Self-employment and job creation: are average self-employed firm sizes among European countries converging?

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Abstract

This article aims at testing the hypothesis of convergence -both stochastic and beta convergence- in self-employed firm sizes among the EU-15 countries for the period 1972-2009, using the Carrion et al's tests of stationary in variance in panel data with multiple structural changes. During the period, the hypothesis of convergence is accepted overall. Finally, and by using the point estimates of both the intercept and trend coefficients for the different regimes identified on the basis of the breaks detected in the analysis, above mentioned, our results confirms that convergence in self-employed firm sizes has been a generalised phenomenon among European countries in their respective current regimes, with the only exception of Luxembourg. In sum, European Countries show a tendency to converge to a pattern of stable size differences over time. As consequence of the adequacy of the European policies or to the existence of market forces, which will eventually lead to similar exploitations of the market opportunities by European self-employed across countries –similar scales-, or both, the self-employment contribution to job creation is converging. This process should contribute to the social cohesion.

JEL classification: C22, C23, J24, L26, M13, O47;

Keywords: Entrepreneurship; Firm size; Multiple breaks; Self-employment; Panel unit root tests; convergence

Acknowledgements

The authors are grateful to Professors Carrión-i-Silvestre and López-Bazo for kindly making available the Gauss computer codes. The paper has been written in the framework of the research program SERG financed by the Andalusian R&D Plan (SEJ-487).

1. **Introduction**

Job creation is probably the greatest challenge and 'hot' political and economic issue at the time of writing. This is particularly true in the case of some European countries where high and persistent unemployment rates exacerbate other problems related to the current crisis. The extent of the problem contrasts with the objectives of the European strategy of development, whereby European countries should have created more and better jobs by means of a more entrepreneurial economy. In this framework the entrepreneurship promotion had to play a pivotal role. It was necessary more new and thriving firms willing to reap the benefits from the European market openings and to embark on creative or innovative ventures for commercial exploitation on a larger scale. In the same logic, entrepreneurship can also contribute to fostering social and economic cohesion for those European countries whose development is lagging behind, to stimulating economic activity and job creation or to integrating unemployed into work.

At the heart of the debate is the question whether the poor countries catch-up the one of the rich ones not only in terms of income but also in terms of employment analysing if country-specific self-employed sectors would be able to exploit the new opportunities opened by the EU Single Market increasing the ability of the self-employed to provide employment.

In this context, the main aim of this paper is to explore the issue of convergence in self-employed firm sizes, that is, whether there has been a tendency for the contribution of the self-employed to employment differences between countries to narrow significantly over the long run.

From an economic policy point of view, the issue of convergence or divergence in the self-employed firm size (*sfs,* henceforth) is very important. In the case of convergence, this would point to the existence of market forces, which will eventually lead to similar exploitations of the market opportunities by European self-employed across countries. In the case of persistently large gaps between countries, there could be a need for new economic policy measures to stimulate a catch-up process.

More generally, this analysis raises questions about the impact of domestic institutions and policies on long-term job creation performance. Looking at past experience may be also be a valuable source of information as regards prospects of achieving a more equitable distribution among the countries of the European continent, that is, with regard to the social cohesion.

Convergence in self-employment firm size is at present a core concern for policy makers in some developed countries that are suffering the most virulent effects of the crisis in terms of massive adjustment accompanied by an exceptionally high job destruction process. Government of these countries want to look into why some countries have showing higher volatility than others. In this sense, the results of our research aims to shed more light on the nature of the job creation amongst the self-employed. In particular, one could expect that countries which holding the same currency should have about the same levels of competitiveness. This is currently not the case in the Eurozone and hence convergence of competitiveness levels is important. One aspect of the competitiveness, the employment contribution of the self-employed and its convergence across countries is then, a hot policy issue and its study the main objective of this paper.

Finally, and from the perspective of the economics of entrepreneurship, this work treats to contribute to a significant gap in this line of research: to know if the greater propensity to employ additional workers observed in some countries (Cowling and Mitchell, 1997) tends to disappear or if by contrast, it is necessary to devise some specific incentives and policies in order to have similar self-employed sectors in terms of their employment contribution.

To this end this paper exploits harmonized data on 15 European countries over 1972—2009 to investigate the convergence or not of the employment contribution of the self-employed sectors, reflecting the availability of data, since for others Members States it is doubtless still too early to draw conclusions.[1] The business owners in this study consist of both, unincorporated and incorporated self-employed individuals. They provide the bulk of the entrepreneurs in any country[2]. Cross-country studies not only should shed light on differences in the composition of the self-employed sector, but they also should allow the study of the comparative role of self-employment in job creation. As we mentioned, the ability of the self-employed to provide employment is not a minor issue. It is well established that new firms are very important sources of job (and wealth) creation, but the key question is to know whether its effects are equally distributed across countries favouring the economic and social cohesion. To this end we analyse the convergence of self-employed firm sizes among the EU-15 countries.[3]

For the study of the convergence two concepts of convergence applies. On the one hand, the concept of stochastic convergence introduced by Quah (1990) -to refer to the persistence of shocks on the variable of interest- and qualified by Carlino and Mills (1993, 1996) who introduced this concept as a time-series notion of convergence. Specifically, stochastic convergence in *sfs* suggests that the shocks in *sfs* relative to the average *sfs* of the sample are temporary. More in details, we test for stochastic convergence by means of panel data unit root and stationarity tests with structural breaks proposed by Carrión, del Barrio and López Bazo (2005) -*CBL* henceforth-. Stochastic convergence will exist when the relative *sfs* are trend stationary, while the existence of a unit root will indicates that the effect of a shock is permanent. If that is the case *sfs* will show divergence from the sample mean.

