The Relationship between Self-employment and Unemployment in the Long-Run: A Panel Cointegration Approach Allowing For Breaks

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Abstract

Although a lot of research has been done on the link between self-employment and unemployment, often focusing on the short-run of the relationship, the long-run association between the two variables has not received adequate attention. In this paper we examine the long-run relationship between self-employment and unemployment using panel cointegration methods allowing for structural breaks and covering a wide range of European OECD countries using the COMPENDIA dataset over the period 1990-2011. Our findings indicate that a long-run relationship between self-employment and unemployment exist in the panel, but the cointegrating coefficients are unstable. Our estimates finds positive and statistically significant long-run association between self-employment and unemployment exists for more than 50% of the countries included in the sample after the break. For the rest of the countries we find either negative or statistically insignificant association.

Keywords: self-employment, unemployment, Europe, panel cointegration, long-run, structural breaks.

JEL Classification: C, J, R

1. Introduction

In recent years, the relationship between business ownership (or self-employment) and unemployment has received considerable attention from policy makers in European countries (Baptista and Thurik, 2007). However, the theoretical and empirical literature on the relationship between unemployment and self-employment is complex and inconclusive. On the one hand it is argued, that increasing unemployment leads to an increase in start-up activity implying a positive (i.e. counter-cyclical) association between unemployment and self-employment. This is frequently referred as a "recession push" effect (see Thurik et al., 2008; Parker, 1996; Cowling and Mitchell, 1997 among others). On the other hand, there is a claim that, when unemployment is low, firms face a higher market demand thereby increasing self-employed income and making credit easier to get. Also, since wage-employment offers are frequent (Taylor, 1996), self-employment becomes less risky to entrepreneurs if their businesses fail to survive. This effect is known as 'prosperity pull' effect, suggesting that self-employment follows the economic cycle, or in other words is pro-cyclical (see Parker and Robson, 2004; Blanchflower, 2000; Blanchflower and Oswald 1998; Meager, 1992).

This paper examines the economic relationship between self-employment and unemployment for a wide range of European OECD countries using the COMPENDIA database to enable international comparison (see Parker et al., 2012). Our empirical methodology inspired by previous time-series (e.g. Saridakis et al., 2014; Parker, 1996) and macro panel data studies (e.g. Parker and Robson, 2004) but differs from that employed in previous literature by utilising recently developed panel cointegration techniques allowing for breaks and estimating both common and individual long-run relationships. Additionally, our paper overcomes limitations of previous panel data studies that use variables in first differences where country-specific effects are simply differenced out and long-run information is lost (see, for example, Thurik et al., 2008). In this paper, we initially use the methods suggested by Pedroni (1999, 2004) and Kao (1999), and then implement the approach suggested by Di Iorio and Fachin (2007) to examine the stability of the cointegrating coefficients and estimate the relationship between the two variables allowing for coefficients break.

Our results show that a long-run association between self-employment and unemployment exists in the panel of the European Countries but the relationship between the variables has undergone a change over time. Looking at individual countries, our paper shows that about 50% of the countries exhibit positive long-run relationship between self-

employment and unemployment, with average long-run elasticity of unemployment to be around 0.16. For the rest of the countries we find either negative (average elasticity of 0.1) or insignificant association between the two variables. The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 presents the data. Section 4 discusses the methodology. Section 5 presents the estimation results. The final section concludes the paper.

2. The self-employment and unemployment nexus

Small business ownership is seen as an important indicator of enterprise activity (Burns, 2001). The small business sector, and hence business ownership, is of considerable importance across the globe (see Picot et al., 1998); and other OECD economies (Carree et al., 2002; White, 1982; Audretsch, 1995; Kwoka and White, 2001). New and small firms are a major vehicle in which entrepreneurship thrives (Wennekers and Thurik, 1999). Persistently high unemployment rates (typically more prevalent during economic downturns) coupled with limited or no economic growth (particularly during recession) have triggered policy makers into giving greater importance to entrepreneurship in particular, and self-employment, as ways to foster economic progress and reduce unemployment, both through the end of unemployment for the entrepreneur but also through direct job creation (Burns, 2001; Caliendo and Kritikos, 2010; Chell, 2001; Curran, 1999). Public policy approaches to nurturing and sustaining entrepreneurial activities vary considerably across different countries (see Audretsch and Thurik, 2001; Reynolds et al., 2000; Pfeiffer and Reize, 2000). Europe (and other industrialized regions of the globe) experienced considerable industrial restructuring in the last three decades, changing from traditional manufacturing industries towards new and more complex technologies such as electronics, software and biotechnology (Baptista and Thurik, 2007), increasing opportunities for creating small ventures in these areas.

The simplest kind of entrepreneurship is self-employment (Blanchflower and Oswald, 1998). Oxenfeldt (1943) states that individuals with low employment prospects turn to self-employment, therefore ,in tm es of increasing unemployment (say during a recession), an unemployed person might be “forced” into self-employment due to the poor prospects of finding a job (Reize, 2000; Svaleryd, 2015). The relationship between unemployment and entrepreneurship lacks solid empirical evidence (Storey, 1991); with considerable debate and lack of consensus as to how unemployment affects self-employment (Parker, 2004; von Greiff, 2009; Westhead and Cowling, 1995); this makes developing policy or theory difficult (Thurik et al., 2008). For example, scholars have found that higher levels of unemployment

increases entrepreneurial (start-up) activity (Audretsch and Thurik, 2000; Evans and Leighton, 1989; 1990; Hamilton, 1989; Highfield and Smiley, 1987; Picot et al., 1998; Pfeiffer and Reize, 2000; Reynolds et al., 1995; Reynolds et al., 1994 and Yamawaki, 1990); others argue that unemployment actually reduces the amount of entrepreneurial activity (Audretsch and Fritsch, 1994; Audretsch, 1995; Garofoli, 1994; Johansson, 2000), having a negative effect on start-ups and hence self-employment; whilst some authors argue that those entering self-employment from unemployment are more likely to fail than those who have entered from employment (Carrasco, 1999; Pfeiffer and Reize, 2000).

In the literature there is an on-going debate about the relevance of unemployment push vs. demand pull factors for company formations (see Audretsch et al., 2005; Cowling and Mitchell, 1997; Parker and Robson, 2004; Meager, 1992;Staber and Bögenhold, 1993). Knight (1921) postulates that individuals choose between three options: unemployment, self-employment and employment. The theory of income choice, which is dependent on the relative prices of each activity available to an individual, has been the foundation for a wide range of studies focusing on the decision of individuals to become self-employed (Blanchflower and Meyer, 1994; Blau, 1987; Evans and Jovanovic, 1989; Evans and Leighton, 1990; Grilo and Irigoyen, 2006; Grilo and Thurik, 2005; Parker, 2004).

