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How sensitive is the business ownership rate to unemployment fluctuations? Evidence of asymmetries in a panel of 23 OECD countries

¿Qué sensibilidad muestran las tasas de autoempleo a las fluctuaciones del desempleo? Evidencia de asimetrías en un panel de 23 países de la OCDE

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Abstract

In this article, we study if the 'recession-push' hypothesis, i.e. the relationship running from unemployment to entrepreneurship/self-employment is affected asymmetrically by country dynamic labor market conditions. To this end, we use a panel threshold regression model that allows the unemployment rate to have an asymmetric impact of the rate of entrepreneurship, in different regimes. Our estimates provide support for the existence of different responses of entrepreneurship/self-employment to unemployment, depending on the value of the deviation between the observed and natural rates of unemployment with a one-period lag – i.e., depending on the intensity of the unemployment problem – that is the threshold variable we use to account for asymmetries.

Keywords: Entrepreneurship; Self-employment; Unemployment; Recession-push; Business Cycles; Panel Threshold Models.

Resumen

En este artículo, estudiamos si la hipótesis *'recession-push'*, esto es, el efecto del desempleo sobre el *entrepreneurship*/autoempleo se produce de forma asimétrica entre países debido a la dinámica de sus mercados laborales. Para ello, usamos un modelo de regresión para datos de panel con umbrales que permite que la tasa de desempleo tenga un impacto asimétrico sobre la tasa de autoempleo. Nuestras estimaciones avalan la existencia de diferentes respuestas del autoempleo al desempleo, dependiendo del valor de la desviación entre las tasas de desempleo natural y observada retardadas un período, es decir, dependiendo de la intensidad del problema del desempleo que es la variable utilizada como umbral a la hora de definir las asimetrías.

Palabras clave: Emprendimiento; Autoempleo; Desempleo; Efecto refugio; Ciclos económicos; Modelos para datos de panel con umbral.

JEL classification: L26; J21; J23; J24; E32; C23.

1. Introduction

Compared to paid employment, there silience of self-employment during the crisis observed in a number of countries should not be surprising. Indeed, the self-employment sector experiences fewer fluctuations and lower volatility than the paid employment sector. There are various reasons that explain this phenomenon and that are outlined below.

It can be argued that during crises, governments in many countries typically intensify both the application of policies oriented toward the general promotion of entrepreneurship (to enhance innovation, employment, and growth) and programmes designed to turn unemployment into self-employment (intensively and successfully applied in Germany).[1]As a result, the self-employment sector can minimise, or even offset, the negative effects of an economic slowdown on business survival.

Another factor at play in this situation could be the national sectoral composition of self-employment. Some recent studies have provided theoretical arguments and empirical evidence on the self-perpetuation of self-employment (hysteresis).[2]It is generally agreed that because self-employment in some sectors – i.e., agriculture and professional services –is the most common occupational status, countries in which these sectors represent a significant portion of the economy will exhibit a higher rate of resilience.

Finally and even more importantly, some of the stylised facts of the development of self-employment in recessions may be the result of voluntary changes in occupational decision making given the deterioration of economic conditions and the consequent lower opportunity cost of paid employment. From an aggregate perspective, the study of the reasons explaining why individuals choose self-employment, although important, are less relevant than information regarding whether unemployed persons who have been 'pushed' into self-employment (because of the lack of opportunities to obtain a job as a paid worker)cause positive fluctuations in the business ownership rate(as stated by the 'recession push' hypothesis)or whether the relationship between unemployment and self-employment is negative(as stated by the 'prosperity-

[1] Baumgartner and Caliendo (2008).

[2] Congregado, Golpe and Parker (2012) and Parker *et al.* (2012a).

pull' hypothesis).[3]

From a theoretical perspective, the model of Ghatak *et al.* (2007) recognizes the existence of the two effects mentioned above. In particular, Ghatak *et al.* (2007) model – the most closely associated with occupational choice and hence the self-employment measure of entrepreneurship used in this article – implies a two-way causality between entrepreneurship and unemployment. Faria *et al.* (2009) propose a similar mechanism that also yields a bi-directional pro-cyclicality ā la Ghatak *et al.* (2007), in which the number of entrepreneurs increases in booms, reducing profits and causing a recession while the recession push effect leads the emergence of new self-employed, starting a new boom.[4]

As both hypotheses may be equally valid, it is only possible to discriminate between them empirically. However, not accounting for the accuracy of the different estimation strategies and the quality of data used to analyse the validity of these hypotheses, it could be argued that any empirical approach can only pursue to capture either the 'net' effect of the recession-push or the prosperity-pull effect (see Parker, 2004, p.95 or Thurik *et al.*, 2008, p.677).