On the other hand, we also investigate the time-series notion of beta-convergence allowing structural breaks, which allows individual behaviour to be transitionally divergent. This concept of convergence, introduced by Baumol (1986), refers to a negative relation between the growth rate of the variable of interest and its initial level. Presence of *βbeta-convergence* implies that panel countries show a mean reverting behaviour to a common level.

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1 The enlargement from EU-15 to EU-25 dates back to 2004.

2 Some scholars probably put in doubt the suitability of using self-employment for measure entrepreneurship. We are aware of limitations but it is the only way of having comparable long time series for cross-section analyses. As usual, in cross-country studies, we use the number of business owners, as a proxy of entrepreneurship, since it is the only variable available to measure entrepreneurship at the country level for a long time period. Alternatives like the GEM Total Entrepreneurial Activity Rate do not have the required length for time series analysis.

3 One could argue, that this measure is a little bit strange, and could suggest instead the use of the traditional average firm size. However, we are not interested in the firms, we are interested in the productive factor, i.e. the entrepreneur and its capacity of contributing to job creation.

In sum, and in the context of the empirical literature on convergence, this study exploits the cross-section dimension as well as the time-series dimension of the panel, and considers the possibility of structural breaks in the data generation process. To set our results in context, we present results of stochastic convergence derived from panel data unit root and stationarity tests taking into account potential structural breaks and also investigate the time-series notion of *beta-convergence*. If this condition holds we will assist to a process of narrowing the *sfs* gap across European countries.

The remainder of the paper is structured as follows. In section 2, we discuss the main factors explored by the entrepreneurship empirical and theoretical literature, which potentially points to convergence in self-employed firm size among countries with similar institutional conditions. In section 3, we describe both the data and the empirical strategy used to test for self-employed firm size convergence –both stochastic and beta-convergence. Section 4 presents the results, including those derived from running the *CBL* test, which allows for structural breaks. Breaks are found to be important features of the data. In any case, our results reveal that convergence in self-employed firm size has been the predominant trend among EU-15 countries during the last decades.

2. Entrepreneurship and Convergence

In principle, convergence in self-employed firm size is important since it should be interpreted as a signal of convergence in competitiveness and on how the market forces contribute to the convergence among European countries. In certain sense this kind of convergence is probably most important for countries with below-average self-employed firm size. The reason is that low average self-employed firm size is associated with lower wages, lower job security, and lower degree of specialisation, i.e., lower quality of jobs. From this perspective, low *sfs* is probably also correlated with high unemployment and associated with lower competitiveness. Hence it is interesting to investigate convergence, particularly for low AFS countries.

Thanks to the emergence of new internationally comparable data, the study of the determinants of entrepreneurship at the macro level, and the analysis of different relationships between entrepreneurship and some macroeconomic variables such as employment/unemployment or economic growth, has suffered an exponential growth.

Behind this interest is one of the most intriguing questions in economics: looking for the key factors in determining the employment intensity of growth. This problem from the perspective of the economics of self-employment is similar to questioning about how is the self-employment contribution to paid-employment, that is, about the self-employed firm size determinants and evolution.

While a relatively abundant literature has analysed the determinants of the individual decisions about self-employment and job creation the literature on the evolution and trends of this relationship is quite scarce (Cowling and Mitchell, 1997, Parker et al., 2012). The former body of literature has showed that the decision to become self-employed and the contribution of the self-employed sector to economic growth and job creation are highly dependent on institutional, technological, demographic as well as economic and political environments that potential entrepreneurs face –see Stel et al. (2003), Ardagna and Lusardi (2008), Klapper et al. (2006) Desai et al. (2003), Glaeser

(2007)–.

In this framework and according to previous literature (e.g., Acs et al., 1994; Carree, et al., 2002, 2007) which argues that economies which are rather similar in their structural characteristics –labour market institutions, government policies, educational systems, production functions, among others could converge to a business ownership steady state equilibria, i.e. follows a common self-employed firm size path– we will try to test this hypothesis of convergence, letting the data speak for themselves.