Specifically, this theory suggests that increasing unemployment leads to increasing start-up activity because the opportunity cost of starting a firm has decreased (Blau, 1987; Evans and Jovanovic, 1989; Evans and Leighton, 1990; Blanchflower and Meyer, 1994). This effect has been referred to as the "unemployment push", "refugee" or "desperation" effect which stimulates entrepreneurship (see Reynolds et al., 1995; Reynolds et al., 1994; Hamilton, 1989; Highfield and Smiley, 1987; Yamawaki, 1990; Evans and Leighton, 1989 and 1990). On the contrary the "prosperity pull" hypothesis, states that high unemployment may negatively affect individual expectations about the success of self-employment and thereby the start-up rate, or reinforce credit constraints which may hinder unemployed people to become self-employed (Glocker and Steiner, 2007). A low rate of entrepreneurship may also be a consequence of the low economic growth levels, which also reflect higher levels of unemployment (Audretsch, 1995).

Thus, entrepreneurial opportunities are not just the result of the push effect of (or the threat of) unemployment, but also the result of the pull effect produced by a thriving economy as well as by entrepreneurial activities in the past. In addition to unemployment leading to more or less entrepreneurial activity, the reverse has also been claimed to hold (Audretsch, 1995; Glocker and Steiner, 2007). New-firm start-ups hire employees, resulting

in subsequent decreases in unemployment (Picot et al., 1998 and Pfeiffer and Reize, 2000a); however, the low rates of survival combined with the limited growth of the majority of small firms (Burns, 2001) imply that the employment contribution of start-ups is limited at best, presenting a case against entrepreneurial activities reducing unemployment (Thurik et al., 2008; Baptista and Thurik, 2007)[1]. Also, Garofoli (1994) and Audretsch and Fritsch (1994) found that unemployment is negatively related to new-firm start-ups. However, Carree (2002) found that no statistically significant relationship exists.

Previous empirical research for various OECD countries has established various important factors determining the entry rate into self-employment (for a useful summary see Parker, 2004). These include the differential between earnings from self-employment and salaried employment, the risk differential associated with these income sources, the degree of risk aversion, the level of taxation, gender, ethnicity, skills set of the individual, some argue that formerly unemployed individual lack the skills set for entrepreneurship (Caliendo and Kritikos, 2010), as unemployed people tend to possess lower levels of human capital and hence the entrepreneurial talent required to start and sustain a new firm (Lucas, 1978; Jovanovic, 1982), suggesting that high levels of unemployment are associated with a low degree of entrepreneurial activities. The duration of an individual unemployment also affects their entry into self-employment (Bryson and White, 1996).

The presence of credit constraints i.e. lack of start-up capital (Cressy, 2000; Blanchflower and Oswald, 1998) is a major factor when deciding to enter self-employment; which could be overcome by government start-up subsidies utilized in a number of OECD countries, such as the "bridging allowance" and the "start-up subsidy" in Germany (Almus 2004; Baumgartner and Caliendo 2008; Caliendo and Kritikos, 2010; Glocker and Steiner, 2007; Pfeiffer and Reize 2000); personal wealth for example the US, Evans and Leighton (1989) and Evans and Jovanovic (1989) find a statistically significant positive relationship between the start-up rate and individual wealth, as well as various personal characteristics, in particular age and previous unemployment (Glocker and Steiner, 2007). "However, most of these studies do not differentiate between short-term and long-term unemployment, which may have very different effects on the entry rate into self-employment, and do not account for its potential dependence on cohort effects" (Glocker and Steiner, 2007, p.7).

Reviewing the evidence relating to unemployment rates to new-firm start-up activity, Storey (1991, p. 177) concludes that, "The broad consensus is that time series analyses point

[1]For the indirect impact of start-ups on aggregate employment see, for example, Fritsch (2008) Fritsch et al. (2005).

to unemployment being, ceteris paribus, positively associated with indices of new-firm formation, whereas cross sectional, or pooled cross sectional studies appear to indicate the reverse. Attempts to reconcile these differences have not been wholly successful". Glocker and Steiner (2007) also confirm these findings stating that time-series studies have tended to find a positive relationship between measures of new firm formation, most of the studies based on cross-section or panel data have found a negative relationship.

Overall we conclude that extant literature mainly focuses on short-term causal relationship between the two variables, and finds a lot of contradictory results. The long-run cointegration relation between both variables in a panel framework has not received similar attention with most of the macro-level studies using time-series data and focusing on a single economy (e.g. Saridakis et al., 2014, Parker and Robson, 2004; Cowling and Mitchell, 1997). This paper attempts to shed light on the latter issue by employing panel cointegration techniques allowing for breaks. Importantly, if cointegration can be established, it implies that Granger causality must exist in at least one direction between the variables (see Engle and Granger, 1987) and we test for common versus individual parameters describing the relation between self-employment and unemployment before and after the break occurred.

3. Data sources

We collected annual data from 21 European OECD countries over the period 1990-2011 using the COMPENDIA dataset. The countries chosen are based on the availability of business ownership[2] (as a percentage of the labour force) data as well as unemployment rate data. The countries included in the analysis are: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, The Netherlands and United Kingdom.[3] Table 1 provides summary statistics. All European OECD countries use the International Labor Organization (ILO) guidelines for measuring employment, although it is acknowledged that OECD data may be affected by differences in operational definitions used in national labour force surveys across countries, the way the surveys are conducted, and changes in the survey design. Importantly, self-employment definitions are not consistent across countries. For this reason, this paper uses the COMPENDIA database that harmonise

[2]The COMPENDIA business ownership data excludes unpaid family workers and those who have self-employment as a secondary activity (see, van Stel, 2005).

[3]The EU's average self-employment rate declined from 14.9% in 1990 to 13.3% in 2011, but with fluctuations over the years. The unemployment rate has also fluctuated through time but on average is positively related to self-employment.

business ownership rates across countries and provides international comparable data on entrepreneurship (see Parker et al., 2012; van Stel, 2005). Figure A1 in the Appendix suggests that the two variables under study tend to follow closely related paths and thus, are possibly linked by a long-run relationship.

