THE RELATIONSHIP BETWEEN SELF-EMPLOYMENT AND ECONOMIC DEVELOPMENT

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ABSTRACT

The shape of the relationship between self-employment and economic development is a hotly debated issue. This paper contributes to the line of research by examining the relationship between self-employment and economic development for a panel of 29 countries over 39 years using panel data analysis techniques. No clear evidence of a U-shaped relationship was found. A robust, negative linear relationship seems to describe the relationship the best. Interestingly, the study also found that the business ownership rate is converging toward a common value with a convergence speed of about 5.5% per year. **JEL Classification:** L26, L51, M13

INTRODUCTION

One relatively new but important line of research is the relationship between self-employment and economic development, and more specifically, its shape. The topic is highly debated mostly due to a lack of convergence of results. While most scholars agree that a significant and important relationship between self-employment and economic development exists, there is a lack of agreement when it comes to its shape (Acs, Desai, & Hessels, 2008). Without understanding the shape of the relationship, one cannot accurately specify a model that explains how economic development influences self-employment. For example, a linear relationship implies that self-employment either increases or decreases continuously with economic development, a U-shaped relationship means that it decreases with economic development up to a point and then, as the economy keeps developing, increases, an inverted U-shaped relationship means that self-employment increases with economic development up to a point and then, as the economy keeps developing, decreases, a clockwise rotated L-shaped relationship implies that after the economy reaches a certain level of development, self-employment converges toward a steady state.

The topic is important because this line of research can produce benchmarks for policy design. Wennekers, Van Wennekers, Thurik, and Reynolds (2005) point out that being able to estimate a country's "natural rate" of self-employment provides the

necessary inputs for targeted policy. Carree, Van Stel, Thurik, and Wennekers (2007) found that a business ownership rate below the "natural rate" is harmful for economic growth. Similarly, Acs, Szerb, and Autio (2016) found that 52 percent of the world is at 52 percent of its entrepreneurial activity. However, without having the right specification and data, the models used to understand the relationship between self-employment and economic development may not produce accurate benchmarks that can be later used to design targeted policy. And since the lack of agreement persists, it is still important to continue this line of research.

Several arguments supporting the hypothesis of a U-shaped relationship between self-employment and economic development were developed. The theoretical arguments were extensively discussed in previous studies (B. D. Audretsch & Thurik, 2006; Blau, 1987; Verheul, Van Stel, & Thurik, 2006; Wennekers et al., 2005) and therefore will only be briefly discussed here. Analyzing the different economic eras, it seems logical that the economic changes led to changes in the business demography. Indeed, as the economy moved from the agricultural era to the industrial era, productivity increased rapidly and businesses were able to take advantage of economies of scale, and therefore a smaller number of businesses was able to supply the same quantity of goods. However, as the economy develops further, the economy moves towards the service era while taking advantage of the new available technologies, and the number of businesses might again rise (B. D. Audretsch & Thurik, 2006; Blau, 1987; Wennekers et al., 2005).

The lack of convergence of results seems to stem from two main areas. First, since scholars failed to agree on a universally accepted definition of entrepreneurship, different measures are used to quantify it (Ács, Autio, & Szerb, 2014; Ahmad & Hoffman, 2008; Ahmad & Seymour, 2008; Stenholm, Acs, & Wuebker, 2013; Vivarelli, 2013) which makes the comparison between results difficult (D. Audretsch, 2012; Dreher & Gassebner, 2013). Second, the different methodological approaches also make the results difficult to assess and compare. This study will address this issue and discuss the possible differences between its approach and other methodologies used in the past.

The next sections will discuss findings reported by previous research in this area followed by a description of the dataset used in the study as well as the sources of the data. The methodology section reveals model specification for each possible shape and explained the economic consequences each of the shapes imply. Several interesting results, including a new theory and finding adjacent to the topic are revealed in the analysis section, and then further discusses in the conclusions.

PREVIOUS FINDINGS

It all started in 1987 with the observation that "In the early 1970s the proportion of the nonagricultural labor force self-employed in the United States ceased its downward trend and has been rising ever since" (Blau, 1987). This change was reversing a century old trend, and was taking place not only in the U.S. but also in a few other developed economies. Blau (1987) concluded that changes in the TFP ratio in the industries where self-employment was prevalent, the tax structure, and the rising real retirement benefits levels under the new legislation were the main reasons for this change.