3. Data and Econometric Strategy

3.1. Data

As we mentioned in the introduction, although there is no consensus in the literature on how to operationalize entrepreneurship in empirical research, the use of self-employment data (business ownership) is the pragmatic option in terms of availability of data for cross-country comparisons (Parker, 2009). Bearing in mind that, business ownership is not a perfect measure of entrepreneurship this definition of entrepreneurship has the merit of convenience.[4]

In our empirical analysis we use data of the EU-15, for the period 1972-2008. In common with most previous studies, entrepreneurship is operationalized in terms of self-employment, reflecting data availability at the time-series level.
We are conscious that entrepreneurship is a multifaceted concept, which encompasses a range of roles and activities and that any single measure of entrepreneurship is therefore a limited proxy. However, in cross-country comparisons, by far the most common measure used in practice is self-employment rates reflecting widespread availability of data. Self-employment firm size, sfs_{it}, is defined as the ratio between paid-employment and self-employment in the country i at the period t. The definitions and sources for these two components are given below.

$$sfs_{it} = \frac{EMP_{it}}{SE_{it}} \quad (1)$$

EMP_{it}: wage workers outside the agriculture, hunting, forestry and fishing industries. This variable is computed from several OECD sources.[5]

SE_{it}: Self-employment is defined as the total number of unincorporated and incorporated self-employed outside the agriculture[6], hunting, forestry and fishing industries, who

[4] Self-employed individuals are close to the Knightian view of the entrepreneur who is considered as the risk-taker (Iversen et al., 2008; O'Kean and Menudo, 2008).

[5] First, total employment is computed by subtracting the number of unemployed from the number of persons in the total labor force. Data on total labor force are taken from OECD Labour Force Statistics while the number of unemployed is calculated using the standardized unemployment rate published in OECD Main Economic Indicators. Some missing values in the unemployment series are estimated using data from OECD Labour Force Statistics. Second, based on employment data by sector from OECD National Accounts government employment and employment in the primary sectors of economy are excluded from total employment to arrive at private sector employment outside the agriculture, hunting, forestry and fishing industries.

[6] Previous authors have pointed out that self-employment in agriculture is likely to be heavily influenced by historically and culturally determined traditions of family ownership and factors (such as a high

carry out self-employment as their primary employment activity, see Van Stel (2005, p. 108). Unpaid family workers are excluded. These data are taken from EIM's COMPENDIA data base (version 2009.1).[7] In this data base, self-employment numbers as published in OECD Labour Force Statistics are corrected for measurement differences across countries and over time and thus harmonized.[8] Let's take a look at our data in order to discover some statistical regularities, some stylized facts for self-employed firm sizes across European Countries.

From 1972 the self-employed firm sizes have decreased in the most European countries, maybe leaded by the increase in the self-employment rates in some of them. In any case, leaving aside the two ends of the distribution (i.e. on the one hand Luxembourg and on the other hand Greece and Italy at the top and bottom ends of the distribution, respectively) European countries seem to show a certain convergence in terms of self-employed firm size.

In table 1, we report the data for the countries, which are ordered based on the 2009 column. As we can see the variances –based on the 15 countries included in our sample– decreases over time, leading a first indication of convergence.

Table 1. Summary of the average self-employed firm size in EU15

Country	Self-employed firm size		
	1972	1990	2009
Luxembourg	6.98	12.12	16.39
Denmark	7.42	8.40	7.99
Austria	7.08	9.20	7.27
Germany*	9.41	9.59	7.02
France	4.87	5.43	6.40
Finland	9.41	7.24	6.04
Netherlands	7.17	8.29	5.97
UK	8.54	5.46	5.96
Sweden	7.14	8.21	5.89
Belgium	6.49	5.41	5.25
EU-15	***5.77***	***5.10***	***5.16***
Ireland	5.78	4.12	4.80
Spain	4.56	4.33	4.56
Portugal	3.42	3.66	4.35
Italy	2.95	2.45	2.77
Greece	2.51	2.41	2.70
Variance	***4,82***	***8,12***	***10,16***
Variance (excluding LUX)	***5,14***	***6,07***	***2,42***

* West-Germany for 1972 and 1989.

proportion of unpaid family workers) other than those that influence other types of self-employment (Iversen et al., 2008).

[7] COMPENDIA is an acronym for COMParative ENtrepreneurship Data for International Analysis. See http://www.ondernemerschap.nl for the data and Van Stel (2005, 2008) for a justification of the harmonization methods. This database has been used and acknowledged widely (see, among other studies, Armour and Cumming, 2008, Carree et al., 2002, 2007, Davis, 2008 (p. 54), Koellinger and Thurik, 2009, Nyström, 2008, and Parker, Congregado and Golpe, 2012).

[8] Data taken directly from the OECD Labour Force Statistics suffer from a lack of comparability across countries and over time. In particular, owner-managers of incorporated businesses (OMIBs) are counted as self-employed in some countries, and as employees in other countries. Also, the raw OECD data suffer from many trend breaks relating to changes in self-employment definitions (Van Stel, 2005).