As a result, scholars are far from obtaining a generalised consensus on the exact nature of the relationship between unemployment and entrepreneurship. Indeed, the existence of opposite theoretical arguments about the direction and sign of this relationship and the weak and sometimes contradictory empirical evidence are the origin of one of the most recurrent controversies in the Economics of Entrepreneurship.[5]

In this paper, we will argue that the mixed results of earlier studies are partly attributable to the predominance of analyses of the long-term relationship in levels and the use of linear models, i.e., the potential existence of asymmetries in the relationship has been ignored. In addition, the scarce research that addresses nonlinearities has been carried out at the country level. Compared to previous studies, this article will use the panel threshold regression model proposed by Hansen (1999). This allows for nonlinearities by using the cyclical components of entrepreneurship and unemployment series to test the two-way relationship between them. To shed more light on this relationship, we carry out our analysis using a panel of 23 OECD countries over the period from 1972 to 2009.

[3] This hypothesis considers that during times of crisis (when there is low paid employment) firms face a lower market demand. This reduces self-employment incomes, pulling out of self-employment those marginal entrepreneurs who cannot resist in these new economic conditions (see, the works of Ben-Ner, 1988 and Pērotin, 2006 on the emergence of marginal entrepreneurs in recessions). As a result, the relationship predicted by this hypothesis is negative.

[4] Nonetheless, we are aware that these propositions are the most likely empirical outcome if and only if one operationalizes entrepreneurship as self-employment. We have not stated this as an unambiguous hypothesis but it nevertheless provides a basis for cutting through the muddled picture painted by the various theories. This line of reasoning also leaves the door open for different empirical regularities if entrepreneurship is operationalized differently in future research.

[5] See Thurik *et al.* (2008), Parker (2009) and Congregado, Golpe and van Stel (2012) for detailed discussions on the interplay between unemployment and entrepreneurship.

This econometric strategy should allow to take into account potential asymmetries across countries, that is, potential heterogeneity in the elasticity of self-employment with respect to unemployment shocks. In particular, the availability of a relatively long panel enables to apply a panel threshold regression model to seek 'potential' asymmetries in the relationship between the two dimensions of our database and to identify how self-employment rates are affected to a greater or lesser extent by shocks to unemployment.

The remainder of the article is organised as follows: in the next section we briefly review previous evidence on the subject, the empirical methodology is outlined in Section 3, and the empirical tests and estimates are performed in Section 4. Finally, the main conclusions are summarised in Section 5.

2. A brief survey of previous empirical literature

Empirical multi-country analysis of the relationship between self-employment and unemployment, by using time series, started with the seminal work of Thurik *et al.* (2008), in which mixed evidence of the two competing hypotheses in 23 OECD countries was found, by using series in levels. Previously, a growing body of empirical studies had covered other countries (Thurik, 2003 for the UK; Verheul *et al.*, 2006 for Spain; van Stel *et al.*, 2007 for Japan; Baptista and Thurik, 2007, for Portugal) and applying other econometric approaches, such as cointegration and error correction models, instead of using the standard VAR analysis (Carmona *et al.*, 2010, 2012). Table 1 summarises their findings. The weak evidence and the apparently contradictory results have leaded the search of new ways of testing empirically this relationship.

