherlands	5.97E+06	5.04E+06	6.85E+06	5.66E+05
Portugal	1.50E+06	9.89E+05	2.57E+06	4.48E+05
Spain	1.00E+07	5.06E+06	1.41E+07	3.11E+06
Slovenia	8.92E+05	8.75E+05	8.99E+05	8.62E+03
Cyprus	4.67E+05	4.33E+05	5.01E+05	2.66E+04
Malta	8.96E+04	7.18E+04	1.04E+05	1.09E+04
Slovak Rep.	6.27E+05	6.26E+05	6.29E+05	1.22E+03
Estonia	4.87E+05	4.62E+05	5.01E+05	1.57E+04
Latvia[a]	9.38E+05	9.38E+05	9.38E+05	0
EMU	7.28E+06	6.89E+04	3.69E+07	9.35E+06

[a] Since Latvia enters the EMU in 2014, which is the last year of our dataset, the mean, minimum and maximum are equal and the standard deviation is automatically 0.

Table 6. Descriptive Statistics EMU, Physical Capital

Country	Mean	Minimum	Maximum	St. dev.
Austria	7.3E+10	4.82E+10	1.05E+11	2.04E+10
Belgium	8.27E+10	4.96E+10	1.33E+11	2.87E+10
Finland	4.18E+10	1.66E+10	7.12E+10	1.6E+10
France	4.46E+11	2.59E+11	7.04E+11	1.51E+11
Germany	5.87E+11	4.14E+11	7.92E+11	1.11E+11
Greece	4.41E+10	2.63E+10	8.69E+10	1.81E+10
Ireland	3.72E+10	8.11E+09	7.89E+10	2.1E+10
Italy	3.31E+11	2E+11	5.21E+11	9.6E+10
Luxembourg	7.26E+09	3.69E+09	1.25E+10	3.08E+09
Netherlands	1.3E+11	7.47E+10	2.09E+11	3.93E+10
Portugal	3.83E+10	2.1E+10	6.17E+10	1.03E+10
Spain	2.48E+11	1.12E+11	4.84E+11	1.12E+11
Slovenia	1.19E+10	8.67E+09	1.82E+10	3.12E+09
Cyprus	5.06E+09	2.87E+09	8.12E+09	1.72E+09
Malta	1.87E+09	1.65E+09	2.06E+09	1.29E+08
Slovak Rep.	2.11E+10	1.88E+10	2.45E+10	1.84E+09
Estonia	6.66E+09	5.82E+09	7.11E+09	5.12E+08
Latvia[a]	7.24E+09	7.24E+09	7.24E+09	0
EMU	1.55E+11	1.65E+09	7.92E+11	1.91E+11

[a] Since Latvia enters the EMU in 2014, which is the last year of our dataset, the mean, minimum and maximum are equal and the standard deviation is automatically 0.

Table 7. Descriptive Statistics EMU, Output

Country	Mean	Minimum	Maximum	St. dev.
Austria	2.97E+11	1.9E+11	4.38E+11	9.29E+10
Belgium	3.61E+11	2.26E+11	5.32E+11	1.15E+11
Finland	1.85E+11	8.93E+10	2.84E+11	6.47E+10
France	2.03E+12	1.33E+12	2.92E+12	5.97E+11
Germany	2.79E+12	1.95E+12	3.88E+12	6.66E+11
Greece	2.07E+11	1.09E+11	3.54E+11	7.68E+10
Ireland	1.6E+11	5.25E+10	2.75E+11	7.81E+10
Italy	1.65E+12	1.06E+12	2.39E+12	4.57E+11
Luxembourg	3.54E+10	1.6E+10	6.49E+10	1.66E+10
Netherlands	6.14E+11	3.49E+11	9.36E+11	2.08E+11
Portugal	1.72E+11	9.5E+10	2.62E+11	5.63E+10
Spain	9.88E+11	5.24E+11	1.63E+12	3.91E+11
Slovenia	4.96E+10	4.63E+10	5.56E+10	2.71E+09
Cyprus	2.56E+10	2.33E+10	2.78E+10	1.53E+09
Malta	9.43E+09	8.53E+09	1.07E+10	7.38E+08
Slovak Rep.	9.49E+10	8.89E+10	1.01E+11	4.56E+09
Estonia	2.44E+10	2.3E+10	2.62E+10	1.33E+09
Latvia[a]	3.13E+10	3.13E+10	3.13E+10	0
EMU	7.11E+11	8.53E+09	3.88E+12	8.97E+11

[a] Since Latvia enters the EMU in 2014, which is the last year of our dataset, the mean, minimum and maximum are equal and the standard deviation is automatically 0.

Table 8. Descriptive Statistics EU, Human Capital

Country	Mean	Minimum	Maximum	St. dev.
Belgium	3.25E+06	2.50E+06	4.01E+06	1.15E+11
Netherlands	5.97E+06	5.04E+06	6.85E+06	2.08E+11
Luxembourg	1.45E+05	6.89E+04	2.22E+05	1.66E+10
France	2.00E+07	1.61E+07	2.46E+07	5.97E+11
Germany	3.33E+07	3.00E+07	3.69E+07	6.66E+11
Italy	1.33E+07	9.50E+06	1.71E+07	4.57E+11
Denmark	2.21E+06	2.11E+06	2.36E+06	7.54E+10
Ireland	1.28E+06	6.92E+05	1.76E+06	7.81E+10
UK	2.35E+07	1.48E+07	3.01E+07	6.35E+11
Greece	2.97E+06	1.84E+06	3.71E+06	7.68E+10
Spain	1.00E+07	5.06E+06	1.41E+07	3.91E+11
Portugal	1.50E+06	9.89E+05	2.57E+06	5.63E+10
Austria	3.33E+06	2.82E+06	3.81E+06	9.03E+10
Finland	2.09E+06	1.77E+06	2.36E+06	6E+10
Sweden	3.90E+06	3.38E+06	4.49E+06	1.21E+11
Cyprus	4.38E+05	3.58E+05	5.01E+05	3.26E+09
Czech Republic	4.90E+06	4.72E+06	5.08E+06	3.59E+10
Estonia	6.22E+05	6.00E+05	6.29E+05	4.39E+09
Hungary	3.72E+06	3.57E+06	3.84E+06	1.44E+10
Latvia	9.52E+05	9.23E+05	1.00E+06	6.15E+09
Lithuania	1.44E+06	1.40E+06	1.47E+06	8.36E+09
Malta	8.02E+04	5.46E+04	1.04E+05	1.46E+09
Poland	1.62E+07	1.51E+07	1.71E+07	9.59E+10
Slovak Rep.	2.51E+06	2.44E+06	2.58E+06	1.48E+10
Slovenia	8.80E+05	8.34E+05	8.99E+05	6.24E+09
Bulgaria	2.91E+06	2.86E+06	2.99E+06	3.86E+09
Romania	7.24E+06	7.13E+06	7.41E+06	1.46E+10
Croatia	1.61E+06	1.60E+06	1.63E+06	3.17E+08
EU	7.16E+06	5.46E+04	3.69E+07	8.97E+06

Table 9. Descriptive Statistics EU, Physical Capital

Country	Mean	Minimum	Maximum	St. dev.
Belgium	9.58E+10	7.06E+10	1.2E+11	1.61E+10
Netherlands	1.58E+11	1.12E+11	1.95E+11	2.17E+10
Luxembourg	8.19E+09	4.99E+09	1.18E+10	2.14E+09
France	5.34E+11	3.84E+11	6.5E+11	8.33E+10
Germany	6.63E+11	5.94E+11	7.33E+11	3.9E+10
Italy	4.12E+11	3.2E+11	5.06E+11	5.43E+10
Denmark	5.9E+10	3.56E+10	7.84E+10	1.08E+10
Ireland	3.99E+10	1.51E+10	6.41E+10	1.43E+10
UK	3.76E+11	2.66E+11	4.96E+11	5.36E+10
Greece	5.23E+10	2.73E+10	8.62E+10	1.67E+10
Spain	3.02E+11	1.89E+11	4.39E+11	7.31E+10
Portugal	4.75E+10	3.36E+10	5.96E+10	8.74E+09
Austria	8.92E+10	7.86E+10	9.9E+10	6.2E+09
Finland	5.13E+10	3.44E+10	6.4E+10	7.8E+09
Sweden	9.79E+10	7E+10	1.23E+11	1.77E+10
Cyprus	5.11E+09	3.05E+09	7.35E+09	1.22E+09
Czech Republic	5.63E+10	4.9E+10	6.58E+10	4.91E+09
Estonia	6.01E+09	3.89E+09	8.39E+09	1.27E+09
Hungary	2.96E+10	2.43E+10	3.38E+10	3.83E+09
Latvia	7.43E+09	4.59E+09	1.14E+10	1.9E+09
Lithuania	7.56E+09	4.89E+09	1.07E+10	1.57E+09
Malta	1.71E+09	1.37E+09	2.06E+09	1.61E+08
Poland	9.8E+10	6.92E+10	1.18E+11	1.6E+10
Slovak Rep.	2.14E+10	1.8E+10	2.55E+10	2.22E+09
Slovenia	1.19E+10	8.62E+09	1.67E+10	2.62E+09
Bulgaria	1.3E+10	1.1E+10	1.83E+10	2.55E+09
Romania	4.8E+10	4.38E+10	6.05E+10	5.68E+09
Croatia	1.15E+10	1.12E+10	1.17E+10	2.67E+08
EU	1.53E+11	1.37E+09	7.33E+11	1.92E+11