Note: Business ownership is defined as including both the owner-managers of incorporated and unincorporated businesses, but excluding unpaid family workers and wage-and-salary workers operating a side-business as a secondary work activity.
Business owners in the primary sectors of the economy are also excluded. See van Stel et al. (2010).
Data Source: EIM: COMParative Entrepreneurship Data for International Analysis (version 2009.1)

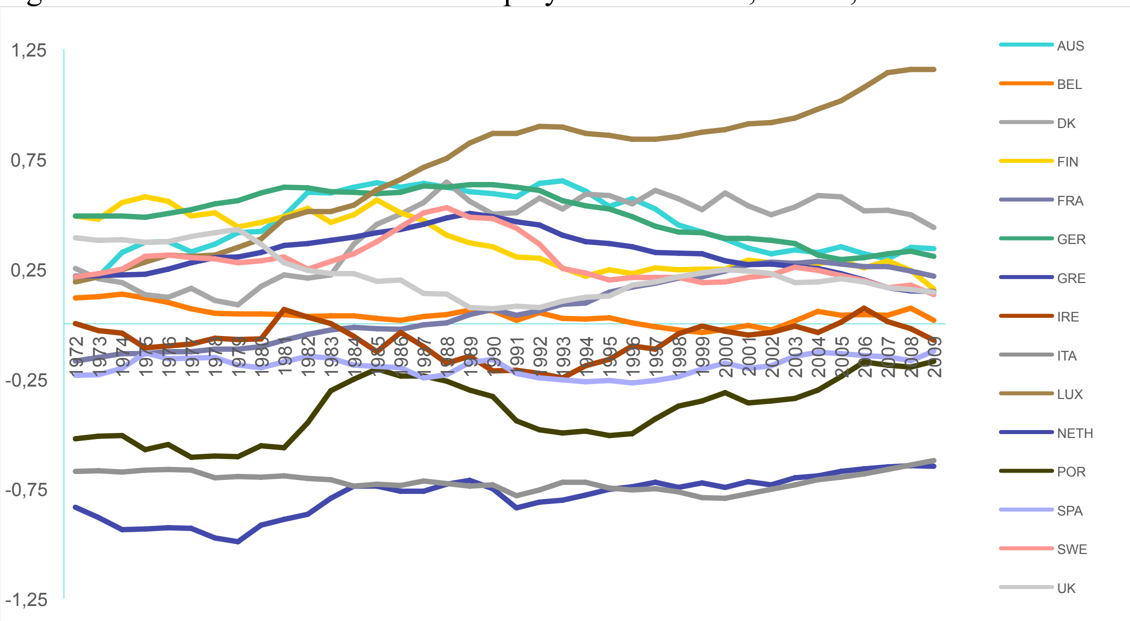
3.2. Empirical Strategy

The empirical analysis of convergence by means of unit root testing has been a highly active area in economic research. In this article, and by using panel unit root tests we look for stochastic convergence –the convergence concept adopted in the most part of this paper-. At starting point we follow the strategy of Carlino and Mills (1993).

In particular, to follow their approach we need, as first step, to compute the logarithm of the *sfs* relative to the average *sfs* for our sample of countries belonging to EU-15. Therefore, the variable for unit root testing is defined by:

$$rsfs_{it} = ln\left(sfs_{it}/\overline{sfs}_{it}\right) \quad (2)$$

Figure 1: Evolution of Relative self-employment firm-size, EU-15, 1972-2009.



The concept of stochastic convergence, applied to our case of study, implies that the relative self-employed firm size (in logs) is trend stationary. By taking a panel data approach –the most suitable for our data since it allows us to exploit not only the time series dimension but also the cross-section dimension of the data- In particular we considers the possibility of structural breaks in the data-generation process. However and to set our results in context, we present results derived from panel data unit root and stationarity tests which both do and do not incorporate structural breaks.

With this empirical strategy in mind, the first step is to run the univariate Kwiatkowski et al. (1992) –KPSS, henceforth- stationarity tests and the panel stationarity test of Hadri (2000).[9]

[9] As is well known, Hadri's test is computed as the average of univariate KPSS tests.

However, inference from panel econometric methods may be biased if we ignore the existence of structural change when it is present. In addition, one could argue that the occurrence of shocks to the convergence process, which can change the dynamic pattern of the *sfs* in a country, is highly probable in a long period –four decades- in which policy shocks and changes in the regulatory framework have been frequent and sizeable.

For these reasons we also employ the panel test of CBL. This test allows us to incorporate potential structural change in the trend function avoiding the potential bias of accepting the null of no convergence in presence of structural breaks.
Once this is done, we run the panel stationarity test developed by CBL (2005). As it is well known this test is a generalisation for the case of multiple changes in level and slop of the Hadri's test.[10]

Finally, and having tested for stochastic convergence, the rest of the paper is devoted to the investigation of the time-series notion of conditional beta-convergence[11] by using the regimes obtained in the analysis of stochastic convergence.

4. Results

Following the empirical strategy discussed above, the first step is the analysis of stochastic convergence. First, we present results derived from panel data unit root and stationarity tests, which do not incorporate structural break. However, there is a consensus about the traditional panel unit root tests tending to under-reject the null of a unit root in the presence of structural breaks. Thus, we proceed to compute the extension of the Hadri's test for stationarity, developed by CBL (2005). This approach will allows to control for heterogeneity and for multiple structural changes and different number of breaks for each country.

After this, we will proceed to investigate whether this has been accompanied with conditional beta-convergence, which would be necessary for cross-country *sfs* differentials to narrow down over time, on the basis of the breaks detected in the analysis of stochastic convergence.

