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# DETECTING TRENDS OF CONVERGENCE AMONG THE EUROZONE COUNTRIES IN TERMS OF ECONOMIC FREEDOM

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**─Abstract ─**

The present paper adopts a broad perspective of the Optimum Currency Area theory, and attempts to detect trends of convergence in terms of economic freedom among the Eurozone countries. The empirical analysis utilizes the Index of Economic Freedom and employs the methodological approaches of unconditional β-convergence and convergence clubs. The results indicate that the trend revealed for the period 2001-2017 is, in fact, the balance between the opposite trends revealed for the sub-periods 2001-2008 and 2008-2017. Particularly, during the sub-period 2008-2017 the trend of convergence vanishes and the trend of divergence becomes stronger.

**Key Words:** *Eurozone countries, Optimum Currency Area theory, Index of Economic Freedom, unconditional β-convergence, convergence clubs*
**JEL Classification:** *C21, F33*

## 1. INTRODUCTION

Eurozone is a monetary union that, currently, consists of 19 European Union (EU) countries, namely: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. The Eurozone (Euro Area) countries have adopted the Euro as their common and sole currency. The European Central Bank sets the monetary policy of the Eurozone, and the Eurogroup makes the political decisions with respect to the Eurozone (see the Treaty on the Functioning of the European Union, title VIII). Within the relative taxonomy (Balassa, 1961; Molle, 1997; Robson, 1998), the Eurozone countries have reached an upper stage of economic integration, that of the Economic and Monetary Union (EMU). EMU is considered to be the penultimate stage of economic integration, prior to the (final) stage of Complete Economic Integration, and reflects the combination of an economic union (i.e. Customs Union and Common Market) and a monetary union.

The Optimum Currency Area (OCA) theory (Mundell, 1961; McKinnon, 1963; Kenen, 1969) describes the optimal criteria (characteristics) of a monetary union with respect to the maximization of economic efficiency. The OCA criteria may encapsulate into: (a) labor mobility, (b) openness (i.e. capital mobility, price flexibility, wage flexibility), (c) operation of fiscal transfer (redistribution) mechanism, and (d) similarity of business cycles. According to the OCA theory, a country that participates in a monetary union has to counterbalance the economic stability loss (due to the loss of the monetary policy "tool") with the competitiveness gain (due to the decrease of inflation and the increase of aggregate demand). The OCA criteria reflect both the reduction of exposure and the adjustment to asymmetric shocks. Thus, for a country that participates in a monetary union, not fulfilling the OCA criteria indicates both a high level of exposure and a low level of adjustment to asymmetric shocks. Given the "architecture" of the Eurozone (Arghyrou and Kontonikas, 2011), an asymmetric shock for a Eurozone country may, in fact, mean an asymmetric shock for the entire Eurozone.

There is a large and growing body of literature (Krugman, 1990; Frankel and Rose, 1998; Artis and Zhang, 2002; Mongelli, 2002; Artis et al., 2011; *inter alia*) that studies the feasibility of the OCA criteria and, consequently, the successful functioning of a monetary union. The common methodological approach adopted is the detection of group of countries that share similar economic characteristics in the sense that these countries are "equally" suitable to join a monetary union. The present paper, following the same rationale, adopts a broad perspective of the OCA theory and attempts to detect trends of convergence in terms of economic freedom among the Eurozone countries. Particularly, the present paper conducts an empirical analysis utilizing the Index of Economic Freedom (IEF) and employing the methodological approaches of unconditional β-convergence and convergence clubs. Given that the essence of the EMU is to create "a union of individual freedom and collective respect; a union of responsibility and cooperation; and a union of stability and prosperity" (Trichet, 2011), and given that composite indicators are increasingly recognized as useful tools in analysis and public communication (Anagnostou et al., 2016), the IEF may act as a suitable proxy for the OCA criteria, within the framework of the OCA theory. The empirical analysis covers the period 2001-2017 (as well as the sub-periods 2001-2008 and 2008-2017). Year 2001 is the last year prior to the physical circulation of the Euro currency (i.e. notes and coins), and year 2008 is considered to be the starting year of the world-wide financial and economic crisis (Marginean and Orastean, 2011). Data are obtained from Heritage Foundation.

The paper proceeds as follows: the next section describes the IEF and provides the IEF scores for the Eurozone countries, the third section deploys the methodological approaches of unconditional β-convergence and convergence clubs, the fourth section provides the results and the last section offers the conclusions.