Table 10. Descriptive Statistics EU, Output

Country	Mean	Minimum	Maximum	St. dev.
Belgium	3.61E+11	2.26E+11	5.32E+11	1.15E+11
Netherlands	6.14E+11	3.49E+11	9.36E+11	2.08E+11
Luxembourg	3.54E+10	1.6E+10	6.49E+10	1.66E+10
France	2.03E+12	1.33E+12	2.92E+12	5.97E+11
Germany	2.79E+12	1.95E+12	3.88E+12	6.66E+11
Italy	1.65E+12	1.06E+12	2.39E+12	4.57E+11
Denmark	2.41E+11	1.43E+11	3.53E+11	7.54E+10
Ireland	1.6E+11	5.25E+10	2.75E+11	7.81E+10
UK	2.05E+12	1.06E+12	3.06E+12	6.35E+11
Greece	2.07E+11	1.09E+11	3.54E+11	7.68E+10
Spain	9.88E+11	5.24E+11	1.63E+12	3.91E+11
Portugal	1.72E+11	9.5E+10	2.62E+11	5.63E+10
Austria	3.12E+11	1.96E+11	4.38E+11	9.03E+10
Finland	1.98E+11	1.26E+11	2.84E+11	6E+10
Sweden	3.91E+11	2.4E+11	5.79E+11	1.21E+11
Cyprus	2.36E+10	1.74E+10	2.78E+10	3.26E+09
Czech Republic	1.91E+11	1.19E+11	2.35E+11	3.59E+10
Estonia	2.06E+10	1.21E+10	2.62E+10	4.39E+09
Hungary	1.3E+11	1.04E+11	1.57E+11	1.44E+10
Latvia	2.61E+10	1.44E+10	3.56E+10	6.15E+09
Lithuania	3.84E+10	2.26E+10	4.84E+10	8.36E+09
Malta	8.46E+09	6.06E+09	1.07E+10	1.46E+09
Poland	4.44E+11	2.55E+11	5.45E+11	9.59E+10
Slovak Rep.	8.6E+10	5.72E+10	1.01E+11	1.48E+10
Slovenia	4.61E+10	3.45E+10	5.56E+10	6.24E+09
Bulgaria	5.32E+10	4.48E+10	5.74E+10	3.86E+09
Romania	1.83E+11	1.67E+11	2.08E+11	1.46E+10
Croatia	5.75E+10	5.71E+10	5.78E+10	3.17E+08
EU	6.28E+11	6.06E+09	3.88E+12	8.52E+11

Table 11, Spearman Rank scores for the EMU

Year	Number of countries	Human Capital & Physical Capital[a]	Human Capital & Output[a]	Physical Capital & Output[a]	Average
1992	12	0.986	0.993	0.993	0.991
1993	12	0.993	0.993	1.000	0.995
1994	12	0.986	0.993	0.993	0.991
1995	12	0.993	0.993	0.986	0.991
1996	12	0.993	0.993	0.986	0.991
1997	12	0.986	0.993	0.993	0.991
1998	12	0.986	0.993	0.993	0.991
1999	12	0.972	0.993	0.979	0.981
2000	12	0.972	0.993	0.979	0.981
2001	12	0.972	0.986	0.993	0.984
2002	12	0.972	0.993	0.979	0.981
2003	12	0.965	0.993	0.972	0.977
2004	12	0.965	0.986	0.979	0.977
2005	12	0.958	0.979	0.993	0.977
2006	12	0.958	0.979	0.993	0.977
2007	13	0.984	0.978	0.995	0.985
2008	15	0.993	0.993	1.000	0.995
2009	16	0.994	0.985	0.997	0.992
2010	16	0.991	0.985	0.994	0.990
2011	17	0.969	0.977	0.990	0.979
2012	17	0.960	0.972	0.990	0.974
2013	17	0.955	0.964	0.993	0.971
2014	18	0.945	0.947	0.998	0.964

[a] For N = 12, all coefficients larger than 0.503 are statistically different from 0 at the 5% level. For N = 18, all coefficients higher than 0.401 are statistically different from 0 at the 5% level (Zar, 1972). The number of countries changes over time, but since all coefficients are statistically different from 0 when taking the most restrictive rejection area (N = 12), we can say that all coefficients are statistically different from zero.

Table 12, Spearman Rank scores for the EU

Year	Number of countries	Human Capital & Physical Capital[a]	Human Capital & Output[a]	Physical Capital & Output[a]	Average
1992	12	0.979	0.986	0.993	0.986
1993	12	0.986	0.993	0.993	0.991
1994	12	0.986	1.000	0.986	0.991
1995	15	0.975	0.989	0.975	0.980
1996	15	0.979	0.993	0.979	0.983
1997	15	0.964	0.989	0.968	0.974
1998	15	0.964	0.989	0.968	0.974
1999	15	0.950	0.993	0.957	0.967
2000	15	0.961	0.993	0.975	0.976
2001	15	0.950	0.989	0.975	0.971
2002	15	0.979	0.993	0.986	0.986
2003	15	0.986	0.993	0.979	0.986
2004	25	0.881	0.888	0.990	0.920
2005	25	0.891	0.891	0.992	0.925
2006	25	0.904	0.899	0.991	0.931
2007	27	0.879	0.847	0.984	0.903
2008	27	0.899	0.866	0.987	0.918
2009	27	0.885	0.872	0.989	0.915
2010	27	0.892	0.858	0.990	0.913
2011	27	0.886	0.864	0.984	0.911
2012	27	0.883	0.860	0.989	0.910
2013	28	0.897	0.866	0.988	0.917
2014	28	0.893	0.868	0.989	0.917

[a] For N = 12, all coefficients larger than 0.503 are statistically different from 0 at the 5% level. For N = 28, all coefficients higher than 0.317 are statistically different from 0 at the 5% level (Zar, 1972). The number of countries changes over time, but since all coefficients are statistically different from 0 when taking the most restrictive rejection area (N = 12), we can say that all coefficients are statistically different from zero.

Table 13. Regression output EMU, Human Capital

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.252 (0.562)	-1.869 (0.310)	-1.692	-1.283	0.763
1993	12	-0.290 (0.526)	-1.828 (0.290)	-1.651	-1.234	0.779
1994	12	-0.300 (0.527)	-1.809 (0.290)	-1.632	-1.211	0.775
1995	12	-0.277 (0.554)	-1.834 (0.305)	-1.657	-1.241	0.761
1996	12	-0.301 (0.543)	-1.803 (0.299)	-1.626	-1.203	0.763
1997	12	-0.298 (0.545)	-1.805 (0.300)	-1.628	-1.205	0.761
1998	12	-0.279 (0.515)	-1.823 (0.284)	-1.646	-1.228	0.786
1999	12	-0.332 (0.510)	-1.766 (0.281)	-1.589	-1.156	0.778
2000	12	-0.340 (0.515)	-1.755 (0.283)	-1.578	-1.141	0.773
2001	12	-0.338 (0.520)	-1.757 (0.287)	-1.580	-1.144	0.769
2002	12	-0.347 (0.518)	-1.746 (0.285)	-1.570	-1.130	0.768
2003	12	-0.369 (0.503)	-1.722 (0.277)	-1.545	-1.097	0.774
2004	12	-0.394 (0.491)	-1.697 (0.270)	-1.520	-1.061	0.777
2005	12	-0.385 (0.510)	-1.705 (0.281)	-1.528	-1.073	0.765
2006	12	-0.398 (0.510)	-1.692 (0.281)	-1.515	-1.055	0.763
2007	13	-0.365 (0.458)	-1.718 (0.243)	-1.544	-1.141	0.803
2008	15	-0.020 (0.562)	-2.010 (0.280)	-1.840	-1.619	0.783
2009	16	-0.046 (0.491)	-1.978 (0.238)	-1.811	-1.640	0.820
2010	16	-0.053 (0.488)	-1.972 (0.236)	-1.805	-1.632	0.821
2011	17	-0.042 (0.442)	-1.977 (209)	-1.812	-1.694	0.846
2012	17	-0.059 (0.438)	-1.961 (0.207)	-1.796	-1.674	0.847
2013	17	-0.063 (0.432)	-1.959 (0.205)	-1.795	-1.672	0.850
2014	18	-0.095 (0.393)	-1.923 (0.182)	-1.761	-1.678	0.867