4.1. Stochastic convergence

We first use univariate KPSS tests, based on a specification with time trends, which corresponds to the notion of stochastic convergence. These results are reported in the panel A of Table 2. In four countries, Austria, Germany, The Netherlands and the United Kingdom the null of stationarity can be rejected at the 1% level, while for Luxembourg and Sweden at 5%. In sum, the univariate KPSS test points to divergence in *sfs* in six countries.

Table 2. Panel KPSS Test
Sample 1972-2009 (T=38, N=15)

[10] In our application, this approach allows for multiple structural changes and different number of breaks for each country.
[11] Absolute convergence implies that incomes across countries are approaching the same steady-state level, whereas conditional convergence implies compensating differentials.

Panel A: Panel KPSS Test without Structural Breaks							
Country				KPSS test			
Austria				0.354***			
Belgium				0.056			
Denmark				0.059			
Finland				0.042			
France				0.088			
Germany				0.591***			
Greece				0.058			
Ireland				0.065			
Italy				0.061			
Luxembourg				0.198**			
The Netherlands				1.177***			
Portugal				0.104			
Spain				0.052			
Sweden				0.156**			
United Kingdom				0.221***			
Panel B: Panel KPSS test without multiple breaks with trends (Hadri, 2000)							
			Bootstraps critical values				
	Test	p value		90%	95%	97.5%	99%
$Z(\hat{\lambda})$ (homogeneous)	7.307	0.000		4.935	6.043	7.405	9.008
$Z(\hat{\lambda})$ (heterogeneous)	14.098	0.000		5.790	7.005	8.031	10.005

Notes: The 1%, 5% and 10% finite sample critical values for the KPSS test for the specification with trends are 0.213, 0.149, 0.121, respectively, for T=50 (see Sephton, 1995). LM homogeneous and LM heterogeneous denote the panel KPSS test by Hadri (2000) for the case of homogeneity and heterogeneity in the estimation of the long-run variance respectively. ***,** and * imply rejection of the null hypothesis at 1%, 5% and 10%, respectively.

Panel B of table 2 reports the results from the panel stationarity test of Hadri (2000) for the case of cross-sectional independence and asymptotic normality as well as the bootstrap critical values allowing for the general forms of cross-sectional correlation. Remarkably, we are able to reject the null of joint stationarity at the 1% significance level. Thus, our results indicate that the null hypothesis cannot be rejected at the 1% suggesting again divergence of *sfs* across European countries.

However, this may result from the failure to allow for structural change in the deterministic component of the trend function of *sfs*. In fact, the traditional unit root tests tend to under-reject the null of a unit root in the presence of structural breaks. Thus, we proceed to compute the extension of the Hadri (2000) test for stationarity in variance in panel data with multiple structural changes developed by CBL.

CBL (2005) specified the following data generation process (DGP) under the null of stationarity in variance:

$$rsfs_{i,t} = \alpha_i + \sum_{k=1}^{m_i} \theta_{i,k} DU_{i,k,t} + \beta_i t + \sum_{k=1}^{m_i} \gamma_{i,k} DT^*_{i,k,t} + \varepsilon_{i,t} \quad (3)$$

The dummy variables for the changes in level and slope are given by $DU_{i,k,t}$ and $DT^*_{i,k,t}$, respectively, such that $DU_{i,k,t} = 1$ for $t > T^i_{b,k}$ and 0 otherwise, with $T^i_{b,k}$ denoting the kth break location for the i^{th} individual for $k = 1,\ldots,m_i$, $m_i \geq 1$. Likewise, $DT^*_{i,k,t} = t - T^i_{b,k}$, for

$t > T^i_{b,k}$ and 0, otherwise. Finally the terms $\varepsilon_{i,t}$ are assumed to be independent across countries. Importantly, this DGP includes: a) Individual effects -individual structural break effects or shifts in the mean caused by the structural breaks-, b) temporal effects if $\beta_i \neq 0$ and c) temporal structural break effects if $\gamma_{i,k} \neq 0$ – when there are shifts in the individual structural time trend. Therefore, this specification is general enough to allow for unit-specific intercepts and time trends in addition to unit-specific mean and slope shifts.

As we mentioned before, and for testing the null of stationarity, CBL (2005) compute an extension of the Hadri's test:

$$LM\left(\hat{\lambda}\right) = N^{-1}\sum_{i=1}^{N}\left(\hat{\psi}_i^{-2}T^{-2}\sum_{t=1}^{T}\hat{S}_{i,t}^2\right) \quad (4)$$

where $LM\left(\hat{\lambda}_i\right) = \hat{\psi}_i^{-2}T^{-2}\sum_{t=1}^{T}\hat{S}_{i,t}^2$ is the univariate KPSS test for the i_{th} country i, and $\hat{S}_{i,t} = \sum_{j=1}^{t}\hat{\varepsilon}_{i,j}$ stands for the partial sum process that is obtained using the estimated OLS residuals of Eq. (3), with $\hat{\psi}_i^2$ as the consistent estimate of the long-run variance of residual $\varepsilon_{i,t}$.