[Table 1 about here]

4. Statistical framework

4.1 Panel unit root tests

We examine whether or not our self-employment (LSE) and unemployment data (LUN) are integrated of order one, *I(1)* (for the estimations we take natural logs of the business ownership rate and unemployment rate). A wide range of panel unit-root tests have been developed and proposed in the econometric literature. Most of these tests are an extension of the Dickey-Fuller (DF) and Augmented Dickey Fuller (ADF) tests, and the specification of a unit root test in the format of a panel model can be generally written as follows:

$$\Delta y_{i,t} = \rho_i y_{i,t-1} + \emptyset_i \sum_{j=1}^{pi} \Delta y_{i,t-j} + \varphi_i X_{i,t} + u_{i,t} \quad (1)$$

Where $y_{i,t}$ is said to be convergent to the target variable generated by a stochastic process if the process is stationary, in contrast to the hypothesis that $y_{i,t}$ follows a random walk process. ρ_i are the parameters of the autoregressive processes that are used to analyze whether or not each one of the series of the panel meets the condition of convergence and, therefore, is a stationary process. $X_{i,t}$ includes exogenous variables such as individual intercepts with the assumption of fixed or random effects and individual time trends.

We are in interested in the coefficient of $y_{i,t-1}$and in testing whether ρ_i =0 in which case $y_{i,t}$ has unit root and behaves like a random walk, against the alternative hypothesis ρ_i<0 (i.e. that y_i is stationary). For the alternative hypothesis, we have considered two cases: 1) ρ is restricted to be homogeneous across all i ($\rho_i = \rho$); and 2) we allow heterogeneity on the coefficient of $y_{i,t-1}$, thus ρ_i. Hence, the definition of the null and alternative unit root test are: H_0: $\rho = 0$; H_1: $\rho < 0$ in the case of common unit roots and, for the individual unit root case: H_0: $\rho_i = 0$; H_1: $\rho_i < 0$, for all i countries. The alternative hypothesis is interpreted as the number of individual processes that are stationary. The proposed tests by Levin et al. (2002) and Breitung (2000) assume that all cross-sectional units have a common autoregressive

parameter while the tests of Im et al. (2003), Maddala and Wu (1999), Choi (2001) and Hadri (2000) allow the individual autoregressive roots to differ across the cross-sectional units.

4.2 Panel cointegration tests

We apply the seven different cointegration statistics proposed by Pedroni (1999, 2004) and the method suggested by Kao (1999). The long-term economic relations are identified using the two specifications for the Pedroni panel cointegration test: 1) The first is to estimate a panel model with fixed effects for LSE, individual trends and common ratio LUN; and 2) The second panel LSE model is estimated with fixed effects, individual trend and individual coefficients LUN. Both the Pedroni (1999, 2004) and Kao (1999) tests, however, are derived from the frame of the methodology of Engle and Granger that consists of two stages. In the first stage, a panel model is considered, with individual intercepts and trend, as well as individual coefficients for *LUN*. That is:

$$LSE_{i,t} = \alpha_i + \beta_i LUN_{i,t} + \delta_i t + e_{i,t} \quad (2)$$

In order to examine whether the variables LSE and LUN have a long-run relationship, it must be found that the errors of the equation 2 ($e_{i,t}$), are *I(0)*. Thus, we consider an auxiliary regression for the errors and test the stationarity of $e_{i,t}$:

$$e_{i,t} = \rho_i e_{i,t-1} + \sum_{j=1}^{p} \vartheta_{ij} \Delta e_{i,t-j} + v_{i,t} \quad (3)$$

Pedroni (1999, 2004) proposed two sets of statistics to test the null hypothesis of non cointegration ($\rho_i = 1$). For the alternative hypotheses two versions exist:1) The hypothesis of homogenous convergence ($\rho_i = \rho < 1$) for all i known as the 'within' dimension test (or panel statistics test); and, 2) the hypothesis of heterogeneity ($\rho_i < 1$) for all *i*, that is known as the 'between' dimension test (or group statistics test). The proposed test by Kao is very similar to the one proposed by Pedroni, but it proposes some restrictions in the first stage of the methodology. To this end, equation 2, does not include trends, rather it assumes individual constants but homogenous coefficients ($\beta_i = \beta$). In the second stage, Kao proposes to consider equation 3 as a pool model, in order to test the null hypothesis of $\rho=1$ against the alternative $\rho< 1$.

We estimate the long-run relationship between the LSE and LUN (equation 2) by using a fully modified OLS (FMOLS) estimator originally developed by Phillips and Hansen (1990). This estimator generates consistent estimates of the parameters in relatively small samples and controls for potential endogeneity of the regressors and serial correlation. Phillips and Moon (1999), Pedroni (2001a), Kao and Chiang (2001) and Pedroni (2001a, 2001b) has also used a modified version of FMOLS in panel models to estimate long-term relationships among the integrated variables. In this respect, the pooled-FMOLS Phillips and Moon (1999) estimator is an extension of the estimator of Phillips and Hansen (1990) with the notion of long-run average relations that are parameterized in terms of the matrix regression coefficient of the long-run average covariance matrix. In addition, the pooled-FMOLS coefficient can be either estimated weighted or un-weighted. In the former case, however, prior knowledge of the estimated parameters is needed and to this end Pedroni (2001a) and Kao and Chiang (2001) proposing different starting values. Finally, to allow for cross-sectional heterogeneity Pedroni (2001a, 2001b) proposed the group-mean FMOLS.

In this paper, in order to analyse the long-run relationship between LSE and LUN, the methodology by Di Iorio and Fachin (2007) is employed, which is a generalisation of Hansen (1992) stability test based on the stationary bootstrap and is fully robust to cross-section dependence, and estimated using a group-mean FMOLS. To do this, equation 2 is amended to allow for potential intercept and coefficient breaks D_{it}, that is:

$$LSE_{i,t} = (\alpha_{0i} + \alpha_{1i}D_{it}) + (\beta_{0i} + \beta_{1i}D_{it})LUN_{i,t} + e_{i,t} \quad (4)$$

where $D_{it}| = 1\ if\ t > \hat{t}_i^b$, 0 otherwise, and $\widehat{t}_i^b = arg\,max(\hat{F}_{it})$ are the estimated breakpoints. When there is no a priori information on the location of the possible breaks $\widehat{t}_i^b$, three test for the hypothesis that the coefficients are stable over time are proposed (see Hansen, 1992; Di Iorio and Fachin, 2007): (i) the maximum of the Chow tests computed at all possible break points (*SupF*); (ii) their mean (*MeanF*); (iii) a Lagrange-Multiplier test of the hypothesis that the coefficients follow a martingale process of zero variance (*Lc*). The panel null hypothesis is $H_0^P = \bigcap_i^N H_0^i$suggesting coefficient stability in all units with the alternative hypotheses being a) H_1^P: "break in the coefficients in all units"; b) H_1^P: "break in at least one unit"; and c) H_1^P: "break in a reasonable majority of the units". The results of the tests depends on the mass of the distribution of the break statistics lies, so the summary statistics are the mean and median and inferences are derived from a bootstrap resampling.