Blau did not, however, directly link self-employment to economic development, or specify a non-linear relationship. The first to specifically analyze the relationship between self-employment and economic development were Acs, Audretsch, and Evans (1994)[1]. While they acknowledged nonlinear relationships (both U-shaped and inverted U-shaped relationships) for some countries, they reported a robust negative relationship between self-employment rate and GNP per capita for the OECD countries. Other studies also reported negative relationships between per capita income and self-employment (Liñán & Fernandez-Serrano, 2014; Noorderhaven, Thurik, Wennekers, & Van Stel, 2004).

Several studies reported nonlinear relationships between business ownership or self-employment (measured in levels or growth) and economic development (Acs et al., 1994; Blau, 1987; Carree et al., 2007; Carree, Van Stel, Thurk, & Wennekers, 2002; Dreher & Gassebner, 2013; Sternberg & Wennekers, 2005; André van Stel, Thurik, Wennekers, & Reynolds, 2004; Verheul et al., 2006; Wennekers et al., 2005). Acs et al. (1994) found some evidence for a U-shape pattern for self-employment for several countries but also pattern of continual increase, continual decrease and inverted U-shape for other countries. More precisely, looking at the relationship between nascent self-employment and per capita income, a study found evidence of a U-shape relationship with the minimum of the U curve at about 20,398 USD corresponding to a minimum business ownership of 10.7% of the labor force (Carree et al., 2002)[2]. In a later paper, the minimum business ownership rate for the U - shaped relationship was estimated at about 8.2% while the L - shaped relationship implies an asymptotic value of 4.7% (Carree et al. 2007). In a similar study which looked at nascent self-employment, the minimum of the U curve was found at about 22,000 USD (Wennekers et al., 2005)[3].

Verheul et al. (2006) found evidence of a U-shaped relationship when it comes to female self-employment and GNI per capita, but not for self-employment over all or male self-employment. They also did not attempt to test for the inverse relationship. Dreher and Gassebner (2013) [4] also found a relatively robust evidence of a quadratic relationship. They did not attempt to test for the inverse relationship.

The relationship between self-employment and income seems to be either complex, or difficult to estimate. This would explain the diversity of findings reported by previous studies and the lack of convergence of these results in time (Acs, Desai, & Hessels, 2008). The two main possible issues are either the data itself or the econometric approach to analyzing it.

While the GEM and COMPEDIA datasets have not been compared yet, a previous study comparing the GEM and World Bank Group Entrepreneurship Survey showed significant differences between the two (Acs, Desai, & Klapper, 2008). Moreover, the usefulness of the GEM data for driving policy in both developed and developing countries was questioned (Acs & Amorós, 2008). If similar issues arise when comparing GEM and COMPEDIA data, then one culprit may be the poor compatibility between the two datasets (Dreher & Gassebner, 2013). However, data may not be the only issue, since even studies using the same dataset report dissimilar results.

Another reason the relationship between self-employment and economic development is elusive may rest with the samples researchers use. Indeed, if the majority of the countries in the sample have an economic development level lower than the one corresponding to the U shape minimum, the relationship will appear L shaped,

and not U shaped (Carree et al., 2002). Finally, issues such as high correlation between variables may also be an issue that needs to be addressed (Dreher & Gassebner, 2013). These issues will be addressed in the Methodology section.

DATA

Table 1 presents the main variables used in some of the studies of interest. The self-employment data comes from either COMPEDIA or GEM, while the income data comes from either COMPEDIA and WDI. The studies by Carree et al. (2007; 2002) used four and two year growth data while the other studies used cross-sections. Since the data used by Carree et al. (2007; 2002) covers a larger and more recent time frame this study will also use COMPEDIA four year growth data as the dependent variable. This approach will make the results of the two studies easier to compare.

Besides economic development, past studies considered several other economic, technological, demographic, cultural and institutional factors as control variables. These factors were organized in an analytic framework used in several papers (Verheul et al., 2002; Wennekers et al., 2002). Following other precedents (Wennekers et al., 2005) this paper will closely analyze a reduced model and then add relevant independent variables. This approach is different than the general-to-specific approach used in several previous studies (André van Stel et al., 2004) for reasons revealed in the methodology section.