Because the test is not independent on the location of the breaks (λ_i), we must use the procedure suggested by Bai and Perron (1998), which is based on the global minimization of the sum of squared residuals, to determine the break locations for each unit. After the dates for all possible $m_i \leq m^{\max}$ for each i are estimated – being m and $m^{\max}$ the number of breaks and the maximum number of breaks, respectively – we must select the appropriate number of structural breaks. To this end, we use the modified Schwarz Information Criterion (LWZ) of Liu, Wu and Zidek (1997). The normalized test statistic is then computed as follows:

$$Z\left(\hat{\lambda}\right) = \frac{\sqrt{N}\left[\eta\left(\hat{\lambda}\right) - \bar{\xi}\right]}{\bar{\varsigma}} \xrightarrow{d} N(0,1) \quad (5)$$

where $\bar{\varsigma}^2$ and $\bar{\xi}$ are computed as the respective averages of the individual means and variances of $LM_i\left(\hat{\lambda}_i\right)$. The limiting distribution of the statistic is derived using sequential asymptotic theory in which $T \to \infty$ is followed by $N \to \infty$. Since the $Z\left(\hat{\lambda}\right)$ statistic assumes cross-sectional independence, we compute the bootstrap distribution of the panel stationary test with multiple breaks following Maddala and Wu (1999), in order to allow for any kind of cross-sectional dependence.

Table 3 reports the results from the panel stationarity test of CBL that allows for multiple level and slope shifts in the trend function. Panel A reports the results from individual KPSS tests with multiple breaks upon which the panel statistic is based. Interestingly, we find that all countries under analysis have experienced at least one abrupt change in the trend function of *sfs*. In terms of convergence, in five countries (Austria, Finland, Luxembourg, Portugal and UK) we are able to reject the null of regime-wise stationarity at 1% level, for Spain at the 5% level, and, for France, Greece and Sweden we reject the null at the 5% level. With the panel KPSS test assuming asymptotic normality and cross-independence, we strongly reject the null of regime-wise trend stationarity in *sfs* at the 1% level, thus supporting again divergence in *sfs*.

However, these conclusions are completely overturned when we compare the test of CBL with the critical values from the bootstrap distribution. Therefore, it is noticeable that the assumption of cross-sectional independence led to spuriously reject the null as a result of size distributions. Once allowance is made for cross-sectional dependence, the critical values shift dramatically to the right of the upper tail of the standard normal distribution. As a result, at 5% level, we are no longer able to reject the null of regime-wise trend stationarity (stochastic convergence) in *sfs*.

Table 3: Individual and panel KPSS test statistics. Sample 1972-2009 (T=38, N=15)

Panel A: Country specific test								
Country	Test	m_i	$\hat{T}^1_{b,1}$	$\hat{T}^1_{b,2}$	$\hat{T}^1_{b,3}$	10%	5%	1%
Austria	0.229***	3	1981	1992	2002	0.073	0.093	0.106
Belgium	0.038	2	1986	2002		0.112	0.154	0.180
Denmark	0.044	2	1979	1988		0.133	0.206	0.253
Finland	0.245***	2	1984	1994		0.101	0.136	0.157
France	0.181*	2	1994	2002		0.147	0.233	0.287
Germany	0.047	3	1979	1992	2004	0.083	0.110	0.127
Greece	0.173*	3	1979	1984	1990	0.112	0.174	0.210
Ireland	0.035	2	1981	1993		0.106	0.147	0.173
Italy	0.117	2	1992	2000		0.133	0.205	0.249
Luxembourg	0.212***	3	1977	1989	1999	0.076	0.099	0.113
The Neth.	0.066	1	1990			0.156	0.220	0.258
Portugal	0.243***	3	1979	1985	1993	0.090	0.131	0.156
Spain	0.265**	2	1976	1998		0.143	0.219	0.272
Sweden	0.108*	3	1981	1987	1992	0.099	0.147	0.179
U.K.	0.178***	3	1980	1990	1999	0.071	0.089	0.099

Panel B: Panel KPSS test with multiple breaks assuming cross-section independence		
	Test	p value
$Z(\hat{\lambda})$ (homogeneous)	14.268	0.000
$Z(\hat{\lambda})$ (heterogeneous)	44.927	0.000

Panel C: Bootstrap distribution (allowing for cross-section dependence)				
	90%	95%	97.5%	99%
$Z(\hat{\lambda})$ (homogeneous)	19.480	22.888	25.183	28.771
$Z(\hat{\lambda})$ (heterogeneous)	49.261	55.082	59.575	65.302

Notes: The specification contains country-specific intercepts and linear trends. $Z(\hat{\lambda})$ (homogeneous) and $Z(\hat{\lambda})$ (heterogeneous) denote the panel stationary test with multiple breaks developed by Carrion-i-Silvestre et al. (2005) for the case of homogeneity and heterogeneity, respectively, in the estimation of the long-run variance. The bootstrap distribution for $Z(\hat{\lambda})$ is based on 20.000 replications. The number of break points has been estimate using the LWZ information criteria allowing for a maximum of m_i=3 structural breaks. ***, ** and * imply rejection of the null hypothesis at 1%, 5% and 10%, respectively.

4.2. Time series beta-convergence tests

After determining the existence of stochastic convergence in the *sfs* in the UE15 using panel unit root techniques, we now are interested whether this convergence has been accompanied with conditional *beta-convergence,* which would be necessary for cross-country differentials over the time.