5. Empirical findings

The unit root tests discussed above are used to define the order of integration of LSE and LUN variables. Table 2 shows the results of the two test groups, for the LSE and LUN variables, where Δ refers to the first difference. The testing procedure is applied to the variables in levels and then for the first differences of the variables, if they are found to follow a random walk in levels. In general, the results suggest that the variables are non-stationary in levels, but after running the test on first differences, it revealed that they are all now stationary. In line with previous work (e.g. Saridakis et al., 2014, Parker and Robson, 2004; Cowling and Mitchell, 1997), we can conclude that both variables are integrated of order one, *I(1)*.[4]

[Table 2 about here]

Table 3 presents the results of the Pedroni and Kao cointegration tests, for LSE and LUN. The results show that five out of the nine tests (unweighted and weighted) indicate that the variables are cointegrated, with common coefficients β for the long-term relationship between LSE and LUN.In addition, two of the three group tests of Pedroni show the existence of a cointegrated relationship with individual coefficient by country for the variables LSE and LUN. According to the panel cointegration tests by Pedroni and Kao, LSE and LUN are cointegrated, even if the coefficient or long-term elasticity of β_i is common or individual for every country in the panel[5].

[Table 3 about here]

Cointegration testing suggests that cointegration holds between self-employment and unemployment and thus, long-run relations between the variables exist. Since public policy measures and changes in business regulations may have effects on the relationship between self-employment and unemployment, however, we continue our analysis allowing for

[4]Also, the Pesaran covariate-augmented Dickey-Fuller (CADF) test (see Pesaran, 2007), which allows for the presence of cross-sectional dependence patterns, suggests that the series are integrated of order one. We also apply the Andrews and Zivot (1992) test allowing for a single structural break in the intercept and the trend of the series. Despite the structural break, the null hypothesis of a unit root in this series cannot be rejected. The Clemente et al. (1998) test produces similar results. In contrast, the paper by Parker et al. (2012) shows that self-employment is integrated of order zero if multiple breaks are allowed in the data-generation process and critical values from the bootstrap distribution are considered. This issue requires further research.

[5]We also employed the four error correction based panel cointegration tests developed by Westerlund (2007). Taking into account cross-sectional dependencies, the tests still reject the null hypothesis of no cointegration.

possible breaks. We first analyze if the long-run individual or common elasticities, β_i, are stable over time for all the countries in the panel. To this end, we use the Di Iorio and Fachin's approach (Di Iorio and Fachin, 2007), which consists of reviewing the individual stability of cointegrating relationship between LSE and LUN according to *Lc*, *SupF* and *MeanF* statistics (see Hansen, 1992). In Table 4 the stability tests of *Lc*, *MeanF* and *SupF* for a single cointegrating relationship between LSE and LUN are presented. The simulations are made with trimming 25%, 15% and 12.5% at both sample ends, but because the results are not sensitive to the choice of trimming results are presented solely for 25% trimming.

The results show four groups of countries: the first group includes countries with evidence of high instability (Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Portugal, Slovak Republic, Spain and Switzerland). The second group includes countries with some evidence of instability (Belgium, Norway and Netherlands). The third group includes countries with some evidence of stability (Austria, Italy, Poland and Sweden). The final group includes only one country with strong evidence of stability in the cointegration relationship between LSE and LUN (United Kingdom). Overall, however, the results show that there is instability in the cointegration relationships between LSE and LUN.

[Table 4 about here]

We continue our analysis by applying stability tests in the panel both in mean and median of the cointegrating relationship between LSE and LUN by country. In Table 5 the results of the panel tests of stability of the self-employment and unemployment long-run relationship are presented. The tests are made with 25%, 15% and 12.5% trimming and 100 bootstrap redrawings. The results with 15% and 12.5% trimming show that median of all statistics suggest strong rejection of the null hypothesis of stability, but there are weak evidence when the mean of the individual statistics are considered. When 25% trimming is applied, however, there are strong evidence that the coefficients of the cointegrating relationship between LSE and LUN are unstable. The results so far seem to suggest that a long-run relationship between self-employment and unemployment exist, but the relationship is likely to have changed over the study period.

[Table 5 about here]

To analyse this further, in Table 6 we present the FMOLS estimates of the long-run relationship between LSE and LUN by country with and without structural break (see equation 4). In general, we find that the coefficients of the intercept dummy variables are statistically significant and because α_1 are positive in general, self-employment rates are higher after the breakpoint in all countries. In some countries self-employment rate falls after the break (e.g. France) or the coefficient after the break is not statistically significant (suggesting no relationship) (e.g. Finland) or the breakpoints falls at the lower or upper values in which they are constrained to lie (1996 and 2007, respectively) providing therefore weak evidence of a structural change (e.g. Czech Republic, Ireland, Italy). Table 6 shows, however, strong evidence that most of the European OECD countries experience a change in the long-run relationship between LSE and LUN in late 1990s and mid 2000s, likely due to cyclical and structural factors that took place in those decades affecting the decision of unemployed people to become self-employed.

[Table 6 about here]

Table 6 also shows that the estimated average elasticity between LSE and LUN with no break in the countries, β_0, is found to be 0.01 (the median is found to relatively higher than the mean i.e. 0.09). The mean results also show that the relationship between self-employment and unemployment turns from positive to negative after the break ($\beta_0 + \beta_1$). However, around 50% of the countries included in the sample remain with a positive relationship between self-employment and unemployment after the break occurred, although in some cases the positive long-run link becomes weaker. Figure 1 categorises the results in four groups depending on the sign of the relationship after the break.

The first group is characterized by positive long-run relationship before (β_0) and after ($\beta_0+\beta_1$) the break (Austria, Finland, Italy, Norway, Sweden, United Kingdom), although in some cases the association has weakened since the break occurred. Within this group, six countries with long-run elasticities between 0 and 0.5 adjust their estimates in a range from 0.07 to 0.22 after the break. With the exception of Italy, the individual elasticities (β_0) are also statistically significant and the group of countries have been also listed among the top European economics regarding the ease of doing business according to the World Bank (2013). The second group is characterized by initial negative relationship and subsequent the breakpoint the relationship becomes positive (Czech Republic, France, Greece, Ireland, Poland). For example, with no break, in France the relationship between self-employment

and unemployment is negative. Henriquez et al. (2001) showed that the negative effect of unemployment on entrepreneurship exceeds the positive effect in France and that the high level of French unemployment benefits and the guaranteed minimum income lowers the incentives of individuals to start their own business. However, after 1999, the relationship becomes positive and it is plausibly related to tax reforms to support small businesses and with plausible lag of few years since the establishment of the SME development bank (BDPME) in 1996.