Table 1. Summary of empirical studies on the relationship between unemployment and self-employment using aggregated data

Model	Type of data	Country-level vs. Multi-country	Econometric approach	Applications in Applied Entrepreneurship Research				
				Authors	Frequency	Period	Unemployment-self-employment relationship	Non-Linear
Time series	Levels	UK	OLS regression	Thurik (2003)	Annual	1970-1998	Pull hypothesis	
		Spain	Bivariate VAR	Verheul *et al.* (2006)	Annual	1972-2004	Pull hypothesis	
		Japan	Bivariate VAR	Van Stel *et al.* (2007)	Annual	1972-2004	Pull hypothesis	
		Portugal	Bivariate VAR	Baptista and Thurik (2007)	Annual	1972-2004	Weak pull hypothesis	
		EU-12	Den Haan (2000) VAR forecast errors	Carmona *et al.* (2010)	Annual	1983-2008	Mixed, Differs across countries (weak)	
		Spain	Den Haan (2000) VAR forecast errors	Carmona *et al.* (2012)	Quarterly	1980:1-2009:4	Pull hypothesis	
		Spain	Threshold co integration Hansen and Seo (2002)	Congregado *et al.* (2012)	Quarterly	1976:3-2004:4	Recession-Push hypothesis (only in economic crisis)	ü
	Cycles	US, UK, Ireland, Spain	Generalised fractional processes	Faria *et al.* (2009)	Annual	1972-2004	Two-way relationship	
		Australia, Japan, US, UK, Ireland, Germany, France, Italy and Spain	STAR-EXT	Faria *et al.* (2010)	Annual	1972-2004	S→U, U→S	ü
		EU-12	VAR, Granger and Instantaneous causality	Carmona *et al.* (2010)	Annual	1983-2008	Mixed Differences across countries	
		Spain	VAR, Granger and Instantaneous causality	Carmona *et al.* (2012)	Quarterly	1980:1 - 2009:4	S→U, U→S	
		UK	VAR, Granger causality, Bai-Perron (1998, 2003a, 2003b) Structural breaks	Parker *et al.* (2012b)	Quarterly	1978:2 - 2010:3	S→U, U→S	ü

Panel	Levels	17 OECD countries	Static Panel Data	Staber and Bog-enhold (1993)	Annual	1972 - 1989	Push hypothesis	
		23 OECD countries	Static Panel Data	Blanchflower (2000)	Annual	1966 - 1996	Mixed relationship	
		13 OECD countries	Static Panel Data	Robson (2003)	Annual	1965 - 1995	No relationship	
		12 OECD countries	Multivariate Panel Cointegration Pedroni Test (1999) FMOLS estimates	Parker and Rob-son (2004)	Annual	1972 - 1996	No relationship	
		19 OECD countries	Multivariate Panel Cointegration Maddala and Wu test (1999) OLS and DOLS esti-mates	Torrini (2005)	Annual	22 years	Pull hypothesis	
		23 OECD countries	Weighted Least Squa-res (pooled data)	Carree *et al.* (2007)	Annual	1972-2004	Push hypothesis	
		17 Spanish regions	Bivariate Weighted VAR (with population as weighting variable)	Golpe and van Stel (2007)	Quarterly	1979:4-2001:4	Pull and Push hypothe-ses (Pull in the whole sample, push effect only in lower income regions)	
		23 OECD countries	Bivariate Weighted VAR (with population as weighting variable)	Thurik *et al.*(2008)	Annual	1974-2002	Pull and Push hypothesis (pull stronger than push effect)	
	Cycles	22 OECD countries	Trivariate VAR Granger causality Trivariate Panel One-step system GMM	Koellinger and Thurik (2012)	Annual	1972-2008	S€U Recession-push hy-pothesis	
		19 OECD countries	Multivariate VAR Generalised Least Squares	Scholman *et al.* (2012)	Quarterly Annual	2000:1-2007:4 1998-2008	No relationship	
		22 OECD countries	Bivariate correlations	Lamballais *et al.* (2012)	Annual	2001-2011	Pull hypothesis	

Note: X→ → Y means that causality runs from X to Y. The finding of causality in both directions implies bidirectionality. Two-way relationship means a relationship between U and E but with no estimated sign.
Microeconometric analyses with individual data have been intentionally excluded from this summary of aggregated studies.

One of these new methods to empirically investigate this relationships the use of panel data models, which has been possible by the recent availability of comparable international aggregate data on entrepreneurship rates (see, COMPENDIA, van Stel, 2005).The works of Staber and Bogenhold (1993), Blanchflower (2000), Robson (2003), Parker and Robson (2004), Torrini (2005), Carree *et al.* (2007), Golpe and van Stel (2009) or Thurik *et al.* (2008) are examples of panel data estimates of the relationship between unemployment and entrepreneurship. Overall, these panel data estimations, which are based on non-dynamic panel data specifications, again provide an inconclusive picture of the empirical relationship.