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.174 for N=13, 0.170 for N=15, 0.167 for N=16, 0.165 for N=17 and 0.162 for N=18.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 14. Regression output EMU, Physical Capital

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.296 (0.420)	-1.812 (0.231)	-1.636	-1.215	0.846
1993	12	-0.311 (0.367)	-1.799 (0.202)	-1.623	-1.198	0.877
1994	12	-0.334 (0.365)	-1.778 (0.201)	-1.601	-1.171	0.875
1995	12	-0.364 (0.376)	-1.744 (0.207)	-1.567	-1.126	0.864
1996	12	-0.394 (0.388)	-1.703 (0.214)	-1.526	-1.071	0.851
1997	12	-0.461 (0.387)	-1.633 (0.213)	-1.457	-0.968	0.840
1998	12	-0.492 (0.383)	-1.602 (0.211)	-1.425	-0.919	0.838
1999	12	-0.510 (0.371)	-1.582 (0.204)	-1.405	-0.887	0.843
2000	12	-0.523 (0.384)	-1.568 (0.212)	-1.391	-0.864	0.831
2001	12	-0.550 (0.394)	-1.541 (0.217)	-1.364	-0.818	0.818
2002	12	-0.571 (0.423)	-1.523 (0.233)	-1.346	-0.787	0.791
2003	12	-0.603 (0.418)	-1.490 (0.230)	-1.313	-0.729	0.788
2004	12	-0.625 (0.424)	-1.470 (0.233)	-1.293	-0.690	0.779
2005	12	-0.642 (0.413)	-1.454 (0.237)	-1.277	-0.661	0.769
2006	12	-0.634 (0.448)	-1.463 (0.247)	-1.286	-0.677	0.756
2007	13	-0.519 (0.434)	-1.570 (0.231)	-1.396	-0.909	0.791
2008	15	-0.070 (0.606)	-1.955 (0.302)	-1.786	-1.556	0.745
2009	16	-0.053 (0.536)	-1.961 (0.260)	-1.794	-1.620	0.789
2010	16	-0.053 (0.494)	-1.969 (0.239)	-1.802	-1.629	0.816
2011	17	0.078 (0.480)	-2.076 (0.227)	-1.911	-1.810	0.838
2012	17	0.074 (0.469)	-2.071 (0.222)	-1.907	-1.805	0.844
2013	17	0.085 (0.459)	-2.087 (0.217)	-1.922	-1.822	0.851
2014	18	0.108 (0.432)	-2.096 (0.199)	-1.934	-1.890	0.866

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.174 for N=13, 0.170 for N=15, 0.167 for N=16, 0.165 for N=17 and 0.162 for N=18.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 15. Regression output EMU, Output

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.337 (0.413)	-1.777 (0.227)	-1.600	-1.170	0.845
1993	12	-0.335 (0.374)	-1.777 (0.206)	-1.600	-1.170	0.870
1994	12	-0.357 (0.364)	-1.755 (0.201)	-1.578	-1.141	0.873
1995	12	-0.379 (0.359)	-1.729 (0.198)	-1.552	-1.106	0.873
1996	12	-0.392 (0.368)	-1.715 (0.203)	-1.538	-1.087	0.865
1997	12	-0.428 (0.377)	-1.677 (0.208)	-1.500	-1.033	0.854
1998	12	-0.440 (0.382)	-1.664 (0.210)	-1.487	-1.013	0.849
1999	12	-0.470 (0.370)	-1.632 (0.204)	-1.455	-0.966	0.851
2000	12	-0.495 (0.372)	-1.606 (0.205)	-1.429	-0.925	0.846
2001	12	-0.507 (0.381)	-1.593 (0.210)	-1.416	-0.905	0.838
2002	12	-0.524 (0.385)	-1.575 (0.212)	-1.398	-0.875	0.832
2003	12	-0.537 (0.388)	-1.561 (0.214)	-1.384	-0.853	0.826
2004	12	-0.548 (0.388)	-1.548 (0.214)	-1.371	-0.831	0.824
2005	12	-0.562 (0.387)	-1.533 (0.213)	-1.356	-0.805	0.822
2006	12	-0.578 (0.378)	-1.517 (0.208)	-1.340	-0.776	0.825
2007	13	-0.450 (0.411)	-1.637 (0.218)	-1.462	-1.018	0.821
2008	15	-0.017 (0.588)	-2.009 (0.293)	-1.840	-1.619	0.767
2009	16	-0.028 (0.523)	-1.986 (0.253)	-1.819	-1.650	0.801
2010	16	-0.033 (0.510)	-1.984 (0.247)	-1.817	-1.647	0.809
2011	17	0.051 (0.484)	-2.050 (0.229)	-1.886	-1.781	0.832
2012	17	0.043 (0.472)	-2.045 (0.223)	-1.881	-1.775	0.838
2013	17	0.039 (0.466)	-2.042 (0.220)	-1.878	-1.772	0.842
2014	18	0.070 (0.430)	-2.063 (0.199)	-1.901	-1.853	0.863

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.174 for N=13, 0.170 for N=15, 0.167 for N=16, 0.165 for N=17 and 0.162 for N=18.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 16. Regression output EU, Human Capital

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.180 (0.637)	-1.903 (0.351)	-1.726	-0.934	0.721
1993	12	-0.227 (0.604)	-1.851 (0.333)	-1.675	-0.892	0.732
1994	12	-0.233 (0.600)	-1.846 (0.330)	-1.669	-0.888	0.733
1995	15	-0.436 (0.508)	-1.626 (0.253)	-1.456	-0.769	0.742
1996	15	-0.460 (0.497)	-1.603 (0.247)	-1.433	-0.740	0.745
1997	15	-0.456 (0.499)	-1.606 (0.248)	-1.437	-0.744	0.745
1998	15	-0.441 (0.476)	-1.617 (0.237)	-1.448	-0.758	0.765
1999	15	-0.453 (0.468)	-1.611 (0.233)	-1.441	-0.750	0.770
2000	15	-0.460 (0.469)	-1.603 (0.234)	-1.434	-0.741	0.767
2001	15	-0.462 (0.475)	-1.601 (0.237)	-1.432	-0.738	0.762
2002	15	-0.471 (0.472)	-1.593 (0.235)	-1.423	-0.728	0.762
2003	15	-0.491 (0.458)	-1.575 (0.228)	-1.405	-0.705	0.769
2004	25	-0.306 (0.442)	-1.646 (0.180)	-1.501	-1.076	0.776
2005	25	-0.309 (0.433)	-1.644 (0.176)	-1.499	-1.074	0.782
2006	25	-0.318 (0.432)	-1.639 (0.176)	-1.494	-1.065	0.782
2007	27	-0.404 (0.416)	-1.563 (0.164)	-1.423	-0.994	0.775
2008	27	-0.410 (0.414)	-1.560 (0.163)	-1.420	-0.989	0.776
2009	27	-0.427 (0.401)	-1.550 (0.159)	-1.410	-0.972	0.784
2010	27	-0.419 (0.398)	-1.549 (0.157)	-1.409	-0.971	0.787
2011	27	-0.436 (0.393)	-1.546 (0.155)	-1.406	-0.964	0.790
2012	27	-0.448 (0.388)	-1.537 (0.153)	-1.397	-0.950	0.793
2013	28	-0.478 (0.365)	-1.518 (0.142)	-1.380	-0.937	0.806
2014	28	-0.491 (0.367)	-1.508 (0.143)	-1.371	-0.919	0.803

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.170 for N=15, 0.145 for N=25, 0.140 for N=27 and 0.138 for N=28.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 17. Regression output EU, Physical Capital