Table 2 presents the main variables of interest used in this study. The self-employment and income data come from the COMPEDIA database. Table 3 reveals the countries in the panel as well as some country summary statistics. According to the data, Luxembourg, one of the richest countries in the sample, has the smallest ownership rate (about 7.5%) while Greece, one of the poorest countries, has the highest one (about 31%). The data also suggest that the average growth of the ownership rate over the whole period is positive for only ten countries (such as Austria, Belgium, Canada, Czech Republic and Germany) and negative in 19 cases. This might suggest that overall, the ownership rate is decreasing over time.

Table 4 reveals some sample summary statistics. Interestingly Table 5 also suggests a negative relationship between the number of business owners per capita and both GDP and GDP^2. Moreover, a relatively strong correlation between GDP and GDP^2 may indicate future specification issues.

METHODOLOGY

Due to the apparently elusive relationship between self-employment and income, this study makes use of several econometric approaches to try to mitigate the possible specification or data issues that might have led to inconclusive results in previous studies. The most important approach is to make the best use of the available data. Indeed, while most past studies analyzed a static dataset (a cross section of countries at a certain moment in time, or a cross section obtained by averaging the data over a time interval) or a relatively short panel this study will employ panel data over a relatively long period of time.

The analysis will begin with the reduced model (no control variables will be

used) to address the possible multicollinearity which was previously reported (Dreher & Gassebner, 2013; André van Stel et al., 2004). Having only the necessary variables alleviates this issue even if the estimated coefficients might be biased due to missing variables. Later on, the omitted variables bias can be mitigated by good proxy variables and by using unobserved effects models (Wooldridge, 2011).

One constructed variable that will be taken in consideration is the running difference between each country's business ownership rate and the overall mean of the business ownership rate, ERRCORR. The variable was introduced after analyzing Figure 1, which suggests that the business ownership rate converges toward a certain common value. This phenomenon is also in line with the observation that while, overall, the business ownership rate tends to decrease in lower income countries, it tends to increase in some richer countries. This tendency would indeed be in line with a movement along a U-shaped curve as previously suggested by some researchers, but also with a convergence movement. If the convergence is apparent, then the speed of convergence can be estimated.

Two variables that might be a good proxy for a certain range of missing variables are urbanization and income inequality (Faggio & Silva, 2014; Fallah & Partridge, 2007; Florida, Adler, & Mellander, 2017; Glaeser, Kerr, & Kerr, 2015; Kang, 2017; Packard & Bylund, 2015; Partridge & Weinstein, 2013; Scholin, Ohlsson, & Broome, 2017; Welch, 1999). First, urbanization (the percentage of the total population living in urban areas) is chosen because of the link between agglomeration economies and business creation and growth. Moreover, due to the relatively long lag of the impact of new businesses on the local economy (André van Stel & Suddle, 2008), a one way relationship should be apparent for the purpose of this study (exogeneity would be assured). Second, while income is an indicator of the average standard of living, it is possible that, should income be unequally distributed, only a few would benefit and the liquidity constraint would lead to lower self-employment compared with a more equal counterpart (Fairlie & Krashinsky, 2012). Also, more unequal societies tend to structurally differ from the more equal ones, and inequality can be a catchall for many unobserved variables (such as taxes, culture, demographic variables and so on). Previous studies did report a significant relationship between income inequality and self-employment (Chowdhury, 2013; Lecuna, 2014). Both these variables should be sufficiently exogeneous for this study. Finally, after adding these variables, several other specifications will be estimated, to allow for testing the sensitivity of the results to changes in the variables and specifications (Dreher & Gassebner, 2013).

ANALYSIS

The overall relationships between variables is difficult to visualize due to the very large numbers of observations. While far from perfect, Figure 1 reveals the scatterplot between the number of business owners per capita and GDP per capita. As in Liñán and Fernandez-Serrano (2014)[5] a negative relationship is revealed. The figure does not seem to confirm a significantly lower ownership rate for former communist countries as suggested by some previous studies (Dreher & Gassebner, 2013). However, the data is available only for four former communist countries, two exhibiting an increase in business ownership rate (the Czech and Slovak Republics) while the other two exhibit a decrease in business ownership rate (Poland and Hungary).