## 2. THE INDEX OF ECONOMIC FREEDOM

### 2.1. Overview

The IEF is compiled from the Heritage Foundation and documents the positive relationship between economic freedom and a series of determinants (goals) (see http://www.heritage.org/index/about). Particularly, the IEF consists of 12, equally-weighted, sub-indicators, namely: (i) property rights, (ii) government integrity, (iii) judicial effectiveness, (iv) government spending, (v) tax burden, (vi) fiscal health, (vii) business freedom, (viii) labor freedom, (ix) monetary freedom, (x) trade freedom, (xi) investment freedom, and (xii) financial freedom. These indicators constitute 4 economic freedom pillars, namely: (a) rule of law (sub-indicators i – iii), (b) government size (sub-indicators iv – vi), (c) regulatory efficiency (sub-indicators vii – ix), and (d) open markets (sub-indicators x – xii). Each sub-indicator is graded on the [0, 100] scale and the overall economic freedom score for each economy under consideration is derived by averaging the scores for the economic freedom sub-indicators.

## 2.2. The scores for the Eurozone countries

Table 1 provides the IEF scores for the Eurozone countries, for the years 2001, 2008, and 2017, together with some descriptive statistics (i.e. max, min, mean, standard deviation, and median). On average, the IEF scores for the Eurozone countries exhibit increase during the sub-period 2001-2008 (from 67.7 to 69.9) and decrease during the sub-period 2008-2017 (from 69.9 to 69.1). During the sub-period 2001-2008, only Greece, Italy, Luxembourg, Portugal, and Slovenia exhibit decrease. During the sub-period 2008-2017, only Austria, Estonia, Germany, Latvia, Lithuania, Luxembourg, and Malta exhibit increase. During the entire period 2001-2017, the IEF scores for the Eurozone countries present, on average, increase (from 67.7 to 69.1). Only Cyprus, Greece, Ireland, Italy, Luxembourg, Portugal, Slovenia, and Spain contrast the general trend. Notable is the fact that Luxembourg contrasts the general trend for both sub-periods. The median takes values close to the mean values for all years under consideration. This indicates that the distribution of the observations is almost identical to the normal distribution (i.e. the median divides the sample of observations almost in half). Standard deviation is rather small (ranging from 6.0 to 6.9 units). Ireland presents the highest IEF score in the years 2001 and 2008 and Estonia presents the highest IEF score in the year 2017. France, Slovenia, and Greece present the lowest IEF score in the years 2001, 2008, and 2017, respectively.

**Table 1: The IEF scores for the Eurozone countries: Descriptive Statistics, years 2001, 2008, 2017**

| Country | IEF 2001 | IEF 2008 | IEF 2017 |
|---|---|---|---|
| Austria | 68.1 | 71.4 | 72.3 |
| Belgium | 63.8 | 71.7 | 67.8 |
| Cyprus | 71.0 | 71.3 | 67.9 |
| Estonia | 76.1 | 77.9 | 79.1 |
| Finland | 69.7 | 74.6 | 74.0 |
| France | 58.0 | 64.7 | 63.3 |
| Germany | 69.5 | 70.6 | 73.8 |
| Greece | 63.4 | 60.6 | 55.0 |
| Ireland | 81.2 | 82.5 | 76.7 |
| Italy | 63.0 | 62.6 | 62.5 |
| Latvia | 66.4 | 68.3 | 74.8 |
| Lithuania | 65.5 | 70.9 | 75.8 |
| Luxembourg | 80.1 | 74.7 | 75.9 |
| Malta | 62.9 | 66.0 | 67.7 |
| Netherlands | 73.0 | 77.4 | 75.8 |
| Portugal | 66.0 | 63.9 | 62.6 |
| Slovakia | 58.5 | 70.0 | 65.7 |
| Slovenia | 61.8 | 60.2 | 59.2 |
| Spain | 68.1 | 69.1 | 63.6 |
| Descriptive Statistics | | | |
| max | 81.2 (Ireland) | 82.5 (Ireland) | 79.1 (Estonia) |
| min | 58.0 (France) | 60.2 (Slovenia) | 55.0 (Greece) |
| mean | 67.7 | 69.9 | 69.1 |
| standard deviation | 6.5 | 6.0 | 6.9 |
| median | 66.4 | 70.6 | 67.9 |

