

Article

Persistence in Self-Employment Rates before the Great Lockdown: The Case of the UK

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Received: 22 June 2020; Accepted: 6 August 2020; Published: 10 August 2020



Abstract: A growing body of empirical literature—both on the micro and macro scale—is devoted to exploring the existence of hysteresis—or at least persistence—in self-employment, i.e., whether policy, economic or external shocks have transitory or persistent effects on the probability of survival, and in turn, on the natural rate of self-employment. In aggregate time series studies, the usual method to address this issue has been to look for unit roots by using alternative tests or by using unobservable components models. In this research, we performed a battery of tests and competing approaches to check the robustness of our results with UK self-employment time series. The UK is a suitable case for study because the recent evolution of the UK self-employment rate figures shows a steady growth since the beginning of the millennium. This long-term rise in UK self-employment has attracted the attention of scholars, at least, before the Great Lockdown. We find evidence of hysteresis, while business cycle output variations significantly affect self-employment rates. The article discusses the implications of the findings.

Keywords: persistence; unobserved components model; time series models; business cycles; self-employment; entrepreneurship; UK

1. Introduction

In December 2019, more than five million people were self-employed in the UK (15.3% of all employed people), the highest number and self-employment ratio since records began. Some analysts hypothesize that the increase in self-employment has been caused mainly by a decrease in people leaving self-employment rather than an increase in people entering it, that is, a certain degree of persistence after the last recession, due to multiple factors, such as the lack of opportunities to work as an employee since the onset of the economic downturn or the emergence of the platform economy [1–3]. However, this rise in self-employment involves not only precariat, part-time and older workers but also professionals and freelancers [4].

However, what does this trend tell us about the state of the UK economy? Does the trend indicate the emergence of new entrepreneurs who are pushed into self-employment due to the lack of job opportunities and therefore a temporary shock to occupational decisions, or is it a permanent structural change in a labor market, which is, or was, close to full employment at the start of 2020?

In hindsight self-employment in the UK rose rapidly in the 1980s, decreased during the mid-1990s, and rose again in the 2000s, showing a particularly large jump after the crisis, and a significant steady rise in the self-employment rate in the coming years [5–8].

Several factors might be behind the observed large jump in UK self-employment (see Figure 1). On the one hand, one could speculate that it is the result of the reaction to the British economy creating

too little paid employment and the opportunity cost of self-employment being relatively low. If that were true, marginal entrepreneurs (and in particular those that were formerly unemployed—necessity entrepreneurs) might show a high survival rate more closely linked to the lack of employment opportunities than to success [9].