Figure 1 suggests a negative relationship between business ownership rate and per capita income. Therefore, a linear specification will be tested first. Equation (1) reveals the specification using panel analysis notation. However, since we want to test for possible nonlinear relationships, three other specifications will be used in the analysis, a quadratic specification (Equation (2)) followed by two decay specification. While both decay specifications could be estimated by way of nonlinear regression, doing so would make comparing the results difficult. Therefore, the exponential decay specification is linearized before estimation (Equation 3.1) Finally, to check for robustness, growth equations (Equation 5) will also be considered.

$$or_{i,t} = \alpha + \beta gdpc_{i,t} + \sum \eta_j Z_{i,t\,j} + c_i + \varepsilon_{1i,t} \quad (1)$$

$$or_{i,t} = \alpha + \beta gdpc_{i,t} + \gamma gdpc_{i,t}^{\,2} + \sum \eta_j Z_{i,t\,j} + c_i + \varepsilon_{1i,t} \quad (2)$$

$$or_{i,t} = \alpha * e^{-\delta * gdpc_{i,t}} * e^{\sum \eta_j Z_{i,t\,j}} * c_i * \varepsilon_{1i,t} \quad (3)$$

$$\log(or_{i,t}) = \alpha - \delta * gdpc_{i,t} + \sum \eta_j Z_{i,t\,j} + c_i + \varepsilon_{1i,t} \quad (3.1)$$

$$or_{i,t} = \alpha + \zeta \frac{log(gdpc_{i,t})}{log(gdpc_{i,t} + 1)} + \sum \eta_j Z_{i,t\,j} + c_i + \varepsilon_{1i,t} \quad (4)$$

$$\Delta^n or_{i,t} = \alpha + \beta \Delta^n gdpc_{i,t} + \sum \Delta^n \eta_j Z_{i,t\,j} + c_i + \varepsilon_{1i,t} \quad (5)$$

where:

$or_{i,t}$ = share of business owners out of labor force
$gdpc_{i,t}$ = GDP per capita
$Z_{i,t}$ = a vector of control variables
i = contry index
t = time index
n =t ime interval
c_i = country effect
$e_{i,t}$ = idiosyncratic error term

The tests imply running the regressions and assessing the statistical significance of the coefficients β,γ,δ and ζ as well as the model fit. If β is statistically significant, the relationship is linear, if γ is statistically significant, the relationship is quadratic, if δ is statistically significant, the relationship corresponds to exponential decay, and if ζ is statistically significant a different decay function may also be considered. Moreover, if $\gamma > 0$, the relationship is U-shaped, while if $\gamma < 0$ the relationship is of inverted U-shape. Finally, should the relationship prove to be nonlinear, the test proposed by Lind and Mehlum (2010) should be performed.

Since heteroskedasticity is present, weighted least squares and heteroskedasticity-

robust standard errors were run for all estimations (Wooldridge, 2011). Also, to account for unobserved effects, each model was estimated with fixed effects. Since the data does not come from a random sample of countries, fixed effects should be used (Frees, 2004).

Finally, a common issue in panel models is serial correlation in the individual error terms due to omitted variables (Bhargava, Franzini, & Narendranathan, 1982). Due to the low values of Durbin-Watson statistics and given the large time interval the data covers, each model was also run in an AR(1) estimation, however, when using lagged dependent variables, the OLS estimator is known to be biased. One solution to this problem is to employ the estimator proposed by Arellano and Bond (1991). The Generalized Method of the Moments (GMM) estimator is obtained by first taking first differences of the equation to be estimated and then use an IV estimator (Arellano & Bond, 1991; Cabral & Mollick, 2011).

Long Run Estimations

Table 6 reveals the results for OLS estimation of the linear and quadratic model. The results of the estimation without effects is not shown due to the much weaker explanatory power of the models (André van Stel et al., 2004). Both the GDP per capita and GDP per capita squared coefficients are significant, suggesting a quadratic relationship, and since the squared term has a positive coefficient, the results suggest a U-shape relationship. However, the very low value of the Durbin-Watson statistics suggest that the specification is not adequate. The next specification adds an AR(1) term to address the small Durbin Watson statistic issue. The results are similar, but the statistical significance of the coefficients of interest decreases significantly and the DW increases, as expected. However, while for a ten years, fifty cross sections panel and five estimated parameters the upper and lower limits for the Durbin-Watson statistic would be 1.7805 and 1.8517 respectively (Bhargava et al., 1982), no limits exist in the literature for the specific panel used in this study.