In contrast to previous studies, Koellinger and Thurik (2012)use a GMM estimation of a dynamic panel data model in a cross-country panel of 22 OECD countries for the period from 1972 to 2007. They provide evidence of a positive effect of the unemployment cycle on the entrepreneurial cycle at the national level, suggesting the presence of a 'refugee' effect, –i.e.the phenomenon of transitions into entrepreneurship increasing when the opportunity cost of entrepreneurship is low– This phenomenon is also known as the "recession push" effect. Note that this mechanism implies a positive (i.e. counter-cyclical) relationship between unemployment and entrepreneurship.

Another potential source of the apparent ambiguity of previous results may be the fact that most of the empirical analysis on the relationship between self-employment and unemployment has only studied the relationship of the trend –i.e., the long-term relationship –rather than its cyclical components, with the exception of the works of Sholman *et al.*(2012) for 19 OECD countries, Faria *et al.* (2010) for a sample of 9 OECD countries, Faria *et al.*(2009) for 4 OECD countries, Carmona *et al.* (2010) for the EU 12, Carmona *et al.* (2012) for Spain, Congregado, Golpe and Parker (2012) for the US and Spain, Parker *et al.* (2012b) for the UK, and Koellinger and Thurik (2012) and Lamballais *et al.* (2012) for 22 OECD countries.

Importantly, another source of controversy in the literature is the sensitivity of the relationship analysis to the sample countries and sampling period used in each study. Sometimes, opposite results are obtained in different periods even for the same country. This last result suggests that we should recognise the potential existence of nonlinearities or asymmetries in the relationship. Indeed one of the most likely reasons to reject a linear relationship is that the relation is time-varying, i.e., the relation is different in different economic conditions. In such cases, the estimation method should allow for nonlinearities in the relationship. Although relatively scarce, there are some contributions that deal explicitly with nonlinearity: Faria *et al.* (2010) used a STAR model with time-series data for 9 countries; Congregado, Golpe and Parker (2012) used an augmented version of the Jaeger and Parkinson model for the US and Spain; Congregado, Golpe and van Stel (2012) accounted for nonlinearity in this relationship by applying thethreshold cointegration model suggested by Hansen and Seo (2002); and Parker *et al.* (2012) used a Bai-Perron structural breaks approach for the UK (1998, 2003a, 2003b).

However, these works searched for asymmetries but used individual time-series data. In contrast, this article extends the empirical analysis searching for asymmetries by using a panel threshold regression model that employs cross-sectional time series data for the cyclical components of entrepreneurship and unemployment to analyse how labour market dynamics determine changes in occupational decisions and therefore observe fluctuations in self-employment rates. The advantages of using panel data in this context are at least the following: i) it allows to control for individual heterogeneity; ii) more variability; iii) less co-linearity; iv) more degrees of freedom; and v) more efficiency.

3. Model specification

The aim of this article is to investigate whether cyclical unemployment causes subsequent cyclical self-employment.

As the starting point, to determine the cyclical relationship between unemployment and self-employment rates involves the estimation of the following equation:

$$\Delta s_{it} = \mu_i + \beta \Delta u_{it} \quad (1)$$

where Δs_{it} and $\Delta \upsilon_{it}$ are the growth rates in period t for country i of the self-employment and unemployment rates, respectively, *and* μ_{it} is the country specific fixed effect.[6]

We can also consider a 'gap' specification in which the Hodrick-Prescott (1997) filter is used to produce the trend components. In this specification, unemployment and self-employment are measured in terms of cyclical components or deviations from long-term trends. In general, the empirical relationship can be represented by the following set of equations:

$$u_{it}^{c} = u_{it} - u_{it}^{n} \quad (2)$$

$$s_{it}^{c} = s_{it} - s_{it}^{n} \quad (3)$$

$$s_{it}^{c} = \mu_i + \beta u_{it}^{c} + \varepsilon_{it} \quad (4)$$

where u_{it}^{c} captures cyclical unemployment (output gap), u_{it} is the log of the current unemployment rate and u_{it}^{n} is the natural or trend level of the unemployment rate; correspondingly, s_{it}^{c} represents the cyclical self-employment

[6] Note that, in this way cyclical self-employment and cyclical unemployment are defined as the difference between the current value of the self-employment (unemployment rate) and its long term (trend) value. As it is well known the gap specification is an alternative way to produce cyclical components.

rate (self-employment gap), s_{it} is the observed self-employment rate and s_{it}^{n} is the natural self-employment rate.[7] In contrast to equation (1), equation (4) requires information about unemployment and self-employment trends or equilibrium rates, which are unobservable. In that sense, a Hodrick-Prescott (1997) filter is used to extract these two trends.