The third group consists of countries (Slovak Republic, Iceland and Spain) with negative elasticities (β_0, β_1), but the coefficients are found to be statistically insignificant except from the case of Iceland, which also has the lower unemployment rate among the European countries included in our sample (see Table 1). In the final group of countries (Belgium, Denmark, Germany, Portugal, Hungary, Switzerland and The Netherlands), the positive elasticities become negative after the breakpoint. Generally these countries (e.g. Belgium, Denmark, Germany), score lower in positive attitudes toward entrepreneurship (e.g. entrepreneurship is a good career choice) than the average European country (Amoros and Bosma, 2013). In the case of Portugal, a law introduced in 2002 related to the social security system and its funding affected the self-employment contribution to social security. Also, following changes made in the State Budget Law affected how income from independent work was taxed or had to be reported to the income office. Hence, these interventions may partly explain the negative association after the 2002 break point.

[Figure 1 about here]

6. Conclusions

This paper builds on previous time-series and (macro) panel data empirical work and seeks to examine the empirical link between self-employment and unemployment in the long-run. To do this, we collect data from the COMPENDIA database, which in contrast to OECD statistics allows international comparison, and examine the long-run relationship between self-employment and unemployment for a wide range of European OECD countries over the period of 1990-2011. We use recently developed non-stationary (macro) panel econometric techniques allowing for breaks overcoming limitations of previous panel data studies by exploring potential changes in the both the magnitude and the direction of the cointegrating relationship over time. We found that self-employment and unemployment are cointegrated

(i.e. unemployment rates move together with self-employment rate) implying a causal link between the two variables in at least one direction.

The results point towards a positive average long-run elasticity of self-employment with respect to unemployment, but the magnitude of the effect is relatively small. Similarly Parker and Robson (2004) find weak association between the two variables. However, when we examine the individual elasticities and consider potential breaks the results are informative and interesting. Most of the European countries report positive and have statistically significant coefficients after the break, to support the contention that a long-run positive association exists between self-employment and unemployment. The results also reveal that structural or cyclical factors can strengthen or weaken the association over the long-run. For example, changes that encourage tax incentives and financial support to small businesses can strengthen the association, whereas changes in the social security system and reporting income that put a strain to self-employment can weaken the association. This information is relevant for governments since self-employed and paid employed differ in terms of social security entitlements, pensions, unemployment benefits, and other issues that may affect the state budget. Finally, we find that a negative association between self-employment and unemployment also holds for some European countries. However, the association is found to be generally weak or hold for countries with relatively low unemployment rates and attitudes toward entrepreneurship. Although our results shed more light on the relationship between self-employment and unemployment in the long-run future work should be carried out examining differences across European countries and in regions within countries (see Fritsch and Mueller, 2004) that are associated with the relationship between the two variables. Also, further work should empirically investigate which country characteristics determine the sign and magnitude of the relationship between self-employment and unemployment. Finally, future research should shed more light on the particular changes occurring within a country that are associated with the timing of the estimated breaks in the statistical relation between the variables.

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Figure A1. Self-employment and unemployment in European OECD countries (%), COMPENDIA, 1990-2011.