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.328 (0.498)	-1.748 (0.274)	-1.571	-0.801	0.783
1993	12	-0.356 (0.474)	-1.721 (0.261)	-1.544	-0.774	0.794
1994	12	-0.365 (0.483)	-1.711 (0.266)	-1.535	-0.765	0.786
1995	15	-0.555 (0.382)	-1.516 (0.190)	-1.346	-0.625	0.817
1996	15	-0.592 (0.398)	-1.482 (0.194)	-1.312	-0.577	0.804
1997	15	-0.641 (0.382)	-1.438 (0.190)	-1.268	-0.511	0.800
1998	15	-0.674 (0.380)	-1.412 (0.189)	-1.243	-0.471	0.796
1999	15	-0.675 (0.364)	-1.413 (0.181)	-1.243	-0.471	0.810
2000	15	-0.690 (0.368)	-1.400 (0.183)	-1.230	-0.451	0.804
2001	15	-0.701 (0.377)	-1.392 (0.188)	-1.222	-0.438	0.794
2002	15	-0.716 (0.395)	-1.383 (0.197)	-1.213	-0.423	0.776
2003	15	-0.740 (0.385)	-1.363 (0.192)	-1.193	-0.388	0.779
2004	25	-0.135 (0.449)	-1.780 (0.182)	-1.635	-1.262	0.797
2005	25	-0.170 (0.429)	-1.755 (0.179)	-1.610	-1.229	0.799
2006	25	-0.195 (0.433)	-1.736 (0.176)	-1.591	-1.204	0.800
2007	27	-0.265 (0.392)	-1.674 (0.155)	-1.534	-1.172	0.817
2008	27	-0.282 (0.382)	-1.661 (0.151)	-1.521	-1.152	0.822
2009	27	-0.153 (0.404)	-1.746 (0.160)	-1.606	-1.276	0.820
2010	27	-0.086 (0.384)	-1.759 (0.152)	-1.619	-1.293	0.837
2011	27	-0.135 (0.376)	-1.763 (0.149)	-1.623	-1.298	0.843
2012	27	-0.128 (0.374)	-1.766 (0.148)	-1.626	-1.303	0.845
2013	28	-0.115 (0.350)	-1.777 (0.137)	-1.639	-1.346	0.862
2014	28	-0.098 (0.362)	-1.784 (0.141)	-1.647	-1.356	0.855

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.170 for N=15, 0.145 for N=25, 0.140 for N=27 and 0.138 for N=28.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 18. Regression output EU, Output

Year	N	Intercept[a]	Slope[a]	Bias-corrected slope[b]	Z-stat.[c]	Adj. R^2
1992	12	-0.312 (0.512)	-1.772 (0.282)	-1.595	-0.823	0.778
1993	12	-0.322(0.478)	-1.760 (0.263)	-1.583	-0.811	0.799
1994	12	-0.333 (0.466)	-1.748 (0.257)	-1.571	-0.800	0.805
1995	15	-0.530 (0.344)	-1.545 (0.171)	-1.376	-0.666	0.852
1996	15	-0.544 (0.355)	-1.533 (0.177)	-1.364	-0.650	0.841
1997	15	-0.564 (0.365)	-1.520 (0.182)	-1.351	-0.632	0.831
1998	15	-0.572 (0.367)	-1.514 (0.183)	-1.344	-0.623	0.828
1999	15	-0.597 (0.355)	-1.491 (0.177)	-1.322	-0.591	0.833
2000	15	-0.610 (0.354)	-1.480 (0.177)	-1.311	-0.575	0.832
2001	15	-0.627 (0.361)	-1.468 (0.180)	-1.298	-0.556	0.824
2002	15	-0.643 (0.363)	-1.453 (0.181)	-1.283	-0.534	0.820
2003	15	-0.665 (0.366)	-1.433 (0.182)	-1.263	-0.503	0.813
2004	25	0.044 (0.444)	-1.921 (0.181)	-1.776	-1.428	0.824
2005	25	0.008 (0.441)	-1.893 (0.179)	-1.748	-1.397	0.822
2006	25	-0.028 (0.433)	-1.866 (0.176)	-1.721	-1.366	0.823
2007	27	-0.109 (0.383)	-1.797 (0.151)	-1.657	-1.344	0.844
2008	27	-0.153 (0.384)	-1.762 (0.152)	-1.621	-1.296	0.837
2009	27	-0.127 (0.382)	-1.779 (0.151)	-1.639	-1.319	0.841
2010	27	-0.121 (0.381)	-1.784 (0.151)	-1.644	-1.327	0.842
2011	27	-0.136 (0.371)	-1.771 (0.147)	-1.631	-1.309	0.848
2012	27	-0.140 (0.362)	-1.771 (0.143)	-1.631	-1.308	0.854
2013	28	-0.152 (0.337)	-1.760 (0.131)	-1.622	-1.323	0.869
2014	28	-0.151 (0.333)	-1.764 (0.130)	-1.626	-1.328	0.871

[a] Standard error are in parentheses and all estimates are significant at the 5 percent level.
[b] The bias-corrected slope is equal to the slope estimate plus the bias. The interpolated biases are: 0.177 for N=12, 0.170 for N=15, 0.145 for N=25, 0.140 for N=27 and 0.138 for N=28.
[c] The Z-statistic is calculated as the bias-corrected slope estimate plus 1 divided by the true standard error.

Table 19. Theoretical Shares

Rank	N=12	N=13	N=15	N=16	N=17	N=18	N=25	N=27	N=28
1	0.3222	0.3145	0.3014	0.2958	0.2907	0.2861	0.2621	0.2570	0.2546
2	0.1611	0.1572	0.1507	0.1479	0.1454	0.1431	0.1310	0.1285	0.1273
3	0.1074	0.1048	0.1005	0.0986	0.0969	0.0954	0.0874	0.0857	0.0849
4	0.0806	0.0786	0.0753	0.0739	0.0727	0.0715	0.0655	0.0642	0.0637
5	0.0644	0.0629	0.0603	0.0592	0.0581	0.0572	0.0524	0.0514	0.0509
6	0.0537	0.0524	0.0502	0.0493	0.0485	0.0477	0.0437	0.0428	0.0424
7	0.0460	0.0449	0.0431	0.0423	0.0415	0.0409	0.0374	0.0367	0.0364
8	0.0403	0.0393	0.0377	0.0370	0.0363	0.0358	0.0328	0.0321	0.0318
9	0.0358	0.0349	0.0335	0.0329	0.0323	0.0318	0.0291	0.0286	0.0283
10	0.0322	0.0314	0.0301	0.0296	0.0291	0.0286	0.0262	0.0257	0.0255
11	0.0293	0.0286	0.0274	0.0269	0.0264	0.0260	0.0238	0.0234	0.0231
12	0.0269	0.0262	0.0251	0.0246	0.0242	0.0238	0.0218	0.0214	0.0212
13		0.0242	0.0232	0.0228	0.0224	0.0220	0.0202	0.0198	0.0196
14			0.0215	0.0211	0.0208	0.0204	0.0187	0.0184	0.0182
15			0.0201	0.0197	0.0194	0.0191	0.0175	0.0171	0.0170
16				0.0185	0.0182	0.0179	0.0164	0.0161	0.0159
17					0.0171	0.0168	0.0154	0.0151	0.0150
18						0.0159	0.0146	0.0143	0.0141
19							0.0138	0.0135	0.0134
20							0.0131	0.0128	0.0127
21							0.0125	0.0122	0.0121
22							0.0119	0.0117	0.0116
23							0.0114	0.0112	0.0111
24							0.0109	0.0107	0.0106
25							0.0105	0.0103	0.0102
26								0.0099	0.0098
27								0.0095	0.0094
28									0.0091