Equation (4) can be extended by adding lagged cyclical self-employment, S_{it-1}^{c}, to remove the serial correlation that arises in equation (4). Therefore we have the following equation,

$$s_{it}^{c} = \mu_i + \beta\, u_{it}^{c} + \delta\, S_{it-1}^{c}\, \varepsilon_{it} \qquad (5)$$

In equation (5), the variable to be explained is the deviation of the business ownership rate in country *i* in year *t* from the equilibrium rate. Cyclical unemployment (a push factor for business ownership) and lagged self-employment (a factor included for capturing the inertia) are the two explanatory variables included in the benchmark specification. The expected sign of the parameter β is positive if the recession-push hypothesis holds.

Asymmetry

There are several reasons that advise test for asymmetry. The most important is that ignoring asymmetry when it is present leads to the misspecification of models, which produces not only bad forecasts but also erroneous inferences in hypothesis testing. To circumvent this problem, we will augment our benchmark equation by allowing for different effects between different regimes.

To this end, we apply a class of panel threshold models developed by Hansen (1999) to characterise the relationship between self-employment and unemployment, in which parameters vary not only across countries but also with time, allowing for the presence of asymmetries in the self-employment dynamics depending on the labour market dynamics (i.e. depending on the extent of the unemployment problem). The model is now defined as follows:

$$s_{it}^{c} = \mu_i + \beta_0\, u_{it}^{c}\, I\left(d_{it} \le k\right) + \beta_1 u_{it}^{c}\, I\left(d_{it} > k\right) + \varepsilon_{it} \qquad (6)$$

where μ_i is a fixed effect, d_{it} is the threshold variable and *k* is the threshold parameter. II is the Heaviside indicator function, a discontinuous function whose value is 1 when the threshold condition is satisfied and 0 otherwise. In

[7] In a broad sense, we can think of this natural rate in terms of an equilibrium rate of business ownership. Following Carre, van Stel, Thurik and Wennekers (2002), this rate can be considered as a function of the stage of economic development.

summary, in this specification, the observations are divided into two regimes depending on whether the threshold variable d_{it} is smaller or greater than the threshold parameter *k*. The two regimes are distinguished by different regression slopes, β_0 and β_1.

However, there is no reason to impose only two regimes. A more general specification with *r* thresholds takes the following form:

$$s_{it}^{c}=\mu_i+\beta_0 u_{it}^{c} I\left(d_{it}\leq k_1\right)+\beta_1 u_{it}^{c} I\left(k_1<d_{it}\leq k_2\right)+\ldots+\beta_r u_{it}^{c} I\left(d_{it}>k_r\right)+\varepsilon_{it} \qquad (7)$$

As a general strategy and once the threshold parameter is estimated, the next step is to check the null hypothesis that describes the linearity, i.e., $\beta_0=\beta_1$, via a likelihood ratio test. In particular, we use the following ratio test:

$$F_1 = \frac{SS_{linear}-SS\left(\hat{k}\right)}{\hat{\sigma}^2} \qquad (8)$$

where ^{SS}linear is the sum of squares of the linear model, ss(k) is the sum of squared errors of the threshold model and $\hat{\sigma}^2$ denotes a convergent estimate of σ^2.