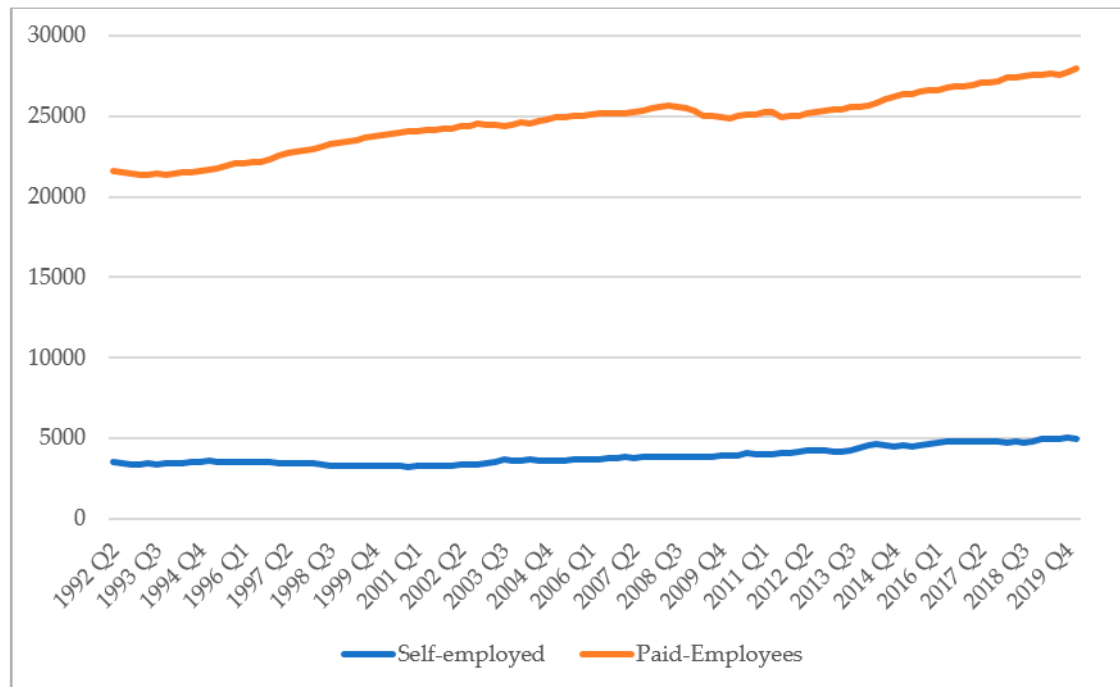


Figure 1. UK unemployment and self-employment (thousands), seasonally adjusted, quarterly data, 1992:Q2–2019:Q4. (Source: Office for National Statistics, UK, Labour Force Survey).

In addition, the existence of different schemes of entrepreneurship promotion could reinforce the effects of this self-employment revival [10,11].

Another explanatory factor is related to the emergence of different forms of dependent self-employment. In particular, to circumvent the most onerous elements of the (paid-) employment protection legislation, some wage earners are induced to switch to self-employment with a guaranteed demand by the employer, substituting the costs and rights associated with paid—sometimes subsidized [12–14]—employment by self-employed workers.

A third potential explanation could be that the upswing shown in self-employment data could be the result of crowding out effects—i.e., non-subsidized firms or self-employed workers may be displaced by supported start-ups [15,16].

In sum, turning unemployment into self-employment is one of the most common causes behind this revival in self-employment in many countries around the world, especially during the Great Recession.

However, the above factors are not all the factors that we can take into account to explain the determinants of the substantial rise in UK self-employment.

On the one hand, the UK labor market has become more flexible than those in other European countries, thanks to the institutional framework that favors labor market flexibility.

On the other hand, one could argue that the flexible labor market should place the UK economy in a better position to respond to unemployment, but it can encourage a growing percentage of individuals to change their initial occupational choice and decide to become entrepreneurs, given that this flexibility tends to equalize the relative valuation of paid employment and self-employment, countering the rights and safety that characterize paid employment versus self-employment [17–20].

Finally, a final explanation could apply. As Acs (2006) [21] argues, average firm size was an increasing function of the wealth of the economy in intermediate stages of economic development and

a source of decreasing self-employment because marginal entrepreneurs find that they can earn more money by being employed by somebody else [22]. However, it seems that as the economy becomes more developed, the self-employment rate increases because the development of business services and the improvements in information technologies provide more opportunities for entrepreneurship. In other words, a U-shaped relationship may characterize the relationship between entrepreneurship and the stage of economic development.

This interpretation is consistent with the evidence provided by Blanchflower and Sandforth [23], who analyzed the evolution of self-employment in the UK over the past four decades, as well as the time series analysis carried out by Cowling and Mitchell (1997) [24], for the 1972–1992 period.

In sum, and whatever the cause of this upward trend—policy or economic shocks—the key question is to know if the effects of these shocks are temporary or permanent, given that one could argue that only those individuals who decide to become entrepreneurs on the basis of voluntary participation—opportunity entrepreneurship—will represent permanent transitions into self-employment, while as the number of self-employees becoming involved in necessity entrepreneurship increases, temporary transitions increase, with people abandoning self-employment when the economy and labor market show symptoms of recovery.

One could argue that looking for hysteresis in UK self-employment is a hot policy issue and a good research question at the time of writing, when policy makers and analysts are probing the deep causes and perspectives of this evolution. In sum, the UK is a suitable case for study, and the use of alternative (and competing) strategies for checking persistence is a good way to address these questions [25].

Therefore, the goal of this paper is to explore persistence in the UK aggregate rate of self-employment in the UK. We do so with quarterly time-series data on self-employment rates for the UK. The self-employment development in the UK has attracted analysts' attention since UK self-employment experienced a sustainable increase during the 1980s, likely thanks to government intervention and liberalization in the context of rapid economic growth, with the UK labor market becoming one of the more flexible ones in Europe.

If this were the case, low employment protection alongside a favorable tax system and the reduction of the credit constraints people face could be a more likely reason for the self-employment boom in the UK.

Therefore, the UK is a suitable case of study, given that labor market conditions and the tax system seem to point to highly sensitive self-employment responses to changing macroeconomic conditions.