Table 20. Correlation actual and theoretical shares

	Year	Number of Countries	Human Capital	Physical Capital	Output
EMU	1992	12	0.886	0.927	0.927
	1993	12	0.894	0.942	0.939
	1994	12	0.892	0.942	0.940
	1995	12	0.885	0.936	0.940
	1996	12	0.886	0.930	0.937
	1997	12	0.885	0.925	0.931
	1998	12	0.897	0.923	0.929
	1999	12	0.893	0.926	0.930
	2000	12	0.891	0.920	0.927
	2001	12	0.889	0.913	0.923
	2002	12	0.888	0.900	0.920
	2003	12	0.891	0.898	0.918
	2004	12	0.893	0.894	0.917
	2005	12	0.887	0.889	0.916
	2006	12	0.886	0.882	0.917
	2007	13	0.905	0.899	0.915
	2008	15	0.894	0.874	0.885
	2009	16	0.912	0.896	0.902
	2010	16	0.912	0.910	0.906
	2011	17	0.926	0.921	0.918
	2012	17	0.926	0.924	0.921
	2013	17	0.928	0.928	0.923
	2014	18	0.936	0.935	0.933
EU	1992	12	0.864	0.896	0.893
	1993	12	0.870	0.901	0.904
	1994	12	0.870	0.897	0.907
	1995	15	0.872	0.911	0.929
	1996	15	0.874	0.905	0.923
	1997	15	0.873	0.903	0.918
	1998	15	0.884	0.900	0.917
	1999	15	0.887	0.908	0.919
	2000	15	0.885	0.904	0.919
	2001	15	0.883	0.899	0.915
	2002	15	0.883	0.890	0.912
	2003	15	0.886	0.892	0.909
	2004	25	0.886	0.897	0.912
	2005	25	0.889	0.899	0.911
	2006	25	0.889	0.899	0.911
	2007	27	0.885	0.908	0.922
	2008	27	0.886	0.910	0.918
	2009	27	0.890	0.909	0.920
	2010	27	0.892	0.918	0.921
	2011	27	0.894	0.921	0.924
	2012	27	0.895	0.922	0.927
	2013	28	0.902	0.931	0.935
	2014	28	0.900	0.927	0.936

Table 21. The Kolmogorov-Smirnov test

	Year	Number of Countries	Human Capital	Physical Capital	Output[a]	Critical Value[b]
EMU	1992	12	0.141	0.147	0.149	0.555
	1993	12	0.135	0.139	0.144	0.555
	1994	12	0.127	0.135	0.140	0.555
	1995	12	0.128	0.128	0.133	0.555
	1996	12	0.124	0.121	0.134	0.555
	1997	12	0.123	0.112	0.130	0.555
	1998	12	0.126	0.110	0.127	0.555
	1999	12	0.120	0.110	0.123	0.555
	2000	12	0.119	0.108	0.119	0.555
	2001	12	0.120	0.106	0.118	0.555
	2002	12	0.119	0.106	0.116	0.555
	2003	12	0.117	0.102	0.114	0.555
	2004	12	0.116	0.100	0.111	0.555
	2005	12	0.118	0.097	0.110	0.555
	2006	12	0.117	0.097	0.108	0.555
	2007	13	0.127	0.110	0.121	0.533
	2008	15	0.150	0.139	0.149	0.497
	2009	16	0.156	0.151	0.156	0.481
	2010	16	0.157	0.157	0.157	0.481
	2011	17	0.165	0.169	0.169	0.466
	2012	17	0.162	0.164	0.169	0.466
	2013	17	0.163	0.167	0.169	0.466
	2014	18	0.167	0.172	0.177	0.453
EU	1992	12	0.121	0.118	0.129	0.555
	1993	12	0.113	0.116	0.123	0.555
	1994	12	0.115	0.115	0.121	0.555
	1995	15	0.097	0.097	0.105	0.497
	1996	15	0.096	0.092	0.106	0.497
	1997	15	0.097	0.085	0.108	0.497
	1998	15	0.098	0.084	0.107	0.497
	1999	15	0.105	0.088	0.104	0.497
	2000	15	0.105	0.084	0.103	0.497
	2001	15	0.104	0.085	0.103	0.497
	2002	15	0.103	0.092	0.101	0.497
	2003	15	0.103	0.095	0.097	0.497
	2004	25	0.098	0.124	0.153	0.387
	2005	25	0.100	0.120	0.148	0.387
	2006	25	0.100	0.116	0.144	0.387
	2007	27	0.079	0.108	0.143	0.370
	2008	27	0.079	0.105	0.132	0.370

2009	27	0.079	0.113	0.136	0.370
2010	27	0.087	0.163	0.128	0.370
2011	27	0.079	0.119	0.130	0.370
2012	27	0.078	0.120	0.132	0.370
2013	28	0.079	0.127	0.134	0.363
2014	28	0.077	0.125	0.137	0.363

[a] All D-statistics are lower than the critical values, indicating that the null hypothesis that both samples come from the same distribution cannot be rejected.

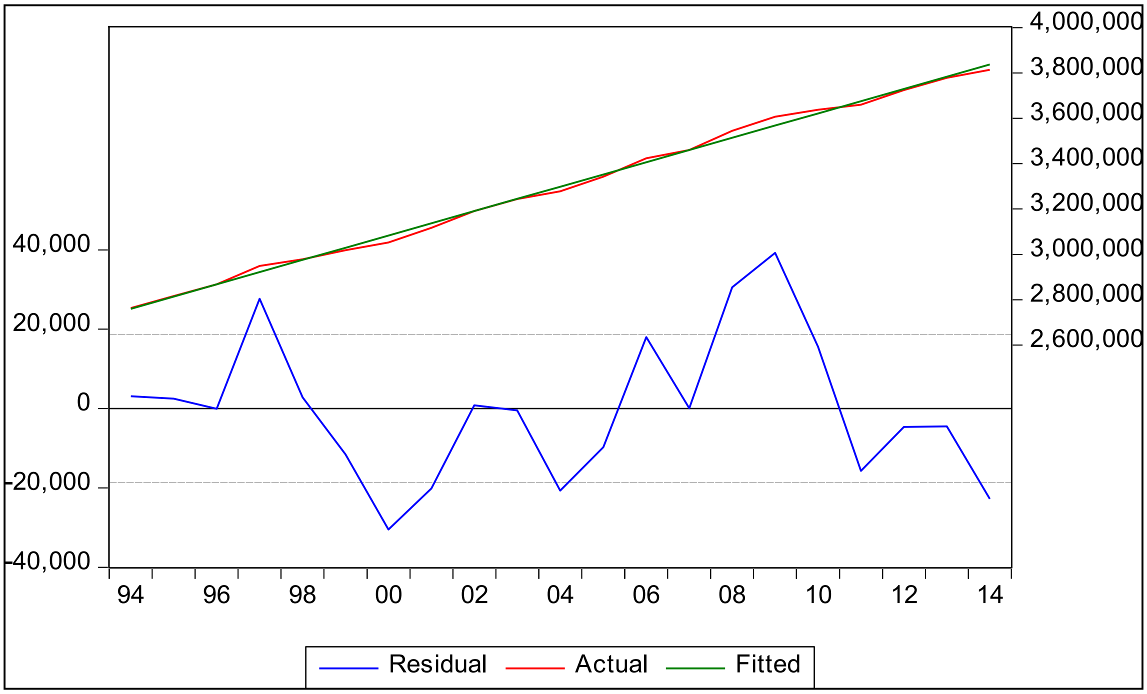
[b] Critical values are calculated as $1.36 * \sqrt{N_1 + N_2 / N_1 * N_2}$.