In the case of two or three thresholds, the same procedure is applied. If the p-value rejects the hypothesis of linearity, then we can discriminate between one and two thresholds. The likelihood ratio test of one threshold versus two thresholds uses the following statistic:

$$F_2 = \frac{SS\left(\hat{k}\right)-SS\left(\hat{k}_1,\hat{k}_2\right)}{\hat{\sigma}^2} \qquad (9)$$

where $\hat{k}_1$ and $\hat{k}_2$ denote the threshold estimates of the model with three regimes (two thresholds), and ss($\hat{k}_1$, $\hat{k}_2$) denotes the corresponding residual sum of squares. The two-regime (one threshold) hypothesis is rejected in favor of the three-regime model (two thresholds) if and only if F_2 is larger than the critical value of the distribution. If the model with two thresholds (three regimes) is not rejected, then we can test the three-regime hypothesis against the alternative of four regimes (three thresholds). Once the threshold effect is proved, the same procedure is sequentially applied to test a specification with *p* regimes versus *p + 1* regimes. The process is complete when the null hypothesis is accepted.

4. Estimation and results

In this section we will present the estimation results. Before doing that we will briefly describe the data used.

Data

In this study we use annual data[8] from 23 OECD countries for the period from 1972 to 2011 drawn from COMPENDIA database.[9]Similarly to most previous studies, entrepreneurship is operationalised in terms of the *business ownership rate*, i.e., the number of business owners divided by total labour force. We also use the *Harmonised Unemployment rate*, that has been drawn from the OECD Main Economic Indicators.

Estimation results

This section presents the empirical results for the estimation of the relationship represented by equation (7) based on two alternative threshold variables: lagged cyclical self-employment and lagged cyclical unemployment.

The obtained empirical results are presented into two steps. First, we check the null of linearity, and if rejected, we look for the 'best' threshold variable.[10] Second, we report estimates of the relationship for the different regimes defined by the selected threshold variable.

Threshold variables

Once the time series are de-trended, we must check the null of linearity and determine the 'best' threshold variable. As we mentioned above, we consider two potential candidates: cyclical self-employment and cyclical unemployment, which are lagged by one period.

On the one hand, it seems sensible to think that past cyclical self-employment to influence the regime switching: a higher cyclical self-employment rate implies a different impact on future self-employment rates –inertia. On the other hand, it is also possible to think that a higher cyclical unemployment rate, defined as the lack of job offers for a period of more than one year, may cause changes in initial occupational decisions (deciding to become entrepreneurs as a last resort) rather than a lower cyclical unemployment rate.

As it is usual in the estimation of a panel threshold regression model, we discriminate between these two candidates according the following criteria: we

[8] It is not possible to account with international comparable data at higher frequencies.

[9] These data are taken from EIM's COMPENDIA database (version 2011.1). Business owners or self-employed workers are defined as the total number of unincorporated and incorporated self-employed people outside the agriculture, hunting, forestry and fishing industries, who carry out self-employment as their primary employment activity – see Van Stel (2005, p. 108).

[10] As usual in the estimation of panel threshold regression models, we discriminate between alternative thershold variables according to a statistical criterion. In particular, we will choose the variable that minimizes the sum of squared residuals (Hansen, 1999) and leads to the strongest rejection of the linearity hypothesis.

select the variable that minimises the sum of squared residuals (Hansen, 1999) and leads to the strongest rejection of the linearity hypothesis as the threshold variable. After selecting the threshold variable, the estimation of the panel threshold regression model involves checking whether the threshold effect is statistically significant relative to a linear specification and determining the number of thresholds. In particular, the null hypothesis (linearity) is tested by a likelihood ratio test in which the sum of the squared residuals of a specification with *r* regimes is tested against a specification with *r + 1* regimes. The process stops when the null is not rejected.

Table 2. Linearity test and tests for threshold effects

Regimes	Threshold variables	
Test for single threshold (two regimes)	S^c_{t-1}	u^c_{t-1}
RSS	51.086	50.947
F1	8.527	10.755
p-value	0.160	0.020
(10%, 5%, 1% critical values, respectively)	(6.909, 8.431, 12.090)	(6.919, 8.490, 13.630)
Test for double threshold (three regimes)		
RSS		50.867
F2		1.557
p-value		0.860
(10%, 5%, 1% critical values, respectively)		(7.637, 9.249, 11.826)

Note: F1 and F2 are the likelihood ratio statistics, p-values are obtained with 300 simulations (Hansen, 1999). RSS: Residuals Sum of Squared.