Furthermore, there is another reason for suggesting the analysis of UK self-employment as a singular case: in several previous studies, UK self-employment has been considered an outlier [23,26–28]. In particular, the relationship between entrepreneurship and unemployment in the UK seems to have a specific nature such that entrepreneurship contributes less to alleviating the unemployment problem in the UK than elsewhere [26], while the most important determinant of the proportion of the workforce in self-employment is the income differential between self-employed and employed workers [23]—i.e., in response to macroeconomic conditions and not in response to labor market conditions (Figure 2).

The remainder of this article has the following structure. The next section briefly discusses the theoretical and empirical evidence on hysteresis in entrepreneurship. The third section describes the data, presents and discusses the results and performs different robustness checks for our findings. The final section concludes with a discussion of policy implications.



Figure 2. UK unemployment and self-employment rates, seasonally adjusted, quarterly data, 1992:Q2–2019:Q4. (Source: Office for National Statistics, UK, Labour Force Survey).

2. A Selective Survey of Previous Literature

We will agree that the durability of shocks to entrepreneurship—policy or economic shocks—should be an important research question in the economics of entrepreneurship. In that sense, there is a growing body of empirical literature devoted to exploring the existence of hysteresis or at least persistence in entrepreneurship. This question is important from at least two different perspectives. On the one hand, persistence in self-employment can be seen as a way of success and, if applicable, survival in entrepreneurship signals the long-term effects of past entrepreneurship promotion policies. On the other hand, another important issue is to check if after crisis times, non-genuine entrepreneurs (i.e. necessity and false self-employed persons who entered into self-employment as a “last resort”) remain as entrepreneurs or whether, on the contrary, they return to paid employment when the economic circumstances improve (*à la* Lucas).

A broad body of empirical literature has addressed these issues. This literature includes both microeconomic and macroeconomic evidence using different approaches.

The first group of works—based on cross/pooled sectional micro-data files—explores this question either by estimating models of survival for different groups of self-employed workers or by exploring the determinants and characteristics of those self-employed who decide to abandon self-employment to enter another state (paid-employment, unemployment or inactivity). The outcomes of these works are well summarized in [9,29,30]. This branch of literature has evolved from a first generation of works with apparently contradictory or at least non-robust results to a second wave of literature in which the explicit recognition of the heterogeneity among self-employed workers has contributed decisively to solve the previous puzzle shedding new light on these hypotheses [30]. The available evidence suggests the presence of persistence in entrepreneurship. Thus, the probability of exit from solo self-employment to employership is higher than the probability of switching to other states [29]. Furthermore, in adverse conditions employers opt to become solo self-employed before exploring other options [30–32].

The alternative to this body of evidence based on estimates of different dummies in individual-level studies of occupational choice is to perform careful analyses of time-series data (macro approach).

Pieces of research provided by Congregado et al. [33], Parker et al. [34] and Gil-Alana and Payne [35] have examined, using time series analysis and panel data unit roots, whether entrepreneurship exhibits

hysteresis as a way to check whether policy shocks, economic shocks or the shocks induced in the occupational choice decisions by a new employment legislation or a new tax treatment for employees' and self-employees' earnings have only temporary effects on self-employment or if, by contrast, they have a permanent character, that is, they are persistent.

Gil-Alana and Payne [35] applied fractional integration to explore the existence of hysteresis using monthly time series data on US self-employment rates. The results suggest the existence of nonstationary behavior, supporting previous evidence provided by Congregado et al. [33] for American entrepreneurship.

In a time-series context, hysteresis can be defined and measured in various ways. The most popular approach in the empirical literature simply equates hysteresis with the existence of a unit root in a variable by using integer or fractional integration.

An alternative approach proposed by Jaeger and Parkinson states that hysteresis exists if and only if cyclical changes affect the natural rate of a variable, even as the natural rate follows a unit root process. In this case, temporary shocks have permanent effects, while the business cycle does not evolve independently of the natural rate; then, it follows that a unit root is a necessary but not sufficient condition for hysteresis. To test for hysteresis in this way, we follow Jaeger and Parkinson [36] and decompose entrepreneurship into two unobservable components: a nonstationary "natural rate" component and a stationary "cyclical" component. These components can be estimated by maximum likelihood using the Kalman filter. This is the third approach carried out in this paper.