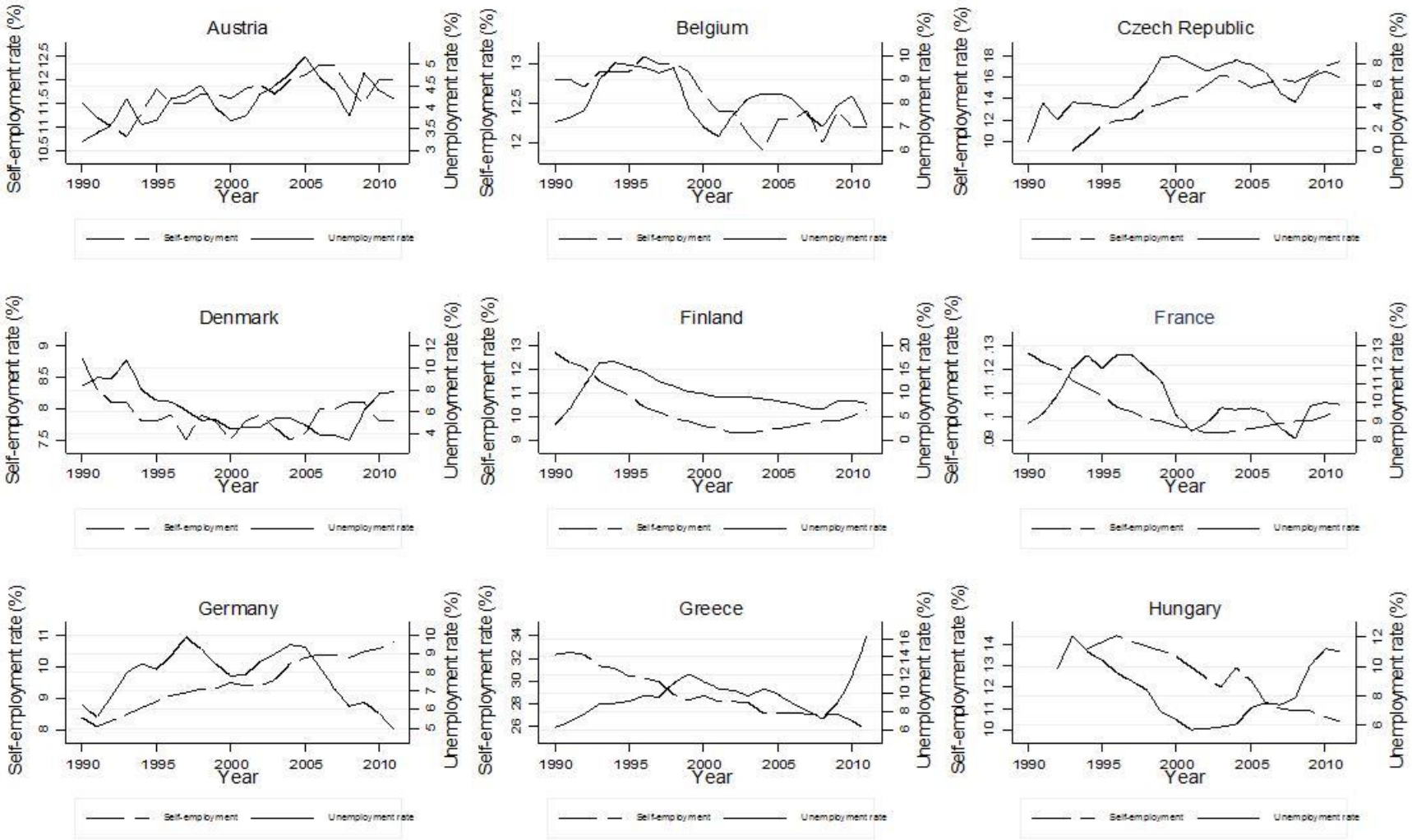

Figure A1.continued

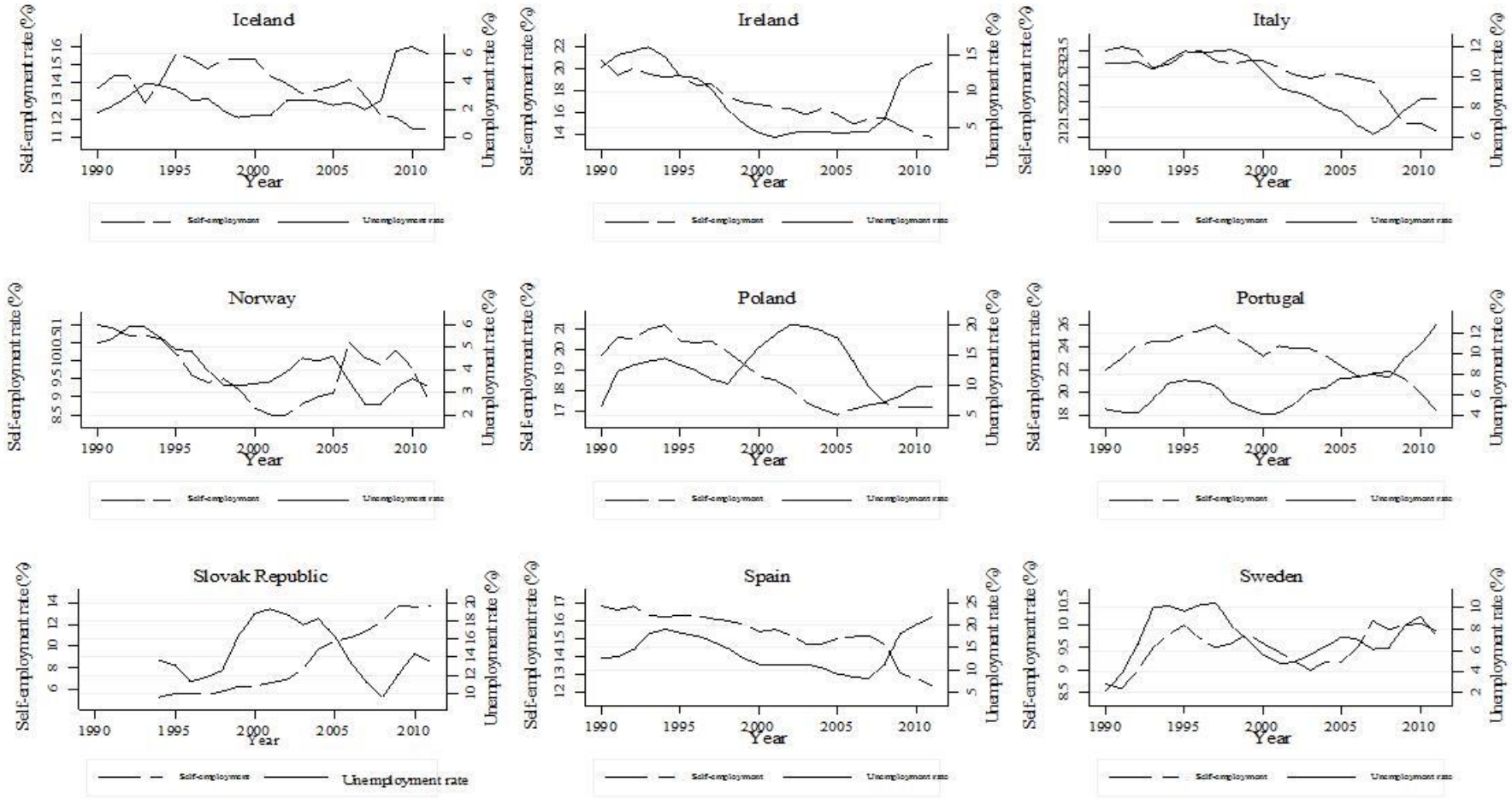

Figure A1.continued

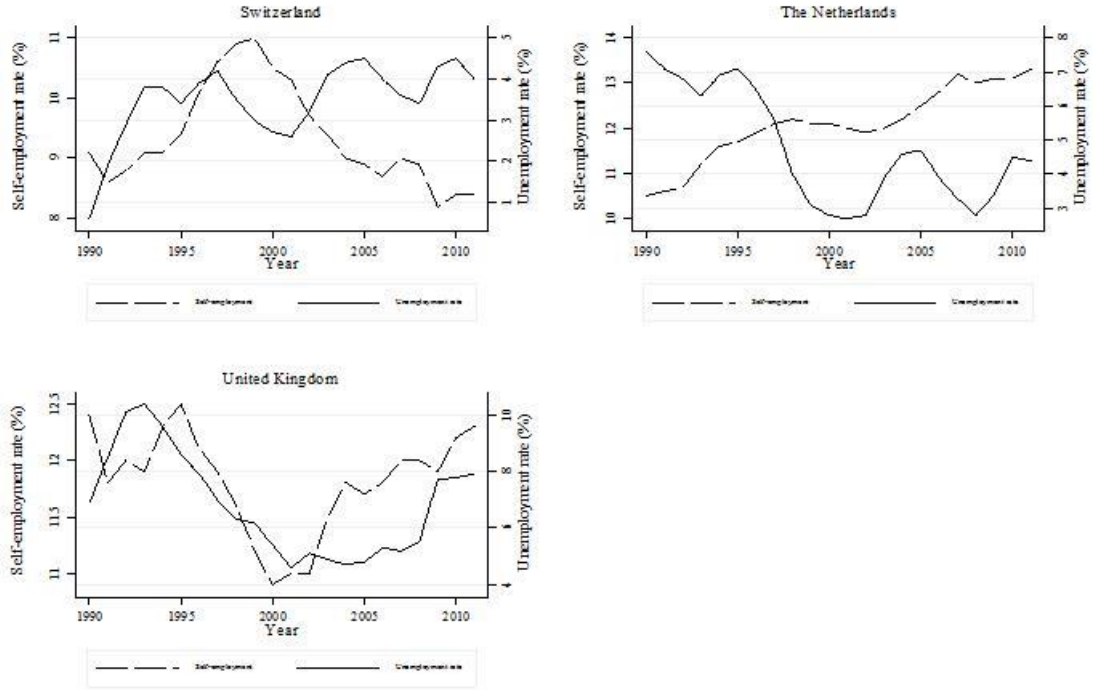

Figure 1: The long-run relationship between self-employment and unemployment before and after breakpoint, 1990-2011.