As it is well-known fact, the presence of *beta-convergence* implies that panel members show a mean reverting behaviour to a common level. Then, for investigating *beta-convergence* we must use *sfs* regressions where the coefficient on the initial *sfs* provides information on the extent of convergence. In particular, we can detect the existence of this kind of convergence by establishing whether the parameters α and β are statistically significant and opposite in sign for each i (see, Carlino and Mills, 1993 or Dawson and Sen, 2007). If we generalize this condition for the case of multiple convergence regimes as identified in our previous analysis, then *beta-convergence* would be consistent with α >0 and β β<0 for the pre-break regime, i.e. countries with *sfs* levels above their compensating differentials should exhibit slower *sfs* growth than countries initially below their compensating differential (α<0) which would exhibit faster *sfs* growth (β >0).

Likewise, *sfs* convergence will be present at the different regimes whether the parameters to be statistically significant and opposite in sign.

Table 4 reports the complete point estimates of the intercept and trend coefficients for this regression model, for the different regimes identified on the basis of the breaks detected in the analysis, by using the Newey and West (1994) robust estimator of the covariance matrix.

In general, the results indicate that *beta-convergence* in self-employed firm size has been a generalised phenomenon in the EU-15, throughout the two last decades. However the process of convergence has not been uniform.

Table 4: Estimates of parameters for the different convergence regimes

$$rsfs_{i,t} = \sum_{k=1}^{m_i+1} \theta_{ik} DU_{ikt} + \sum_{k=1}^{m_i+1} \eta_{ik} DT^*_{ikt} + \upsilon_{it}$$

	$\hat{\theta}_1$	$\hat{\eta}_1$	$\hat{T}^1_{b,1}$	$\hat{\theta}_2$	$\hat{\eta}_2$	$\hat{T}^1_{b,2}$	$\hat{\theta}_3$	$\hat{\eta}_3$	$\hat{T}^1_{b,3}$	$\hat{\theta}_4$	$\hat{\eta}_4$
Austria	0.230*** (0.022)	0.027*** (0.003)	1981	0.615*** (0.013)	-0.000 (0.002)	1992	0.645*** (0.008)	-0.037*** (0.001)	2002	0.330** (0.007)	-0.000 (0.002)
Belgium	0.125*** (0.011)	-0.008*** (0.001)	1986	0.058*** (0.009)	-0.006*** (0.001)	2002	0.035** (0.011)	0.001 (0.003)			
Denmark	0.230*** (0.013)	-0.021*** (0.026)	1979	0.125*** (0.034)	0.062*** (0.005)	1988	0.541*** (0.010)	-0.002 (0.002)			
Finland	0.523*** (0.021)	-0.004 (0.003)	1984	0.537*** (0.010)	-0.036*** (0.002)	1994	0.259*** (0.017)	-0.001 (0.002)			
France	-0.177*** (0.071)	0.012*** (0.000)	1994	0.145*** (0.002)	0.019*** (0.001)	2002	0.289*** (0.007)	-0.010*** (0.002)			
Germany	0.474*** (0.011)	0.010*** (0.002)	1979	0.603*** (0.007)	0.002 (0.001)	1992	0.552*** (0.001)	-0.022*** (0.002)	2002	0.330*** (0.018)	-0.004 (0.004)
Greece	-0.862*** (0.016)	-0.018*** (0.003)	1979	-0.931*** (0.012)	0.045*** (0.005)	1984	-0.751*** (0.009)	0.003 (0.004)	1990	-0.811*** (0.011)	0.010*** (0.001)
Ireland	-0.059 (0.039)	0.002 (0.008)	1981	0.008 (0.013)	-0.024*** (0.002)	1993	-0.138*** (0.026)	0.013*** (0.003)			
Italy	-0.658*** (0.006)	-0.005*** (0.000)	1992	-0.718*** (0.002)	-0.011*** (0.001)	2000	-0.771*** (0.011)	0.018*** (0.001)			
Luxembourg	0.193*** (0.005)	0.026*** (0.003)	1977	0.308*** (0.009)	0.045*** (0.001)	1989	0.880*** (0.011)	-0.003 (0.002)	1999	0.860*** (0.015)	0.035*** (0.003)
The Netherlands	0.193*** (0.008)	0.017*** (0.001)	1990	0.443*** (0.001)	-0.016*** (0.001)						
Portugal	-0.505*** (0.014)	-0.015*** (0.003)	1979	-0.591*** (0.021)	0.081*** (0.007)	1985	-0.197*** (0.021)	-0.043*** (0.004)	1993	-0.502*** (0.017)	0.023*** (0.002)
Spain	-0.241*** (0.008)	0.024*** (0.005)	1976	-0.153*** (0.009)	-0.005*** (0.001)	1998	-0.194*** (0.050)	0.007*** (0.002)			
Sweden	0.241*** (0.021)	0.008*** (0.003)	1981	0.232*** (0.011)	0.052*** (0.004)	1987	0.533*** (0.087)	-0.038*** (0.005)	1992	0.232*** (0.011)	-0.003** (0.002)
United Kingdom	0.382**** (0.014)	0.002 (0.003)	1980	0.075*** (0.001)	-0.023*** (0.002)	1990	0.051*** (0.001)	0.019*** (0.001)	1999	0.244*** (0.005)	-0.011*** (0.001)

Note: ***,** and * denotes significance at the 1, 5 and 10% respectively.