Table 22. The Entropy Statistic

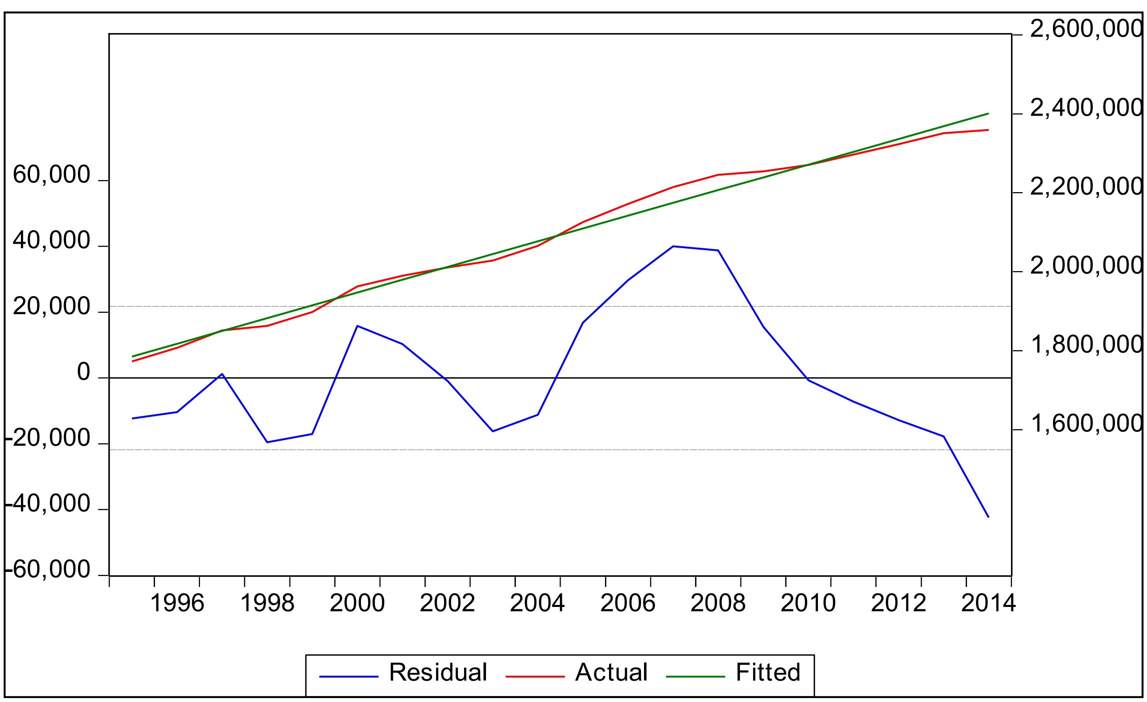
	Year	Entropy Statistic	Inverse Entropy	Difference EMU-EU	Inverse Entropy Human Capital	Inverse Entropy Physical Capital	Inverse Entropy Output
EMU	1992	0.121	0.886	0.006	0.886	0.888	0.885
	1993	0.109	0.896	0.006	0.894	0.901	0.895
	1994	0.104	0.901	0.011	0.899	0.905	0.900
	1995	0.100	0.905	-0.020	0.895	0.912	0.909
	1996	0.096	0.908	-0.016	0.901	0.917	0.906
	1997	0.092	0.912	-0.010	0.901	0.926	0.910
	1998	0.091	0.913	-0.009	0.899	0.931	0.911
	1999	0.085	0.918	-0.003	0.907	0.932	0.916
	2000	0.085	0.918	-0.001	0.908	0.930	0.917
	2001	0.086	0.918	0.000	0.908	0.928	0.918
	2002	0.089	0.914	0.000	0.909	0.916	0.919
	2003	0.089	0.915	0.001	0.911	0.916	0.918
	2004	0.089	0.915	0.057	0.914	0.911	0.919
	2005	0.092	0.912	0.052	0.911	0.905	0.919
	2006	0.092	0.912	0.048	0.912	0.902	0.921
	2007	0.105	0.901	0.023	0.907	0.892	0.902
	2008	0.175	0.840	-0.044	0.851	0.832	0.835
	2009	0.174	0.840	-0.038	0.854	0.829	0.838
	2010	0.170	0.843	-0.053	0.855	0.835	0.841
	2011	0.185	0.831	-0.053	0.851	0.818	0.825
	2012	0.182	0.834	-0.049	0.853	0.820	0.828
	2013	0.182	0.834	-0.050	0.853	0.820	0.829
	2014	0.186	0.831	-0.053	0.856	0.815	0.821
EU	1992	0.127	0.881	0.006	0.878	0.891	0.874
	1993	0.116	0.890	0.006	0.887	0.896	0.887
	1994	0.116	0.891	0.011	0.886	0.895	0.891
	1995	0.078	0.925	-0.020	0.922	0.924	0.929
	1996	0.079	0.924	-0.016	0.924	0.925	0.922
	1997	0.081	0.923	-0.010	0.922	0.931	0.915
	1998	0.081	0.923	-0.009	0.923	0.931	0.914
	1999	0.082	0.921	-0.003	0.916	0.930	0.916
	2000	0.084	0.920	-0.001	0.915	0.930	0.914
	2001	0.086	0.918	0.000	0.916	0.925	0.913
	2002	0.090	0.914	0.000	0.917	0.913	0.913
	2003	0.090	0.914	0.001	0.916	0.913	0.913
	2004	0.153	0.858	0.057	0.899	0.849	0.828
	2005	0.151	0.860	0.052	0.899	0.849	0.832
	2006	0.147	0.864	0.048	0.898	0.856	0.838
	2007	0.130	0.878	0.023	0.912	0.872	0.850
	2008	0.124	0.884	-0.044	0.911	0.881	0.860
	2009	0.130	0.878	-0.038	0.912	0.863	0.859
	2010	0.109	0.897	-0.053	0.921	0.915	0.856
	2011	0.123	0.884	-0.053	0.913	0.874	0.866
	2012	0.125	0.883	-0.049	0.912	0.872	0.865
	2013	0.123	0.884	-0.050	0.916	0.870	0.868
	2014	0.124	0.883	-0.053	0.915	0.868	0.867