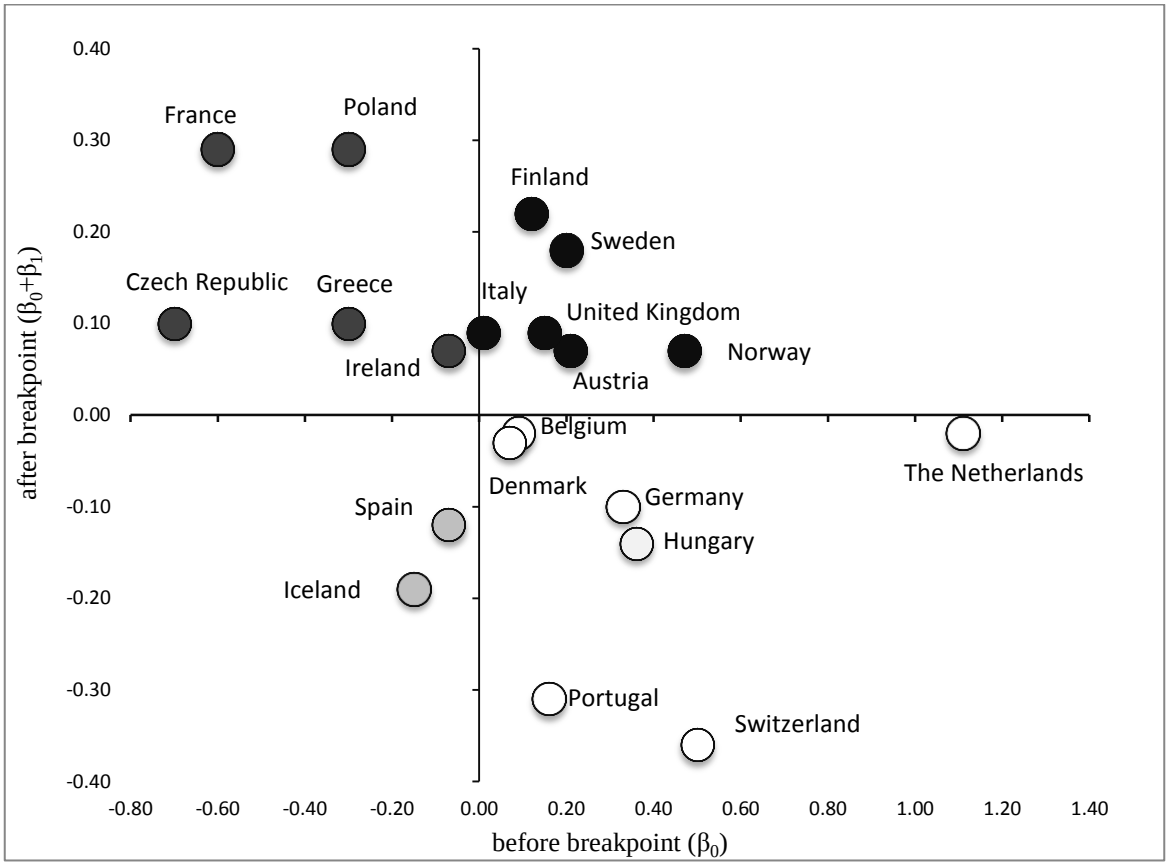

Table 1: Summary statistics, 1990-2011

	Business ownership rate in labour force (%)				Harmonised unemployment rate (%)			
Country	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Austria	11.7	0.4	10.8	12.3	4.2	0.5	3.2	5.2
Belgium	12.6	0.4	11.9	13.1	8.1	1.0	6.6	9.7
Czech Republic	14.2	2.3	9.2	17.5	5.9	2.1	0.8	8.7
Denmark	7.9	0.3	7.5	8.8	6.2	2.0	3.4	10.7
Finland	11.8	0.7	11.0	13.7	9.9	3.4	3.4	16.6
France	10.3	1.0	9.3	12.7	10.2	1.4	8.1	12.5
Germany	9.5	0.8	8.1	10.8	7.8	1.4	4.9	9.9
Greece	28.9	2.1	25.7	32.5	9.7	2.1	6.3	16.3
Hungary	12.5	1.4	10.4	14.4	8.5	2.1	5.7	12.1
Iceland	13.9	1.2	11.5	15.6	3.0	1.5	1.4	6.5
Ireland	17.1	2.1	13.7	20.8	9.2	4.6	3.7	16.1
Italy	22.8	0.7	21.2	23.6	9.6	1.8	6.2	11.8
Norway	9.7	0.8	8.5	11.0	4.1	1.0	2.5	5.9
Poland	18.8	1.6	16.8	21.2	13.2	4.0	6.5	20.0
Portugal	23.1	1.9	18.4	25.9	6.7	2.3	4.1	12.8
Slovak Republic	8.8	3.2	5.3	13.7	14.6	3.0	9.6	19.3
Spain	15.3	1.2	12.4	16.8	14.1	4.0	8.3	21.7
Sweden	9.5	0.4	8.6	10.2	7.1	2.2	2.2	10.5
Switzerland	9.4	0.8	8.2	11.0	3.5	0.9	0.6	4.5
The Netherlands	12.1	0.8	10.5	13.3	4.8	1.7	2.7	7.6
United Kingdom	11.8	0.5	10.9	12.5	6.8	1.8	4.6	10.4

Source: Both business ownership rate and the unemployment rate are extracted from COMPENDIA.

Tables 2: Panel unit root test

Method	**LSE**		**LUN**	
Null: Unit root (assumes common unit root process)	Statistic	Prob.**	Statistic	Prob.**
Levin, Lin and Chu *t*	-0.41	0.34	0.23	0.59
Breitung *t-stat*	5.91	1.00	-0.26	0.40
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin *W-stat*	0.75	0.77	-0.95	0.17
ADF - Fisher *Chi-square*	39.38	0.59	65.85	0.01
PP - Fisher *Chi-square*	34.37	0.79	64.58	0.01
Method	**Δ(LSE)**		**Δ(LUN)**	
Null: Unit root (assumes common unit root process)	Statistic	Prob.**	Statistic	Prob.**
Levin, Lin and Chu *t*	-11.19	0.00	-5.10	0.00
Breitung*t-stat*	-5.83	0.00	-3.68	0.00
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin *W-stat*	-10.13	0.00	-6.78	0.00
ADF - Fisher *Chi-square*	167.86	0.00	118.50	0.00
PP - Fisher *Chi-square*	231.71	0.00	159.74	0.00

Notes:

** Probabilities for Fisher tests are computed using an asymptotic Chi square distribution. All other tests assume asymptotic normality.
Sample: 1990 2011; Exogenous variables: Individual effects, individual linear trends; Automatic selection of maximum lags.
Automatic lag length selection based on SIC: 0 to 3; Newey-West automatic bandwidth selection and Bartlett kernel.