The results of the linearity tests and the determination of the number of thresholds are reported in table 2. The F_1 likelihood ratio test clearly leads to the rejection of the null hypothesis of linearity when lagged cyclical unemployment is the selected threshold variable. This evidence supports the decision of estimating the model in non-linear form and implies that there are at least two regimes. According to Hansen's procedure, it would be necessary to estimate and test for the existence of two thresholds, and so on, until the corresponding F-test is statistically non-significant. Following this strategy, the F_2likelihood ratio test is not statistically significant at the 10 percent level for lagged cyclical unemployment. Therefore, the selected model is the one with two regimes in which the optimal threshold variable is cyclical unemployment lagged one period.

Table3 reports the threshold value for this two-regime model, the estimates of the parameters of the panel transitions regression model and the corresponding *t-statistics* based on standard errors and corrected for heteroscedasticity.

The threshold estimate indicates when the transition between the two regimes occurs. For example, if cyclical unemployment is greater than 0.411, the concerned country switches to the second regime. Hence, the first regime would occur when the cyclical component of the unemployment rate is below 0.411. As we can see, this is the usual regime(see table 4, where we report the number of years each country is in each of the two regimes). In contrast, the relatively unusual regime would occur when the level of cyclical unemployment exceeds 0.411.

Table 3. Regression estimates: single threshold model

Regressor and Regime	Coefficient estimate
$u_{it}^{c} I\left(u_{it-1}^{c} \leq 0.411\right)$	-0.036*** (0.013)
$u_{it}^{c} I\left(u_{it-1}^{c} > 0.411\right)$	0.025** (0.013)

Note: Standard error in brackets. ***,** and * represent significance at 1%, 5% and 10%, respectively.

The estimates from the two-regime threshold panel regression model are reported in Table 3. It can be checked that we get significant effects in both regimes[11].

In the cases in which the deviation between the observed and natural unemployment rates is higher than 0.411, the relationship between cyclical self-employment and cyclical unemployment is positive, i.e., a value of the unemployment gap above 0.411 produces upward pressure on the self-employment rate in the subsequent year. In contrast, when cyclical unemployment is below the threshold (i.e., the most usual regime),a negative shock in the employment rate (i.e., an increase in the unemployment rate) causes a reduction in the self-employment rate.

The interpretation of the previous findings is as follows. When cyclical unemployment is very high, negative shocks in employment cause upward pressure on the self-employment rate. Job offers become scarcer because of the decline in economic activity; hence, more people decide to start their own businesses, facing the lack of job opportunities in the salaried sector. However, we observe the opposite phenomenon when the cyclical unemployment rate

[11]One could still argue that a potential problem of reverse causation could emerge. In order to overcome this problem, we have also run a different version of the model by introducing one and two lags of the explanatory variable as instrumental variable. The estimates we obtain are roughly identical to the ones reported and are available upon request.

is below the estimated threshold value. These results suggest that the recession-push hypothesis is only valid when economic circumstances are poor, i.e., when cyclical unemployment rates are high.

However, when the difference between the observed and natural unemployment rates is small in magnitude, the relationship is negative. In other words, the smoothest shocks –either positive or negative– on employment rates cause substantial decreases in self-employment rates, as stated by the pull hypothesis.

According to the estimated threshold values, we can allocate countries among the different regimes (table 4) and plot these transitions, taking time and countries into consideration (Figure 1).

Table 4. Data distribution between regimes and countries

	Lower (first)	Upper (second)
Australia	28	12
Austria	35	5
Belgium	24	16
Canada	28	12
Denmark	26	14
Finland	29	11
France	26	14
Germany	26	14
Greece	32	8
Iceland	34	6
Ireland	22	18
Italy	32	8
Japan	32	6
Luxembourg	34	6
The Netherlands	25	15
New Zealand	29	11
Norway	28	12
Portugal	26	14
Spain	23	17
Sweden	24	16
Switzerland	32	8
United Kingdom	25	15
United States	28	12

Note: The threshold variable is the cyclical unemployment lagged by one period.

We observe that the majority of observations are in the first regime, which corresponds to a negative relationship. However, observations from Ireland, Portugal, Spain and the UK are often in the second regime. Importantly, in 2011, the last year considered in our sample, only six countries were in the first regime (Austria, Germany, Japan, Luxembourg, Switzerland).