This methodology must enable us to assess not only the question of the persistence but also the relationship between entrepreneurship and business cycle, i.e., to investigate the economic forces shaping the aggregate relationship between self-employment, business cycles and the labor market, summarized in the controversy between the recession-push and the prosperity-pull hypotheses. The recession-push hypothesis states that in times of high unemployment individuals are pushed into self-employment for lack of alternative sources of income such as paid employment. The prosperity-pull hypothesis represents an opposite (but equally possible) interpretation of this relationship. At times of crisis, the risk of business failures increases, and thus, individuals are pulled out of entrepreneurship. The empirical performance of competing hypotheses like those is very important for gaining more in-depth knowledge about the relationship between entrepreneurship and some macroeconomic variables [37]. This is the secondary goal of this paper.

3. Methods and Results

This section describes the indicators and data sources used as proxies for entrepreneurship and the general strategy for checking the presence of hysteresis in UK self-employment series.

3.1. Data and Measurement Issues

Similar to most previous studies, entrepreneurship is defined in this paper in terms of self-employment, reflecting data availability at the time-series level. Entrepreneurship is difficult to measure and operationalize for empirical work. The most commonly used indicators of entrepreneurship are divided into three categories: (1) stock measures (self-employment or firm data), (2) flow measures (firm or self-employment entry/exit rates) and (3) indirect indicators of entrepreneurship such as competitiveness, patents, etc. In a strict sense, self-employment data are related to the Knightian entrepreneur who assumes all the uncertainty connected with the firm (see Congregado [38] for a detailed discussion).

Our empirical analysis uses seasonally adjusted quarterly data on self-employment rates for the UK. The self-employment rate, (St), is defined as the share of the workforce that is self-employed. British self-employment data are seasonally adjusted quarterly observations drawn from the Labour Force Survey (LFS, Office for National Statistics).

The sample starts in 1992:4 and ends in 2019:4. It should be noted that independent owner-managers and directors of incorporated enterprises are classified as employers, i.e., in the survey,

workers were asked questions about their main job or business, including, “Are you an employee or self-employed?” If self-employed, the respondent was further asked whether they had any employees. Finally, real GDP is denoted by Y_t . Data on British real GDP are taken from the Quarterly National Accounts database. These data are seasonally adjusted and are expressed in billions of chained 2005 British pounds.

3.2. Methodology

The most common approach for testing hysteresis in economic time series matches the presence of hysteresis in a time series with a unit root process. This approach has two potential sources of bias. The first one is that results obtained from traditional batteries of unit roots tests might be taken with caution, given the low power of these procedures if the alternatives are of a fractional form. To avoid this possibility, we used the framework proposed by Gil-Alana and Hualde [35] as a way to check the robustness of the results of our first approach (see Appendix A). The second one is that the defining feature of hysteretic processes in time series is that changes to the cyclical component of a time series induce permanent changes in the natural rate of the series (Jaeger and Parkinson [39]). This is not the case in a unit root process.

Several macroeconomic studies equate hysteresis in a time series with a unit root process. Independent of the use of an integer or fractional unit, the problem with these two approaches is that the existence of a unit root in the self-employment time series is a necessary but not sufficient condition for hysteresis.

Alternatively, Congregado et al. [33] argued that hysteresis in self-employment arises if and only if changes to the cyclical component of a time series induce permanent changes to its natural rate.

To test this definition of persistence, Jaeger and Parkinson [36] proposed a framework from a decomposition of the time series into the sum of two unobservable components: the natural rate and the cyclical component.

To illustrate the approach applied to our case under study, let us decompose the UK self-employment series, S_t , into the sum of its two (unobservable) components: the nonstationary natural rate component, S_t^N , and the stationary cyclical component, S_t^C :

$$S_t = S_t^N + S_t^C, \quad (1)$$

Now, we will define the natural rate component as a random walk plus a term capturing a possible hysteresis effect:

$$S_t^N = S_{t-1}^N + \beta S_{t-1}^C + \varepsilon_t^N, \quad (2)$$

where the β coefficient measures, in percentage points, how much the natural rate increases if the economy experiences a cyclical self-employment rate increase of one percent.

Evidently, we can check whether a unit root in the self-employment rate is a necessary but not sufficient condition for the existence of hysteresis since a unit root could be generated by an accumulation of shocks to the natural rate while $\beta = 0$ simultaneously. In contrast, there is hysteresis if $\beta > 0$.