Adding the business ownership correction term as an independent variable leads to the quadratic term losing its statistical significance. Finally, replacing the quadratic term with the urbanization and GINI variables leads to only a minor decrease in fit ($\sum resid^2$ decreases from 0.0075 to 0.0074) while both coefficients of the newly added variables are not statistically significant. Of course, all these results need to be compared to other estimations, but it is interesting to notice that both coefficients of interest preserve their signs throughout the estimations, while seems to have the most stable value.

To address the issue of having an AR term as an independent variable, GMM first differences estimations were also run (Table 7). The results are similar to the previous estimation with the difference that both the urbanization and the GINI coefficients are statistically significant and negative, suggesting that higher urbanization and higher levels of income inequality may lead to lower business ownership rate. This result apparently contradicts Lecuna (2014) who reports a positive relationship between inequality and entrepreneurial activity. Again, further tests will reveal the degree of robustness of these results. However, the results revealed in both tables suggest that the linear specification with the AR, business ownership rate correction, urbanism and GINI fit the data the best. Moreover, all coefficients tend to converge toward the values revealed by the last GMM estimation.

Table 8 reveals the results for the exponential decay of the ownership rate model. Only a few specifications are presented, based on the most revealing results. As expected, a clear negative relationship between business ownership rate and income is revealed. The best model as judged by the sum of the squared residuals would be the simple exponential decay, but again the value (and sign) of the coefficient is relatively stable regardless of the specification.

For the L-shaped decay model (Table 9) the results were somewhat similar. Again, only a few specifications are presented, based on the most revealing results. As expected, the coefficient of interest () is negative in every specification, suggesting an L-shaped relationship. The specification with the best fit reveals negative coefficients for the urbanization and income inequality terms similar to the previous estimations. As in the exponential decay estimation, the coefficients (especially the urbanization and inequality ones) seem less stable to the different specifications.

Business Ownership Convergence

In all previous estimations, the business ownership correction term is always significant and negative suggesting a convergence process. In other words, the business ownership rate tends to converge towards a common value similar to the hotly debated income convergence process (Barro, 2012; Barro & Sala-i-Martin, 1992; Carree et al., 2007; Durlauf & Johnson, 1995). At this point, even if not directly related to the main topic, everything calls for further examination of the business ownership rate convergence process and for estimating its speed. For a visual inspection, Figure 2 reveals the evolution of the mean and standard deviation of the business ownership rate for the sample. The relatively high variability for the first years may be explained by new countries entering the sample each year. However, the sample componence stabilized around 1993 (which can also be seen from the figure). After that there is a clear trend toward convergence. The main equation to be estimated to assess for convergence is:

$$\frac{1}{38} * \ln\left(\frac{OR_{i,2010}}{OR_{i,1972}}\right) = a - \left(\frac{1 - e^{-38b}}{38}\right) * \ln\left(OR_{i,1972}\right) + \varepsilon_{i,t}$$

where *b* represents the convergence speed. To assess the influence of other variables, they can be added to the model.

Table 10 reveals the results of the OLS regression (since data is only available for a small number of countries for the first twenty or so years, the results should be interpreted with caution)[6]. According to the results, the conditional convergence speed is about 5.5% and robust to specifications. Moreover, the positive coefficient of the per capita gross domestic product suggests that countries whose income grew faster have a lower business ownership rate speed of convergence while those who experienced a faster urbanization have a higher speed of convergence.

Growth Estimations

To assess the robustness of the relationships between the variables, the linear and quadratic growth rates models were also estimated (since the GMM models are the most adequate, only these are shown). Differentiating both sides of the equation with the same lag allows for a direct comparison of the coefficients between the levels and growth estimation, and Table 11 reveals the results of the estimations. The full models (those considering urbanization and income inequality) did not add anything to the estimation, probably due to the large number of observations lost by differentiation. The main observation is that the results also suggest the linear estimation as the best fit, with a relatively stable β for similar specifications (see Tables 6, 7 and 11).

To compensate for the loss of observations a two-year growth specification was estimated (see Table 12). The results again suggest a linear fit as the best model, with relatively stable coefficients with the exception of the significance of the urbanization and income inequality coefficients. However, when statistically significant the urbanization and income inequality coefficients are positive, indicating an inverse relationship compared to the long-run one. This result is in line with Lecuna (2014) and Reynolds (2010) who report a positive relationship between inequality and entrepreneurial activity. It appears that the growth of the business ownership rate is positively related to the growth of urbanization and income inequality while the level of business ownership rate is negatively related.