In sum, according to our results, the null hypothesis on the existence of a linear relationship is rejected in favour of an asymmetric relationship characterised by a two-regime model in which two opposite relationships characterise the dynamic adjustment path of the self-employment rate to unemployment shocks, depending on the magnitude of cyclical unemployment. Only the most severe job destruction processes will cause positive shocks on self-employment rates.

5. Conclusions

There is an extended body of empirical literature on the relationship between unemployment and self-employment, but the exact nature of the relation is still a matter of debate. The absence of conclusive findings, given the lack of robustness of a great part of the extant research, may be caused by data availability limitations with regard to the use of self-employment time series. In fact, time-series analysis of self-employment has traditionally been one of the least developed areas in the Economics of self-employment field due to the low frequency and limited availability of long time series and harmonised data for multi-country studies.

In addition, previous findings on the relationship seem to be highly dependent on the examined time span. This fact should make the possibility of a time-varying relationship central to the research agenda. Therefore, we must look for econometric approaches that should allow for nonlinearity in the relationship.

In that sense, the availability of a relatively long panel allows for the application of a panel threshold regression model to look for 'potential' asymmetries in the relationship, thereby exploiting the two dimensions of our database.

Estimating the relationship with annual data from 23 OECD countries over the period from 1972 to 2011, we find that the recession-push hypothesis is only valid when the cyclical unemployment rate is higher than 0.411. In other words, in times of high unemployment, individuals are pushed into self-employment due to the lack of alternative sources of income. Therefore, we can argue that the magnitude of the recession-push effect is non-linear and depends on the labour market cycle, i.e., the effect only exists when unemployment is above the threshold.

Our results reflect that unemployed individuals are more inclined to start their own businesses when unemployment levels are high compared to periods of low unemployment. An obvious factor influencing starting a business in times of recession is the lower job offer arrival rate, which results in too much difficulty finding a paid job –especially among those with the lowest educational attainment. Given the current international crisis, the high unemployment regime may be particularly relevant in present times in most countries.

As with any research, there are limitations to this study. In particular, any aggregate study results should be interpreted with caution given that the composition of self-employment may be extremely different between countries, not only in terms of the type of business –SMEs versus large companies – but also in terms of the relative weights of employers and own-account workers in business ownership. In addition, sectoral diversity between countries likely also plays an important role in explaining differences in entrepreneurship equilibrium rates and the interplay between entrepreneurship and unemployment.

On this basis, an important avenue for future research should be to identify differences between different types of self-employment by decomposing the aggregate self-employment rate into its constituent parts (employers, own-account workers, and members of producer cooperatives) to determine whether the recession-push effect is being driven by one or more of these elements.

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Appendix

We have studied the stationary properties of the self-employment rate and unemployment series, using the traditional panel unit root tests: the Fisher-ADF and the Fisher-PP, proposed by Maddala and Wu (1999), and the tests proposed by Hadri (2000) and Breitung (2000) or those proposed by Levin *et al.* (2002) and Im *et al.* (2003). The null hypothesis of non-stationarity – except for Hadri's test, in which the null is stationarity – cannot be rejected. As a result, we can conclude that the two variables are non-stationary –see table A1, below–.

Table A1: Unit root tests in the panel data

Statistic	Self-employment		Unemployment	
	Without trend	Trend	Without trend	Trend
LLC	-0.024	1.452	-0.007	2.325
Breitung		5.423		1.654
IPS	1.453	4.429	-0.473	2.315
Fisher-ADF	37.907	23.923	48.624	25.048
Fisher-PP	36.409	56.667	46.656	22.588
Hadri	10.302***	8.105***	5.395***	7.042****

Notes: LLC and IPS represent the panel unit roots test of Levin *et al.* (2002) and Im *et al.* (2003), respectively. Fisher-ADF and Fisher-PP represent the Maddala and Wu (1993) Fisher-ADF and Fisher-PP panel unit root tests, respectively.*** indicates statistical significance at the 1 percent level. Probabilities for Fisher-type tests are computed by using an asymptotic chi-square distribution. All other tests assume asymptotic normality. A time trend and an intercept are included in all underlying specifications. The modified AIC was used to select the optimal lag length.

Figure 1: Distribution of threshold variables among the different regimes in the 23 countries