The specification of the model is completed by writing the cyclical component of the self-employment rate as a stationary second-order autoregressive process:

$$S_t^C = \phi_1 S_{t-1}^C + \phi_2 S_{t-2}^C + \alpha \Delta Y_{t-1} + \varepsilon_t^C, \quad (3)$$

augmented with a term, $\alpha \Delta Y_{t-1}$, which relates cyclical self-employment to lagged output growth, where Y_{t-1} is lagged real GDP. This enables the relationship between the business cycle and entrepreneurship to be analyzed.

The random shocks ε_t^N and ε_t^C are assumed to be mean-zero draws from the normal distribution with variance–covariance matrix Ω ; the state-space form of the model can be written as

$$S_t = \begin{pmatrix} 1 & 1 & 0 \end{pmatrix} \begin{pmatrix} S_t^N \\ S_t^C \\ S_{t-1}^C \end{pmatrix} \quad (4)$$

$$\begin{pmatrix} S_t^N \\ S_t^C \\ S_{t-1}^C \end{pmatrix} = \begin{pmatrix} 1 & \beta & 0 \\ 0 & \phi_1 & \phi_2 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} S_{t-1}^N \\ S_{t-1}^C \\ S_{t-2}^C \end{pmatrix} + \begin{pmatrix} 0 \\ \alpha \\ 0 \end{pmatrix} \Delta Y_{t-1} + \begin{pmatrix} \varepsilon_t^N \\ \varepsilon_t^C \\ 0 \end{pmatrix} \quad (5)$$

$$\Omega = \begin{pmatrix} \sigma_N^2 & 0 & 0 \\ 0 & \sigma_C^2 & 0 \\ 0 & 0 & 0 \end{pmatrix} \quad (6)$$

To summarize, hysteresis is inferred if the coefficient β is significantly different from zero, whereas pro- or anti-cyclical variation is inferred depending on whether the coefficient α is positive or negative, respectively.

The coefficients of models (4)–(6) are estimated with maximum likelihood using a Kalman filter.

The estimation of the linear unobserved components model outlined above enables hysteresis to be tested directly and the existence of business cycle effects to be examined.

Finally, ignoring asymmetry when it is present leads to a misspecified model that produces erroneous inferences in hypothesis testing [39]. Additionally, potential asymmetries according to how self-employment absorbs positive or negative shocks should be considered too. Therefore, we follow the nonlinear specification of the unobserved components model developed by Pérez-Alonso and di Sanzo [40]. This asymmetric approach can be summarized by the following set of equations:

$$S_t = S_t^N + S_t^C \quad (7)$$

$$S_t^N = S_{t-1}^N + S_{t-1}^C I(\Delta Y_{t-1} \geq \tau) + S_{t-1}^C I(\Delta Y_{t-1} < \tau) + \varepsilon_t^N, \quad (8)$$

$$S_t^C = \phi_1 S_{t-1}^C + \phi_2 S_{t-2}^C + \alpha \Delta Y_{t-1} + \varepsilon_t^C, \quad (9)$$

where I is the Heaviside indicator function.

As was done for the previous model, the estimations are carried out via the maximum likelihood and Kalman filter methods. The threshold parameter needs to be estimated together with the rest of the parameters of the model, i.e., β_1 and β_2 .

From the perspective of this specification, we can analyze the potential asymmetry by testing for linearity, with the null hypothesis being $H_0 : \beta_1 = \beta_2$ and the alternative being $H_0 : \beta_1 \neq \beta_2$; that is, the existence of a single regime against the presence of two different regimes. Rejecting the null hypothesis implies that there is evidence of nonlinear persistence in the self-employment rate, which means that the cyclical shocks cause asymmetric changes in the natural rate component of the time series. As Pérez-Alonso and di Sanzo [40] pointed out, it may be necessary to resort to bootstrap methods to provide reliable approximations for the sampling distribution of the test statistic.

4. Results and Discussion

4.1. Unit Roots

As a preliminary check, given that several studies equal hysteresis to unit roots, we performed standard unit root tests on the series.

The results based on Augmented Dickey–Fuller and Phillips–Perron tests are reported in Table 1, and they show that the series of the UK self-employment rate is integrated of order one—i.e., $I(0)$ stationary in first differences. Then, the shocks are mean reverting. This finding buttresses our

conclusion that a unit root exists in the self-employment rates. As noted above, a unit root is a maintained assumption needed to test for Jaeger and Parkinson's notion of hysteresis. We now test it.

Table 1. Conventional unit root tests.