CONCLUSION

This study uses a dataset that has several advantages over previous investigations. One advantage is that this data panel is the longest used in this research line, covering the period between 1972 and 2011. Another advantage of this panel is that the data for all variables is standardized, removing one of the main issues in cross country research. Moreover, while the countries in the panel are divers, they are not that far from each other when it comes to factors such as the access to technology, social structure and level of democracy, which does lower the need for a large number of control variables.

The most important finding of this study is the movement toward a common rate of business ownership evident in this sample. Indeed, while, for most countries with lower per capita income, the business ownership rate is decreasing relatively fast, it is increasing slowly for some of the richest countries. As mentioned before, this may be a development in line with a movement along a U-shape, but when panel data methodologies are used, it turns out that it is only the outcome of a convergence phenomenon. The speed of convergence of about 5.5% is slightly faster than the speed of convergence of income across countries.

When it comes to the shape of the relationship between business ownership rate and economic development, the findings of this study contrast with those of other studies. Indeed, while, when both GDP per capita and its square coefficients are significant they suggest a U-shaped relationship as in some previous studies (Carree et al., 2007; Carree et al., 2002; Dreher & Gassebner, 2013; André van Stel et al., 2004), when panel data techniques are employed, the nonlinear relationship disappears. It is possible that the relationship exists for smaller panels or cross sections, but it is not

apparent in the long run.

Finally, this study found a negative relationship between the growth of ownership rate and inequality, also contradicting previous findings. The relationship is very robust and its implications clear. The more income inequality the country experiences (whether it is due to less regressive taxes or due to higher differences in the gross income) the smaller its ownership rate growth. Therefore, as previously suggested (Kimhi, 2010; Lecuna, 2014), maybe governments should focus on the overall rate of ownership by creating programs that help the start-ups in the more unequal areas and leave the development of the start-ups with high-growth potential for the private sector.

There are several possible reasons the results differ from the previous studies. First, this study used a long panel data, whereas the previous studies used a cross section (Dreher & Gassebner, 2013; André van Stel et al., 2004; Wennekers et al., 2005) or cross section(s) of averaged data (Carree et al., 2007; Carree et al., 2002). Secondly, because of the specifics of the sample used in this study, weighted panel regressions, fixed effects, and AR(1) specifications were estimated, which again distinguishes this study from the previous ones. Finally, the data from COMPEDIA used in this study might differ significantly from the GEM data used in other studies.

ENDNOTES

1 The study looked at 23 OECD countries using both cross-section and time series data. The study did report increases in self-employment rate during 1970s and 1980s, but concludes that the trend is temporary and that self-employment tends to decrease as economies evolve.

2 The variables of interest were the growth of the number of business owners per labor force and per capita GDP in thousands of purchasing power parities per US$ in 1990 prices. The data for the 23 OECD counties was accessed from EIM's COMPENDIA database (available through www.eim.net) for business ownership and from OECD National Accounts for GDP which is measured in purchasing power parities of 1990 and it covers the 1980 to 1996 interval.

3 The cross-section study looked at 36 countries from the GEM 2002 database (available through www.eim.net) and used several dependent and control variables.

4 The study used nascent entrepreneurship from GEM (percentage of the adult population who are "nascent" entrepreneurs) and GDP per capita in constant 2000 USD from the World Bank. For a discussion of GEM data see (Minniti, Bygrave, & Autio, 2005). An extreme bounds analysis on the relationship between GEM nascent entrepreneurship and lagged GDP per capita and lagged GDP per capita squared shows a significant and negative relationship between nascent entrepreneurship and lagged GDP per capita and positive between nascent entrepreneurship and lagged GDP per capita squared. Other tests (with a panel data of 43 countries over the 2003-2005 period) reinforced the findings.

5 The study looked at 56 countries (including 19 countries from the European Union), using averaged data over the 2001-2011 period. It looked at the relationship between several GEM indicators and GDP per capita. However, no attempt to test for a possible nonlinear relationship was made.

6 The countries in this sample were Canada, Denmark, Finland, France, Italy, New Zealand, Norway, Sweden, United Kingdom, and the United States.