Sources: Heritage Foundation / Authors' elaboration

## 3. METHODOLOGIES FOR DETECTING TRENDS OF CONVERGENCE

### 3.1. Unconditional β-convergence

The dominant approach in the empirical convergence / divergence literature has been introduced by Baumol (1986) and extended and popularized by Barro

(1991), Barro and Sala-i-Martin (1992) and Sala-i-Martin (1996), and is derived from the neoclassical paradigm (Solow, 1956; Swan, 1956). This approach may encapsulate in the concept of unconditional β-convergence i.e. the outcome of the negative and the statistically significant relation between the initial level of a variable under consideration and the corresponding subsequent growth rate of the economies under consideration. Unconditional β-convergence assumes that the economies considered are structurally homogeneous allowing for convergence towards the same steady-state equilibrium (i.e. an equilibrium situation in the long-run). The evaluation of unconditional β-convergence is tested on the cross-section equation:

$$\ln\left(\frac{X_{r,tf}}{X_{r,tb}}\right) = \alpha + \beta \ln\left(X_{r,tb}\right) + \varepsilon_{r,tb}$$

where $X$ is the variable under consideration, $r$ is each economy under consideration, $tb$ is the initial (base) year of the analysis, $tf$ is the final year of the analysis, $\alpha$ is the constant term, $\varepsilon$ is the disturbance term, and $\beta$ is the β-convergence coefficient.

### 3.2. Convergence clubs

The linear specification of the β-convergence equation may mask the fact that convergence and divergence trends may co-exist (Petrakos et al., 2011) as it rules out the possibility that the economies under consideration may form convergence clubs (Artelaris et al., 2010 and 2012). Under the concept of convergence clubs, it is quite natural to expect that economies may form convergence clubs that are themselves diverging from each other (i.e. it is quite natural to expect that there is convergence among economies within each convergence club but there is not convergence across convergence clubs). A notable approach for investigating for the emergence of convergence clubs is the gaps approach, suggested by Chatterji (1992) and further explained by Chatterji and Dewhurst (1996). The gaps convergence clubs approach, requiring the identification of a “leading” economy (i.e. an economy with the highest level among the economies under consideration, in terms of a variable under consideration), relates the gap (i.e. the quotient between the level of the “leading” economy, in terms of a variable under consideration, and the corresponding level of each of the economies considered, including the "leading" one), at a final year with the corresponding gap at an initial year, including further powers of the latter. Indisputably, the gaps convergence clubs approach transcends the linear (i.e. "black or white") rationale of the concept of β-convergence. The evaluation of the gaps convergence clubs is tested on the cross-section equation:

$$\ln\left(\frac{X_{l,tf}}{X_{r,tf}}\right) = \sum_{p=1}^{n} \gamma_p \left[\ln\left(\frac{X_{l,tb}}{X_{r,tb}}\right)\right]^p + \varepsilon_{r,tb}$$

where $l\ (\in r)$ is the "leading" economy among the economies under consideration, $p\ (= 1, 2, \dots, n)$ denotes the powers of the equation, and $\gamma$ denotes the convergence clubs coefficient(s).

Considerable multicollinearity between the various powers of the independent variable makes difficult the selection of the best parsimonious estimation. Customarily, such a selection is made under the rule of dropping the statistically insignificant coefficients. When more than one equations have all coefficients statistically significant, the selection is made on the basis of the lowest Akaike Information Criterion (AIC) (Akaike, 1974) figure. In any case, convergence to the "leading" economy is detected when, on average, the gap in the final year is lower than the corresponding gap in the initial year, and divergence from the "leading" economy is detected when, on average, the gap in the final year is higher than the corresponding gap in the initial year.

## 4. EMPIRICAL FINDINGS

Tables 2, 3, and 4 present the econometric estimations of the β-convergence equations for the period 2001-2017, and for the sub-periods 2001-2008 and 2008-2017, respectively. It comes that, on average, during the period 2001-2017 the Eurozone countries exhibit a statistically non-significant trend of convergence, in terms of the IEF. Such a finding is explained from the findings revealed for the sub-periods 2001-2008 and 2008-2017. Particularly, during the sub-period 2001-2008 it comes that, on average, the Eurozone countries exhibit a statistically significant trend (at the level of 10%) of convergence. Yet, during the sub-period 2008-2017 it comes that, on average, the Eurozone countries exhibit a statistically non-significant trend of divergence. Note that the econometric estimations of the β-convergence equations have been checked and corrected, where necessary, with the White heteroscedasticity test (White, 1980).