Variable	I(1) vs. I(0)						
	ADF	PP	Ng-Perron				
	Test	Test	MZa	MZt	MSB	MPT	Lags
Self-employment rate	−1.6442 (0.7688)	−1.7552 (0.7197)	−2.14730	−0.95439	0.44446	38.1818	1
GDP	−1.2879 (0.8856)	−1.4225 (0.8492)	−9.36138	−2.05835	0.21988	10.1738	1
Unemployment rate	−3.2788 * (0.0758)	−1.5470 (0.8073)	−4.51677	−1.50199	0.33254	20.1686	2

Notes: For the Augmented Dicky Fuller (ADF) (based on Akaike Information Criterion) and Phillips Perron (PP) test (based on the Bartlett kernel and Newey–West Bandwidth), we used Mackinnon (1996) one-sided p-values for the null hypothesis of a unit root. The critical values for the Ng–Perron test are tabulated in Ng and Perron (2001). The Modified Akaike Information criterion was used to select the autoregressive truncation lag, k , as proposed in Ng and Perron (1995). * denote significance at 10% level.

In the Appendix A (Table A1) we also report an alternative method, fractional integration, in order to test the robustness of traditional unit roots. Results seem to reinforce the presence of hysteresis.

4.2. An Unobserved Component Model

Table 2 presents the results of estimating models (4) through (6) for aggregate self-employment rates. The parameter β is statistically significant, which implies that self-employment exhibits hysteresis.

Table 2. Linear unobserved component model.

	3 Lags	4 Lags
Natural rate equation		
β	1.842 *** (0.082)	1.893 *** (0.040)
σ_N	0.089 *** (0.030)	0.000 (0.001)
Cyclical rate equation		
ϕ_1	−0.469 *** (0.303)	−0.611 *** (0.079)
ϕ_2	0.391 *** (0.092)	0.287 *** (0.076)
σ_C	0.115 *** (0.030)	0.149 *** (0.012)
α	0.821 *** (0.058)	0.808 *** (0.060)
δ	1.038 ** (0.504)	0.490 ** (0.248)
σ_D	0.467 *** (0.057)	0.480 *** (0.050)

Notes: Standard errors in parentheses. ***, **, * Rejects null hypothesis at 1%, 5% and 10% significance level respectively.

The estimate of α reported in the fourth row suggests that only the aggregate self-employment series S_t also exhibits a significant impact of business cycle variations in output on cyclical self-employment.

As we mentioned above, we should take into account the potential existence of asymmetries. To this end, we ran the test of linearity based in bootstrap test, proposed by Pérez and di Sanzo [40] (Table 3). The results seem to point out that the linear model was adequate, since the test does not allow the rejection of the null hypothesis of linearity. Estimates of the nonlinear version of this model are reported in Appendix A (Table A2).

Table 3. Test of linearity $H_0: \alpha_1 = \alpha_2$.

<i>Bootstrap p value</i>	0.25
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We also report estimates (Table 4) of our baseline unobserved linear component model, substituting GDP by the unemployment rate, in order to check the robustness and whether the cyclical pattern of self-employment is also linked to the labor market evolution. The results point to this positive effect of unemployment rate on the self-employment rate (recession push effect) reinforcing the result of resilience too in line with previous findings [41].

Table 4. Linear unobserved component model. Self-employment–Unemployment.

	3 Lags	4 Lags
Natural rate equation		
β	1.945 ** (1.175)	1.192 *** (0.146)
σ_N	0.123 *** (0.012)	0.000 (0.014)
Cyclical rate equation		
ϕ_1	0.520 *** (0.210)	0.037 (0.162)
ϕ_2	−0.068 (0.055)	0.178 * (0.132)
σ_C	0.048 (0.040)	0.148 *** (0.012)
α	0.4812 *** (0.107)	0.485 *** (0.101)
δ	2.071 (9.393)	0.519 (2.236)
σ_D	3.035 *** (0.213)	3.036 *** (0.213)

Notes: Standard errors in parentheses. ***, **, * Rejects null hypothesis at 1%, 5% and 10% significance level respectively.

5. Conclusions

This paper reported evidence of unit roots and estimated an unobserved components model for testing the existence of hysteresis in the self-employment rate in the United Kingdom. Defining hysteresis in terms of the interdependent evolution of a nonstationary natural rate and a stationary cyclical component, thereby distinguishing hysteresis from natural rate shocks, the results provide robust evidence of hysteresis in entrepreneurship. This implies that economic and/or non-economic shocks have cyclical and permanent effects on rates of entrepreneurship.