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TABLE 1: THE MAIN VARIABLES USED IN PREVIOUS STUDIES

Author	Year	Variable(s)	Date	Obs.
Caree et al.	2007	Growth of number of business owners (in all sectors excluding the agricultural sector) in a period of four years, expressed as a fraction of the labor force.	1980 - 2004	COMPEDIA
		Four-year lag of per capita GDP in thousands of purchasing power parities per US$ in 1990 prices (quadratic and inverse specification).		
Verheul et al.	2006	Share of people in age group of 18 to 64 years who are actively engaged in the start-up process or managing a business less than 42 months old (in%).	2002	GEM
		Share (number) of women in age group of 18 to 64 years who are actively engaged in the start-up process or managing a business less than 42 months old (in%).		
		Share of men in age group of 18 to 64 years who are actively engaged in the start-up process or managing a business less than 42 months old (in%).		
		Gross national income per capita in 2001 in purchasing power parities per 1000 US Dollars (quadratic specification).		WDI
Wennekers et al.	2005	Share of people in age group of 18 to 64 years who are actively engaged in the start-up process or managing a business less than 42 months old (in%).	2002	GEM
		Gross national income per capita in 2001 in purchasing power parities per 1000 US Dollars (linear and quadratic specifications).		WDI

van Stel et al.	2004	Share of people in age group of 18 to 64 years who are actively engaged in the start-up process or managing a business less than 42 months old (in%), for opportunity based and necessity based entrepreneurship. Gross national income per capita in 2001 in purchasing power parities per 1000 US Dollars (linear, quadratic and inverse specifications).	2002	GEM WDI
Caree et al.	2002	Growth of number of business owners (in all sectors excluding the agricultural sector) in a period of four years, expressed as a fraction of the labor force.	1976 - 1996	COMPEDIA 2000.1
		Four year lag of the per capita gross domestic product in purchasing power parities per U.S. dollar in 1990 prices (log-quadratic specification).		

Note: WDI – World Development Database (available at http://data.worldbank.org).

TABLE 2: MAIN VARIABLES USED IN THIS STUDY AND THEIR SOURCES

Variables	Interval	Source.
Number of business owners (in all sectors excluding the agricultural sector) expressed as a fraction of the labor force. Per capita gross domestic product in purchasing power parities per U.S. dollar in 1990 prices.	1972 – 2011	COMPEDIA

TABLE 3: SUMMARY STATISTICS BY COUNTRY

Country	OR	Δ^4OR	GDPC	Δ^4GDPC
Australia	0.1834	-0.0017	24,075	1,756.26
Austria	0.1163	0.0004	26,331	1,837.68
Belgium	0.1242	0.0005	24,547	1,554.45
Canada	0.1249	0.0026	24,292	1,505.47
Czech Republic	0.1424	0.0157	16,605	1,795.87
Denmark	0.0923	-0.0056	24,052	1,442.67
Finland	0.1294	-0.0045	21,477	1,758.92
France	0.1240	-0.0079	22,140	1,317.31
Germany	0.0915	0.0010	24,297	1,053.86
Greece	0.3051	-0.0138	17,772	1,129.79
Hungary	0.1250	-0.0097	13,194	1,553.79
Iceland	0.1385	-0.0061	29,291	2,338.75
Ireland	0.1851	-0.0100	20,314	2,724.85
Italy	0.2296	-0.0023	21,318	1,223.67
Japan	0.1455	-0.0099	21,411	1,668.20
Luxembourg	0.0746	-0.0081	48,075	5,513.78
Mexico	0.2789	-0.0062	9,692	520.00
Netherlands	0.1159	0.0014	24,553	1,713.62
New Zealand	0.1706	-0.0042	19,298	744.11
Norway	0.1109	-0.0056	28,846	2,476.81
Poland	0.1879	-0.0071	10,799	1,822.33
Portugal	0.2323	-0.0061	13,994	1,075.85
Slovak Republic	0.0875	0.0224	13,119	2,248.21
Spain	0.1618	-0.0075	18,378	1,443.28
Sweden	0.0942	0.0004	24,221	1,643.14
Switzerland	0.0901	0.0000	29,365	1,186.56
Turkey	0.2605	-0.0072	9,278	911.90
United Kingdom	0.1071	0.0036	21,708	1,587.67
United States	0.1123	-0.0010	29,052	1,945.08

Obs: OR – business ownership rate
Δ^4OR – four-year business ownership rate growth
GDPC – GDP per capita
Δ^4GDPC– four-year GDP per capita rate growth
Data averaged over the 1972 – 2011 interval
Included observations: 964