Finally and following the typology suggested by Dawson and Sen (2007), table 5 reports a classification as a result of application of the previous typology to results reported in table 4. In particular, this typology establish that: a C denotes points estimates that are statistically significant (both, intercept and trend) at the 10% level and with signs consistent with *beta-convergence* (opposite signs), SS denotes trend estimates that are statistically insignificant (and trend) at the 10% level or better, suggesting that *beta-convergence* has already occurred, and finally D denotes the rest of cases which are consistent with divergence.

For the first regime there was divergence in eight countries (Austria, Germany, Greece, Italy, Luxembourg, The Netherlands, Portugal and Sweden) and beta-convergence process in only four countries (Belgium, Denmark, France and Spain). For the last regime, only Luxembourg is consistent with a process of divergence and nine out of fifteen of the countries in our sample have achieved the beta-convergence (France, Greece, Ireland, Italy, Portugal, Spain, The Netherlands, Sweden and UK). It is important to note is that, the first five countries of this last group are exactly the countries that were below the average self-employment firm size in 1972. Finally, five out of the fifteen probably have completed the convergence process (Austria, Belgium, Denmark, Finland, Germany).

Table 5. Summary of empirical results regarding time-series β-Convergence

	Pre-break Regime 1	Post-break Regime 2	Post-break Regime 3	Post-break Regime 4
Austria	D	1981 SS	1992 C	2002 SS
Belgium	C	1986 C	2002 SS	
Denmark	C	1979 D	1988 SS	
Finland	SS	1984 C	1994 SS	
France	C	1994 D	2002 C	
Germany	D	1979 SS	1992 C	2002 SS
Greece	D	1979 C	1984 SS	1990 C
Ireland	SS	1981 D	1993 C	
Italy	D	1992 D	2000 C	
Luxembourg	D	1977 D	1989 SS	1999 D
The Netherlands	D	1990 C		
Portugal	D	1979 C	1985 D	1993 C
Spain	C	1976 D	1998 C	
Sweden	D	1981 D	1987 C	1992 C
United Kingdom	SS	1980 C	1990 D	1999 C

Notes: To be considered C (converging) in a given period, a country's relative *sfs* have statistically significant intercept and trend coefficient estimates of opposite signs. SS (Steady state) indicates that the country has reached its steady state in the given period, as indicated by a trend coefficient that is insignificantly different from zero. All other instances are denoted as D (diverging).

5. Conclusions

The issue of convergence in *sfs* is relevant not only in the context of the extent in which every new Member has profited from the European integration, but also because it can help us to understand whether those national self-employed sectors with the lowest records in *sfs* have converged or not*, in terms of their* capacities as job creators. In addition, and for practitioners and policy makers, since significant transfers have been provided -the Structural and Cohesion Funds- to support the process of economic convergence, it is interesting to test if these funds have contributed to this objective, from this new perspective. Although maybe we also should test if the observed convergence has been the effect of these funds or only the consequence of the economic integration process and of the market forces in action, in which case they must rethink the need of promoting the convergence across countries.

The Lisbon Strategy and its successive renewals identified the encouragement of entrepreneurship and the job creation as one of the main priorities. So that, although, macroeconomic stability and structural reforms are preconditions for the success of cohesion policies a range of other conditions that can also favour this cohesion. Our results seem to point to the convergence in terms of the ability of self-employed to contribute to job creation across countries, as one of them.

The article provided empirical evidence of *sfs* convergence by employing panel stationarity tests, which incorporate structural breaks to explore stochastic convergence. Combining tests with and without structural breaks, we find considerable evidence of stochastic convergence suggesting a tendency for *sfs* to equalise over time, among European countries.

However the catching-up process requires not only that the *rsfs* gaps are stationary but also that the deterministic trends are decreasing. The analysis of the β-convergence showed that the process of convergence is not constant over time. Countries experiences periods of divergence and periods of convergence. In this regard, probably market forces is the major determinant of the convergence of *sfs*. However, changes in European policies or to the existence of obstacles to market forces –frictions-, could not be constant over time.

To the best of our knowledge this paper is a pioneer empirical contribution to the study of convergence in entrepreneurship, maybe, one of the most promising avenues for further research in the field of Entrepreneurship and Economic Growth when adequate data for these studies are now available. Future work could also fruitfully apply the methodology used in this article to a broader range of countries –maybe more heterogeneous and should also seek to alternative data series, such us business ownership rates or business ownership productivity. In addition, the use of a more flexible approach to the convergence phenomenon, which allows not only for overall convergence but also for subgroups –convergence clubs- under different transition paths, can be other interesting working line opportunity for focus future efforts.

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Figure 1: Relative self-employment firm size across countries

Note: *Dot line denote "Convergence", Dash line denote "Steady State", Solid line denote "Divergence"*