Tables 5, 6, and 7 present the econometric estimations of the convergence clubs equations for the period 2001-2017, and for the sub-periods 2001-2008 and 2008-2017, respectively. In the years 2001 and 2008, Ireland exhibits the highest IEF values, whereas in the year 2017 this holds for Estonia. Thus, for the period 2001-2017 and the sub-period 2008-2017, Estonia is considered to be the "leading" country, whereas during the sub-period 2001-2008, Ireland is considered to be the "leading" country. It comes that during the period 2001-2017 the Eurozone countries exhibit, on average, a statistically significant trend (at the level of 1%) of divergence (that is almost equal to stability) from the "leading" country and *inter se*, in terms of the IEF. Such a finding is explained from the findings revealed for the sub-periods 2001-2008 and 2008-2017. Particularly, during the sub-period 2001-2008 it comes that, on average, the Eurozone countries exhibit a statistically significant trend (at the level of 1%) of convergence to the "leading" country. Yet, during the sub-period 2008-2017, it comes that, on average, the Eurozone countries exhibit a statistically significant trend (at the level of 1%) of divergence from the "leading" country and *inter se*. Note that the econometric estimations of the convergence clubs equations have been checked and corrected, where necessary, with the White heteroscedasticity test (White, 1980).

**Table 2: The econometric estimation of the β-convergence equation, period 2001-2017**

Dependent Variable: LN[(IEF17/IEF01)]
Method: Least Squares
Included observations: 19

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 1.100093 | 0.806944 | 1.363283 | 0.1906 |
| LN(IEF01) | -0.256388 | 0.191597 | -1.338160 | 0.1985 |

| | | | |
|---|---|---|---|
| R-squared | 0.095296 | Mean dependent var | 0.020526 |
| Adjusted R-squared | 0.042078 | S.D. dependent var | 0.077874 |
| S.E. of regression | 0.076218 | Akaike info criterion | -2.211135 |
| Sum squared resid | 0.098756 | Schwarz criterion | -2.111720 |
| Log likelihood | 23.00578 | Hannan-Quinn criter. | -2.194310 |
| F-statistic | 1.790673 | Durbin-Watson stat | 1.935603 |
| Prob(F-statistic) | 0.198469 | | |

Sources: Heritage Foundation / Authors' elaboration

**Table 3: The econometric estimation of the β-convergence equation, sub-period 2001-2008**

Dependent Variable: LN[(IEF08)/(IEF01)]
Method: Least Squares
Included observations: 19

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 1.259004 | 0.590930 | 2.130547 | 0.0480 |
| LN(IEF01) | -0.291140 | 0.140308 | -2.075012 | 0.0535 |

| | | | |
|---|---|---|---|
| R-squared | 0.202091 | Mean dependent var | 0.033105 |
| Adjusted R-squared | 0.155155 | S.D. dependent var | 0.060724 |
| S.E. of regression | 0.055815 | Akaike info criterion | -2.834249 |
| Sum squared resid | 0.052960 | Schwarz criterion | -2.734834 |
| Log likelihood | 28.92536 | Hannan-Quinn criter. | -2.817424 |
| F-statistic | 4.305675 | Durbin-Watson stat | 2.861176 |
| Prob(F-statistic) | 0.053480 | | |

Sources: Heritage Foundation / Authors' elaboration

**Table 4: The econometric estimation of the β-convergence equation, sub-period 2008-2017**

Dependent Variable: LN[(IEF17)/(IEF08)]
Method: Least Squares
Included observations: 19

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -0.138307 | 0.604477 | -0.228804 | 0.8218 |
| LN(IEF08) | 0.029602 | 0.142412 | 0.207860 | 0.8378 |

| | | | |
|---|---|---|---|
| R-squared | 0.002535 | Mean dependent var | -0.012684 |
| Adjusted R-squared | -0.056139 | S.D. dependent var | 0.050432 |
| S.E. of regression | 0.051828 | Akaike info criterion | -2.982480 |
| Sum squared resid | 0.045664 | Schwarz criterion | -2.883065 |
| Log likelihood | 30.33356 | Hannan-Quinn criter. | -2.965655 |
| F-statistic | 0.043206 | Durbin-Watson stat | 1.359605 |
| Prob(F-statistic) | 0.837808 | | |