Graphs 3. Extrapolating Human Capital

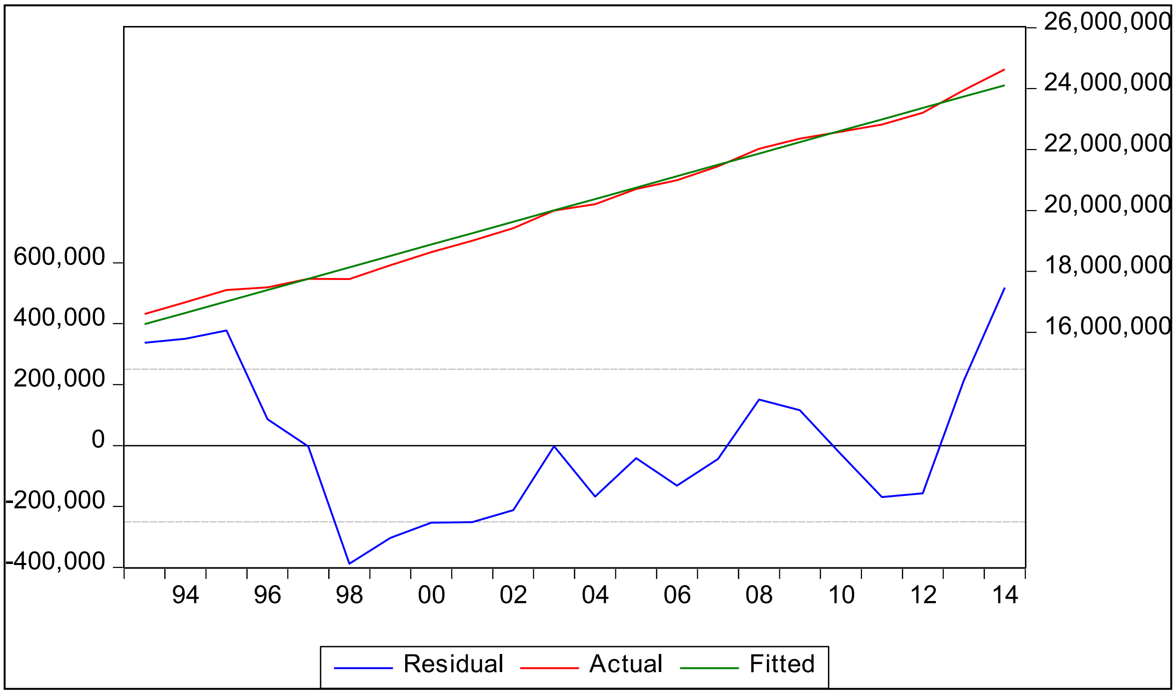
Austria



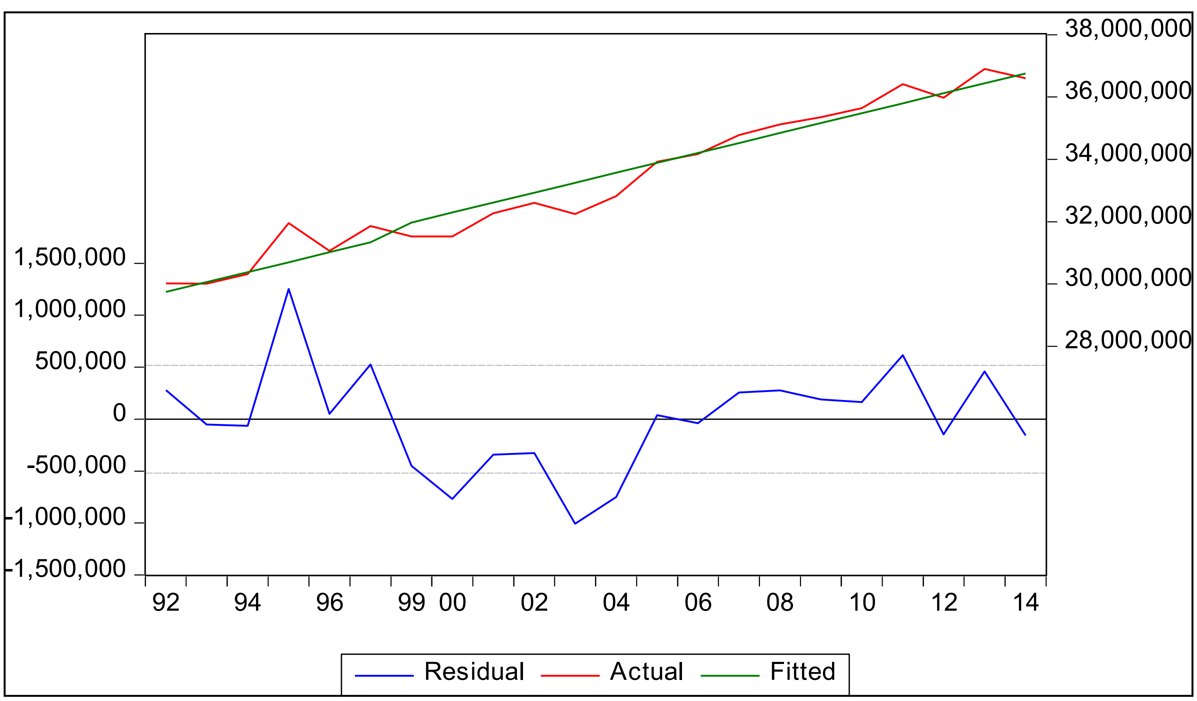
Finland



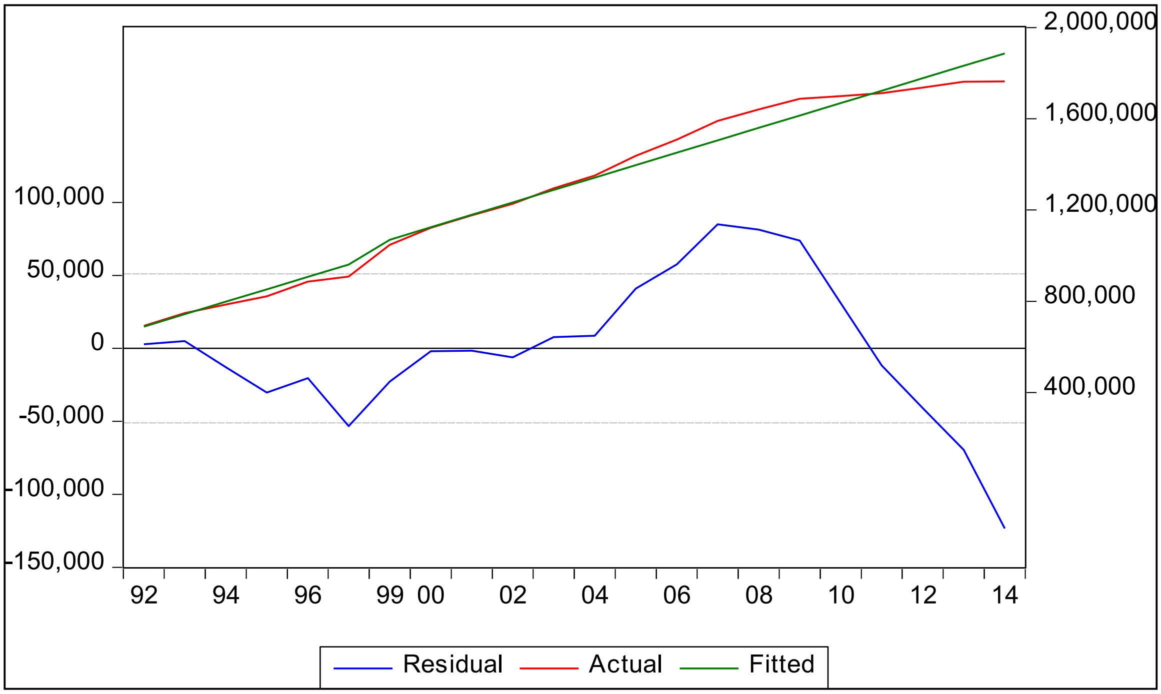
France



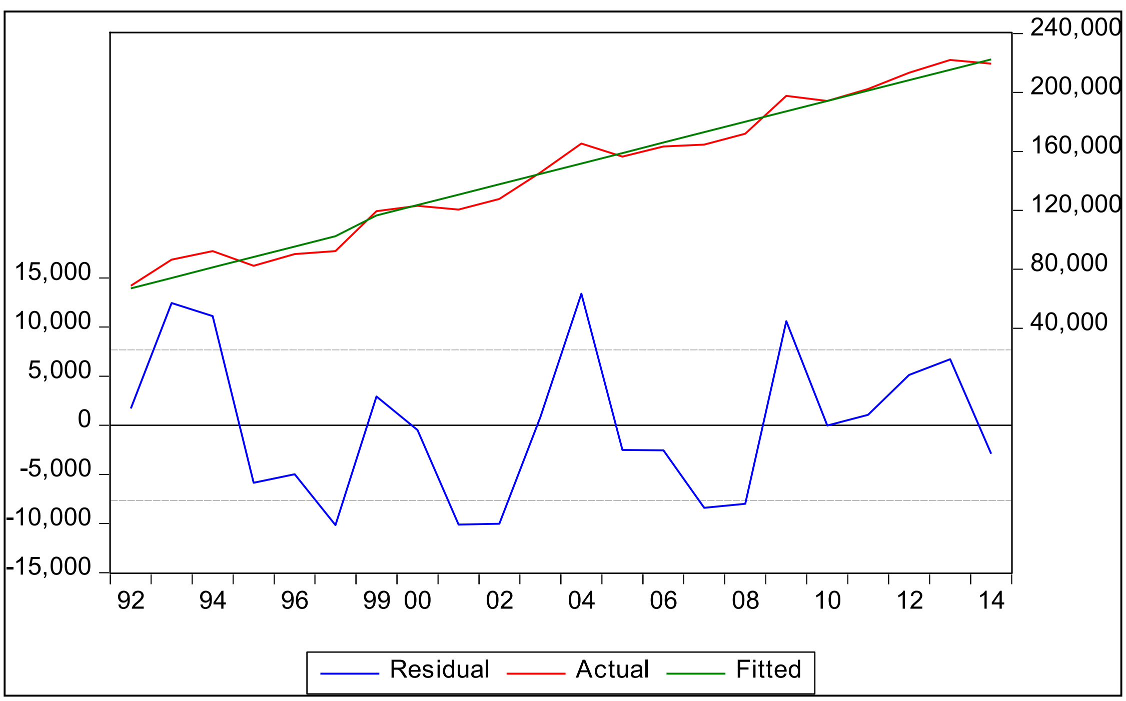
Germany



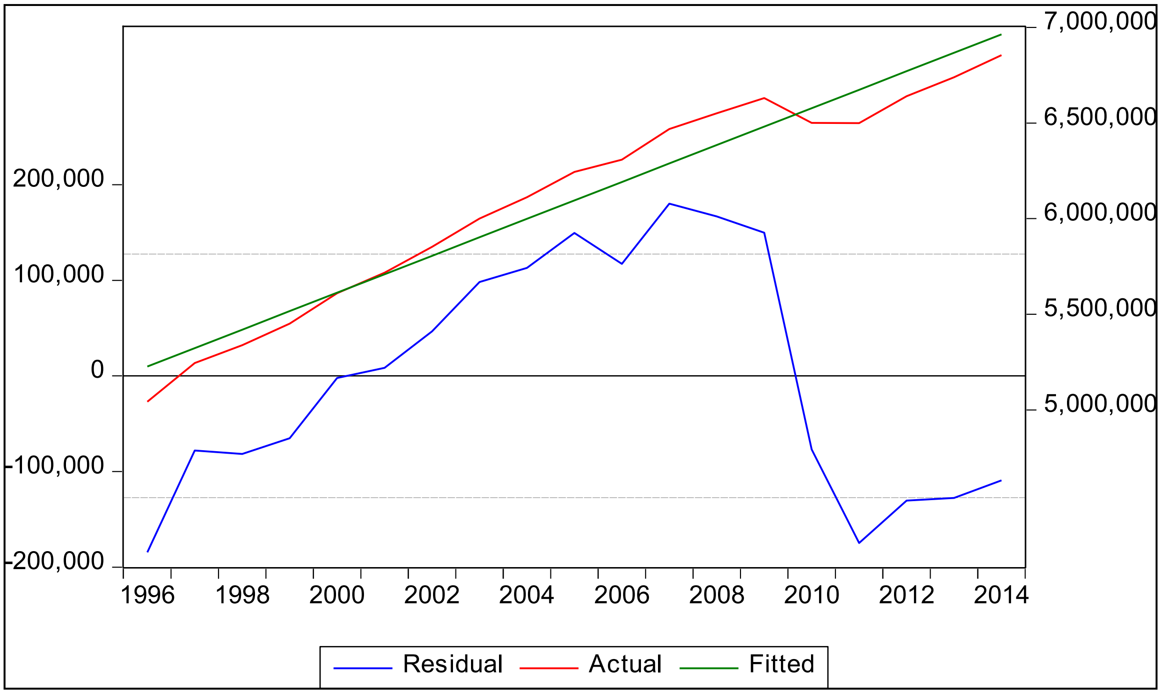
Ireland



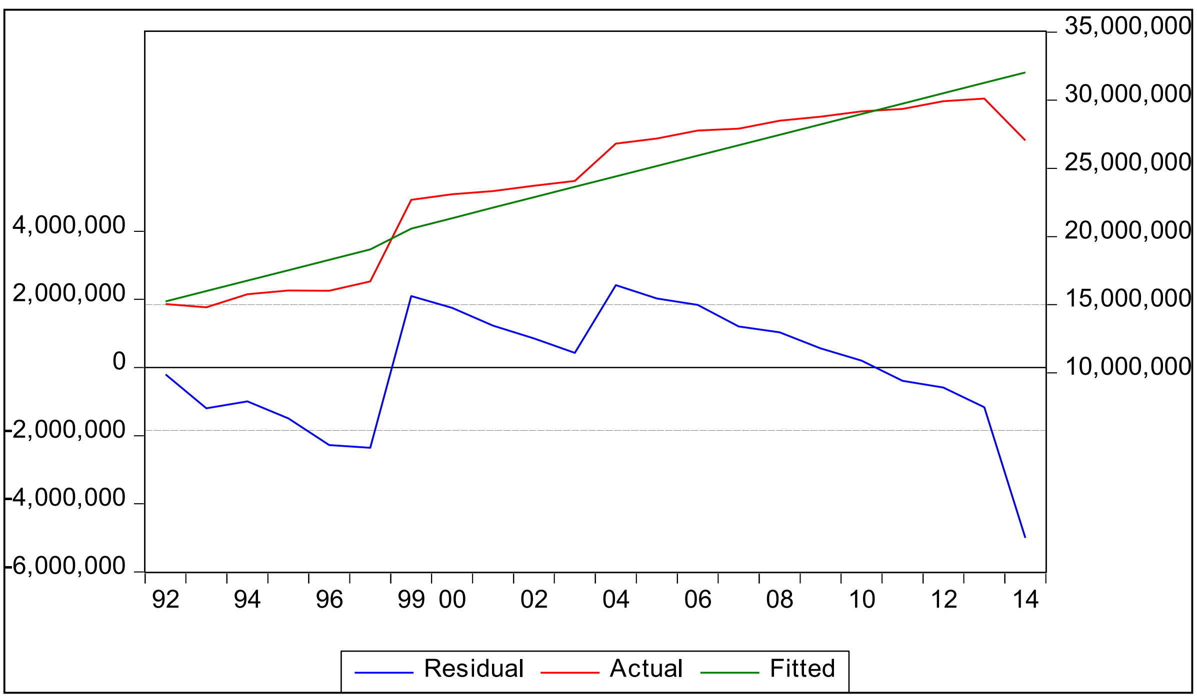
Luxembourg



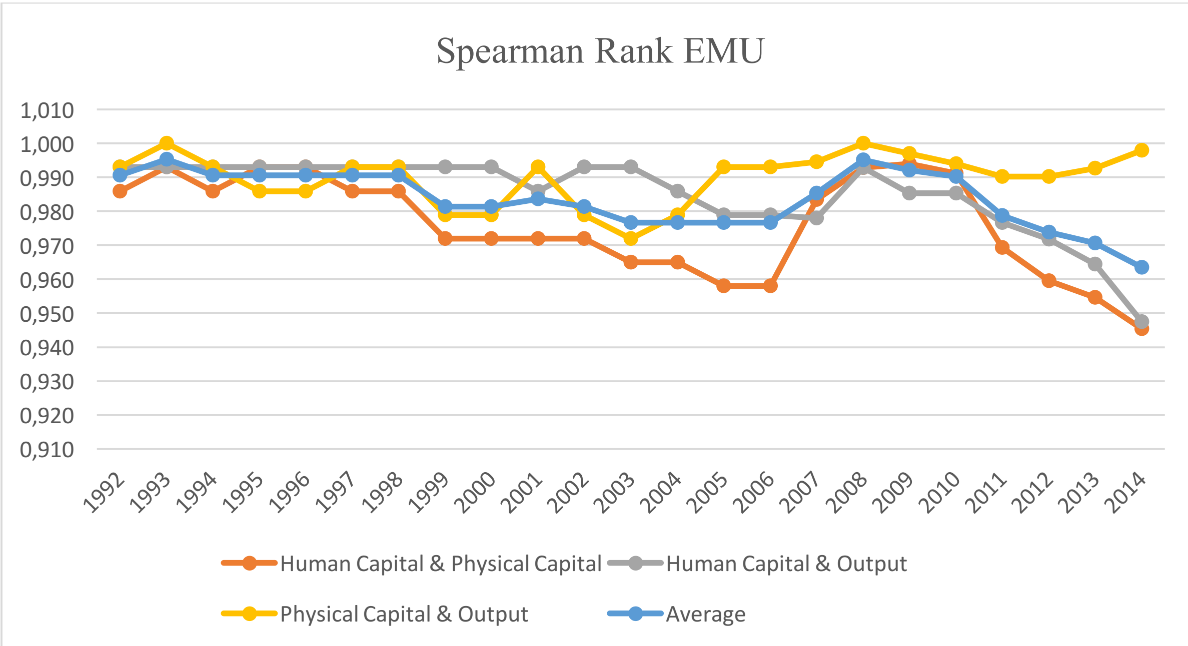
The Netherlands



The United Kingdom

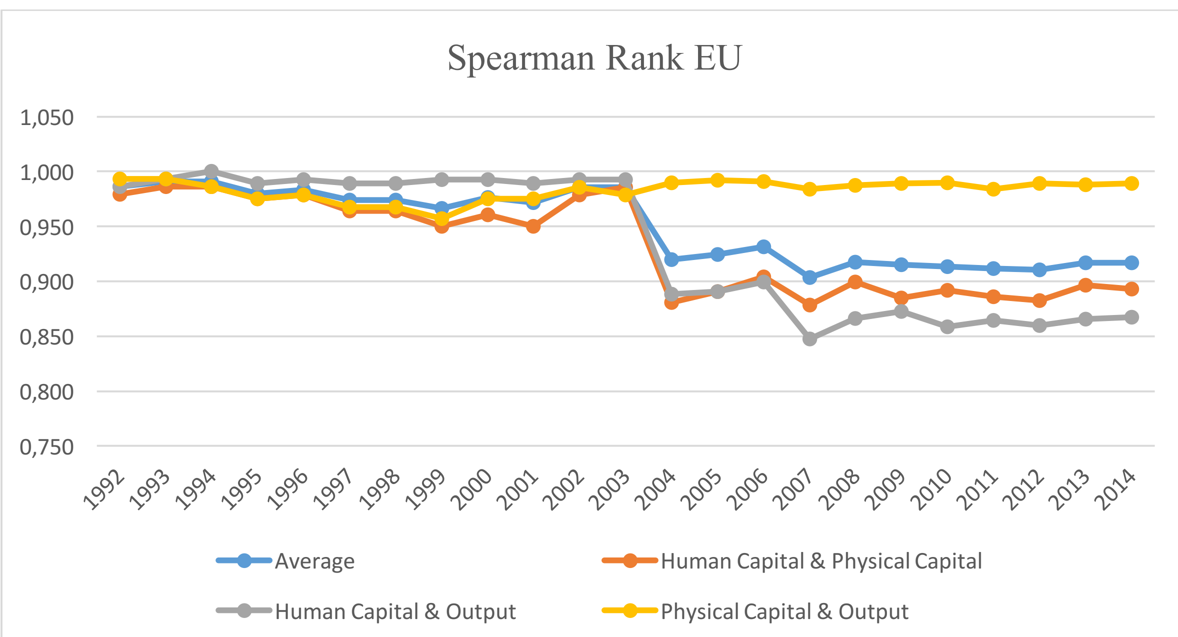


Graph 2, Development Spearman Rank EMU



This graph shows the pairwise Spearman rank correlation for human capital, physical capital and output in the EMU. A correlation of 1 indicates perfect conformity of the shares ranks.

Graph 3, Development Spearman Rank EU



This graph shows the pairwise Spearman rank correlation for human capital, physical capital and output in the EU. A correlation of 1 indicates perfect conformity of the shares ranks.