Table 3: Panel cointegration test results

Null Hypothesis: No cointegration				
Pedroni *Test Statistics*	**Relationship between LSE and LUN**			
Alternative hypothesis: common AR coefficients (within-dimension)			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel *v-Statistic*	-3.26	1.00	-3.32	1.00
Panel *rho-Statistic*	-4.66	0.00	-4.00	0.00
Panel *PP-Statistic*	-7.81	0.00	-5.66	0.00
Panel *ADF-Statistic*	-3.60	0.00	-4.05	0.00
Kao's *ADF Test Statistics*	1.29	0.10		
Alternative hypothesis: individual AR coefficients (between dimension)				
Group *ρ-Statistic*	0.64	0.74		
Group *t-Statistic* (non-parametric)	-5.26	0.00		
Group *t-Statistic* (parametric)	-4.19	0.00		

Notes:
Trend assumption: No deterministic intercept or trend; Use d.f. corrected Dickey-Fuller residual variances.
Automatic lag length selection based on AIC with lags from 2 to 4; Newey-West automatic bandwidth selection and Bartlett kernel.

Table 4: Individual stability tests of long-run relationship between LSE and LUN, 1990-2011

	Austria	Belgium	Czech Republic	Denmark	Finland	France	Germany
Lc	0.08	0.41*	0.99***	0.95***	0.66**	0.5**	1.63***
MeanF	0.66	2.81	6.34**	7.66***	11.15***	6.93***	8.8***
SupF	1.41***	5.65***	20.58***	13.25***	16.41***	16.11***	30.78***
	Greece	Hungary	Iceland	Ireland	Italy	Norway	Poland
Lc	0.84***	6.57***	0.72**	0.85***	0.11	0.25**	0.12
MeanF	4.74**	154.96***	6.62**	24.08***	1.8	1.88	1.33
SupF	10.72***	579.45***	27.03***	135.17***	2.59***	2.62***	3.51***
	Portugal	Slovak Republic	Spain	Sweden	Switzerland	The Netherlands	United Kingdom
Lc	1.18***	14.81***	348.95***	0.29	1.94***	0.26	0.19
MeanF	15.1***	285.6***	4642.07***	2.98	11.99***	11.67***	0.27
SupF	35.08***	977.77***	10021.79***	3.92***	20.03***	74.29***	0.86

Notes:
Trimming: 25%;*: significant at 10%; **: 5%;***: 1%.Asymptotic critical values for Hansen' stability tests.

Table 5: Panel stability tests of long-run relationship between LSE and LUN, 1990-2011 (p-values X 100)

	Mean			**Median**		
Trimming	***Lc***	***MeanF***	***SupF***	***Lc***	***MeanF***	***SupF***
25.0%	0.0	0.0	0.0	0.0	0.0	0.0
15.0%	0.0	43.0	43.0	0.0	0.0	0.0
12.5%	0.0	43.0	43.0	0.0	0.0	0.0

Notes:
Panel bootstrap: 100 redrawings. Mean/median: of the test statistics across units.

Table 6: The LSE-LUN long-run relationship, 1990-2011

FM-OLS estimates

Country	β_0	β_1	α_0	α_1	Breakpoint
Austria	0.21***	-0.14	-2.46***	0.22*	2000
	(0.07)	(0.09)	(0.10)	(0.13)	
Belgium	0.09***	-0.11***	-2.25***	0.19***	2002
	(0.02)	(0.04)	(0.03)	(0.08)	
Czech Republic	-0.7**	0.8**	-1.32***	-0.78	1996
	(0.33)	(0.35)	(0.45)	(0.52)	
Denmark	0.07***	-0.1***	-2.67***	0.19***	2005
	(0.01)	(0.02)	(0.02)	(0.03)	
Finland	0.12***	0.10	-2.42***	-0.18	2005
	(0.04)	(0.17)	(0.10)	(0.34)	
France	-0.6***	0.89***	-0.73*	-2.26***	1999
	(0.16)	(0.22)	(0.38)	(0.51)	
Germany	0.33***	-0.43***	-3.09***	1.02***	2006
	(0.09)	(0.16)	(0.20)	(0.31)	
Greece	-0.3***	0.4***	-0.55***	-1.00***	2006
	(0.07)	(0.09)	(0.16)	(0.21)	
Hungary	0.36	-0.50	-2.87***	1.06	1996
	(0.48)	(0.49)	(1.14)	(1.15)	
Iceland	-0.15***	-0.04	-1.76***	-0.05	1997
	(0.05)	(0.05)	(0.05)	(0.06)	
Ireland	-0.07	0.14	-1.43***	-0.52	1996
	(0.24)	(0.24)	(0.64)	(0.64)	
Italy	0.01	0.08	-1.47***	-0.23	1996
	(0.29)	(0.29)	(0.69)	(0.69)	
Norway	0.47***	-0.4***	-3.03***	0.62***	2006
	(0.06)	(0.13)	(0.08)	(0.16)	
Poland	-0.3***	0.59***	-0.84***	-1.59***	2007
	(0.07)	(0.22)	(0.18)	(0.49)	
Portugal	0.16***	-0.47***	-1.68***	0.79***	2002
	(0.02)	(0.03)	(0.03)	(0.05)	
Slovak Republic	-1.30	-0.15	0.35	1.19	1998
	(1.53)	(1.58)	(3.93)	(4.08)	
Spain	-0.07	-0.05	-1.6***	-0.01	1998
	(0.09)	(0.10)	(0.25)	(0.26)	
Sweden	0.2***	-0.02	-2.78***	0.07	1998
	(0.05)	(0.08)	(0.11)	(0.16)	
Switzerland	0.5***	-0.86***	-2.83***	0.82*	2002
	(0.14)	(0.31)	(0.16)	(0.42)	
The Netherlands	1.11	-1.13	-4.33***	2.29	1996
	(0.74)	(0.74)	(1.43)	(1.43)	
United Kingdom	0.15***	-0.06**	-2.44***	0.16***	2002
	(0.02)	(0.03)	(0.04)	(0.06)	
Mean	0.01	-0.07	-2.01	0.10	

Median	0.09	-0.06	-2.25	0.16

Notes:
Breakpoint estimated using 25% trimming at both ends (hence, constrained in the interval 1996-2007)
Standard errors are in brackets.
*: Significant at 10%; **: 5%;***: 1%.