Sources: Heritage Foundation / Authors' elaboration

**Table 5: The econometric estimation of the convergence clubs equation, period 2001-2017**

Dependent Variable: LN[GAP(IEF17)]
Method: Least Squares
Included observations: 19

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LN[GAP(IEF01)] | 1.003375 | 0.120860 | 8.301943 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.380521 | Mean dependent var | 0.139632 |
| Adjusted R-squared | 0.380521 | S.D. dependent var | 0.101657 |
| S.E. of regression | 0.080011 | Akaike info criterion | -2.162106 |
| Sum squared resid | 0.115232 | Schwarz criterion | -2.112399 |
| Log likelihood | 21.54001 | Hannan-Quinn criter. | -2.153694 |
| Durbin-Watson stat | 1.802479 | | |

Sources: Heritage Foundation / Authors' elaboration

**Table 6: The econometric estimation of the convergence clubs equation, sub-period 2001-2008**

Dependent Variable: LN[GAP(IEF08)]
Method: Least Squares
Included observations: 19
White heteroskedasticity-consistent standard errors & covariance

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LN[GAP(IEF01)] | 0.869426 | 0.076612 | 11.34841 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.561249 | Mean dependent var | 0.169000 |
| Adjusted R-squared | 0.561249 | S.D. dependent var | 0.085862 |
| S.E. of regression | 0.056873 | Akaike info criterion | -2.844786 |
| Sum squared resid | 0.058222 | Schwarz criterion | -2.795079 |
| Log likelihood | 28.02547 | Hannan-Quinn criter. | -2.836374 |
| Durbin-Watson stat | 2.690509 | | |

Sources: Heritage Foundation / Authors' elaboration

**Table 7: The econometric estimation of the convergence clubs equation, sub-period 2008-2017**

Dependent Variable: LN[GAP(IEF17)]
Method: Least Squares
Included observations: 19

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LN[GAP(IEF08)] | 1.170416 | 0.086469 | 13.53560 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.732390 | Mean dependent var | 0.139632 |
| Adjusted R-squared | 0.732390 | S.D. dependent var | 0.101657 |
| S.E. of regression | 0.052588 | Akaike info criterion | -3.001454 |
| Sum squared resid | 0.049779 | Schwarz criterion | -2.951746 |
| Log likelihood | 29.51381 | Hannan-Quinn criter. | -2.993041 |
| Durbin-Watson stat | 1.466074 | | |

Sources: Heritage Foundation / Authors' elaboration

## 5. CONCLUSIONS

The paper adopts a broad view of the OCA theory, and attempts to detect trends of convergence in terms of economic freedom among the Eurozone (Euro Area) countries. To this end, the paper conducts an empirical analysis for the period 2001-2017 (as well as for the sub-periods 2001-2008 and 2008-2017), utilizing the IEF, and employing the methodological approaches of unconditional β-convergence and convergence clubs.

It comes that irrespective of the estimation technique (i.e. unconditional β-convergence or convergence clubs), two contrasting trends may record comparing the results for the sub-periods 2001-2008 and 2008-2017. Particularly, for sub-period 2001-2008 the Eurozone countries exhibit, on average, a statistically significant trend of convergence (at the level of either 10% or 1%) and form one convergence club, converging to "leading" country. In contrast, for the sub-period 2008-2017 the Eurozone countries exhibit, on average, either a statistically non-significant or a statistically significant (at the level of 1%) trend of divergence, and diverge both from the "leading" country and *inter se*. Thus, for the period 2001-2017 the Eurozone countries exhibit, on average, either a statistically non-significant trend of convergence or a statistically significant (at the level of 1%) of divergence, depending on the estimation technique. Overall, it comes that the trend revealed for the period 2001-2017 is, in fact, the balance between the opposite trends revealed for the sub-periods 2001-2008 and 2008-2017.

As both the β-convergence and the convergence clubs results indicate, the trend of convergence that the Eurozone countries exhibit during the sub-period 2001-2008, vanishes during the sub-period 2008-2017 as the trend of divergence becomes stronger. Apparently, this seems to be an adverse impact of the world-wide financial and economic crisis that seems to dissociate the Eurozone reality from the broad perspective of the OCA theory.

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