For policy makers and trade unions, our results should be interpreted as great news. For both, tackling unemployment and maintaining employment is a major challenge. Policies to promote entrepreneurship (genuine or not) and self-employment income support schemes (oriented to support self-employed workers in bad times when cost cutting, shrinkage and retrenchment is not sufficient

for survival) impose sizeable costs on the taxpayer. However, our findings appear to indicate that the long-term effects of these policies are guarantees in the UK.

Further research is needed to determine whether it is different national and institutional conditions, or structural changes which lead to different findings.

Similarly, further research will be required to gather more information concerning the long-term effects of the new support income schemes approved for combating the effects the Great Lockdown on the UK self-employment sector.

Author Contributions: Conceptualization, E.C., A.R.-S.; Methodology, E.C., A.R.-S.; Software, E.L.-P., A.R.-S.; Validation, E.L.-P., A.R.-S.; Formal analysis, E.C.; Investigation, E.C., E.L.-P., A.R.-S.; Data, E.C., E.L.-P., A.R.-S.; Writing—Original Draft Preparation, E.C., E.L.-P., A.R.-S.; Writing—Review and Editing, E.C., E.L.-P., A.R.-S.; Visualization, E.L.-P., A.R.-S.; Supervision, E.C., E.L.-P., A.R.-S. All authors have read and agreed to the published version of the manuscript.

Funding: Emilio Congregado and Ana Rodriguez-Santiago are members of the Spanish Entrepreneurship Research Group (SERG) SEJ-487 funded by the Andalusian Government and acknowledge the financial support from the Spanish Ministry of Economy and Competitiveness (Project ref. ECO2017-86402-C2-2-R). and the EPIT 2020 (University of Huelva).

Acknowledgments: The authors would like to thank the three anonymous reviewers for their insightful and constructive feedback.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Fractional Integration

The objective of this paper is to evaluate the robustness of hysteresis in UK self-employment rates by using alternative econometric models other than traditional unit root tests. The first alternative is the employment of fractional integration—see Gil-Alana and Hualde [42] for a survey—to infer the existence of hysteresis in UK self-employment rates. This approach has been recently applied to the field of the economics of entrepreneurship by Gil-Alana and Payne [35]. The key difference between the traditional time-series approach and fractional integration is that the number of differences required for rendering a series $I(0)$ stationary is a fractional value rather an integer one. In particular, we will consider that the British self-employment rate can be $I(0)$ stationary (i.e., $d = 0$), nonstationary and non-mean-reverting (if $d \geq 1$), stationary with long memory (if $0 < d < 0.5$) or nonstationary but mean reverting (if $0.5 \leq d < 1$). In other words, the larger the value of d , the greater the degree of dependence on the past data and the longer the effects of shocks (more persistence).

Table A1. Estimates of the fractional parameter.

	Coefficient	Std. Error	t-Value	t-Prob
d parameter	0.7762	0.05297	4.29	0.0000
Constant	11.0493	7.849	1.41	0.1610

Log-likelihood: −1129,51; No. Observations: 227; No. parameters 3; AIC: 9,97; ARFIMA (0, d , 0).

We estimate the fractional differencing parameter d . The estimate of the fractional differencing parameter is displayed in Table 2. We observe that the value of d is the interval (0, 1), implying long memory ($d > 0$) and mean reverting ($d < 1$) behavior. We notice that the estimated value of d implies a long memory, i.e., nonstationary but mean reverting. Then, the shocks are mean reverting. This finding buttresses our conclusion that a unit root exists in the self-employment rates.

Table A2. Non-linear unobserved component model.

Regime	3 Lags		4 Lags		6 Lags	
	$i = 1$	$i = 2$	$i = 1$	$i = 2$	$i = 1$	$i = 2$
β_i	0.037 * (0.022)	0.038 * (0.026)	0.043 *** (0.018)	0.040 ** (0.021)	3.146 ** (1.409)	1.851 ** (1.102)
α	0.573 *** (0.149)		0.592 *** (0.146)		0.773 *** (0.061)	
τ	−0.0040		0.0302		0.0286	
% obs.	54.13%	45.87%	46.79%	53.21%	47.71%	52.29%

Notes: Standard errors in parentheses. ***, **, * Rejects null hypothesis at 1%, 5% and 10% significance level respectively.

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