TABLE 4: SUMMARY STATISTICS

Variable	Mean	Median	Max.	Min.	Std. Dev.
OR	0.1470	0.1260	0.3840	0.0510	0.0597
Δ^4OR	-0.0030	-0.0030	0.0390	-0.0550	0.0106
GDPC	22,413.00	22,146.00	65,943.00	6,806.00	8,452.26
Δ^4GDPC	1,669.88	1,634.50	11,265.00	-4,822.00	1,659.64

Obs: Sample: 1972 – 2011
Included observations: 964

TABLE 5: CORRELATION TABLE

Correlation Probability	OR01	D4OR	GDPC	D4GDPC
OR	1			

D^4OR	-0.1733	1		
	0.0000	-----		
GDPC	-0.5599	0.0179	1	
	0.0000	0.6021	-----	
D^4GDPC	-0.1495	-0.0019	0.3306	1
	0.0000	0.9555	0.0000	-----

Obs: Sample: 1972 – 2011
Included observations: 848

Variable	OLS, fixed effects							
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.1853	0.0000	0.0091	0.0000	0.0709	0.0000	0.0761	0.0000
L_1OR	-	-	0.9554	0.0000	0.5594	0.0000	0.5620	0.0000
ERRCORR	-	-	-	-	0.4203	0.0000	0.4231	0.0000
L_4GDPC	-2.26E-06	0.0000	-2.13E-07	0.0104	-3.29E-07	0.0000	-2.50E-07	0.0000
L_4GDPC^2	1.65E-11	0.0001	2.45E-12	0.0452	6.18E-13	0.5312	-	-
L_4URB	-	-	-	-	-	-	-4.89E-05	0.3767
L_4GINI	-	-	-	-	-	-	-0.0001	0.0709
R^2	0.9507		0.9958		0.9974		0.9974	
Adj. R^2	0.9489		0.9956		0.9973		0.9973	
$\sum$resid^2	0.1397		0.0119		0.0075		0.0074	
F-stat.	524.89		6,223.20		9,643.17		9,414.41	
Prob(F-stat.)	0.0000		0.0000		0.0000		0.0000	
J-stat.	-		-		-		-	
Prob(J-stat.)	-		-		-		-	

Obs: Dependent variable: business ownership rate.

TABLE 7: LINEAR AND QUADRATIC MODELS, GMM ESTIMATIONS

Variable	GMM, first differences					
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-	-	-	-	-	-
L_1OR	0.9306	0.0000	0.5451	0.0000	0.5145	0.0000
ERRCORR	-	-	0.4187	0.0000	0.4589	0.0000
L_4GDPC	-2.80E-07	0.0000	-3.65E-07	0.0000	-2.64E-07	0.0000
L_4GDPC^2	2.92E-12	0.0000	3.67E-13	0.7816	-	-
L_4URB	-	-	-	-	-3.10E-05	0.0364
L_4GINI	-	-	-	-	-0.0001	0.0000
R^2	-		-		-	
Adj. R^2	-		-		-	
$\sum resid^2$	0.0197		0.0077		0.0069	
F-stat.						
Prob(F-stat.)						
J-stat.	24.15		29.06		24.83	
Prob(J-stat.)	0.6735		0.3581		0.4717	

Obs: Dependent variable: business ownership rate.

Variable	OLS, fixed effects		GMM, first differences					
	Coeff	Prob	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.
C	-1.78	0.0000	-	-	-	-	-	-
log L_1OR	-	-	0.9416	0.0000	0.9432	0.0000	0.9713	0.0000
ERRCORR	-	-	-	-	-	-	-0.2744	0.0000
L_4GDPC	-1.01E-05	0.0000	-6.83E-07	0.0000	-6.28E-07	0.0000	-5.66E-07	0.0000
L_4URB	-	-	-	-	1.73E-05	0.0000	-1.99E-04	0.0000
L_4GINI	-	-	-	-	-2.74E-04	0.0000	-	-
R^2	0.9263		-		-		-	
Adj. R^2	0.9237		-		-		-	
$\sum$resid^2	8.64		0.9045		0.9060		0.9294	
F-stat.	354.71		-		-		-	
Prob(F-stat.)	0.0000		-		-		-	
J-stat.	-		28.84		40.21		27.07	
Prob(J-stat.)	-		0.4209		0.0633		0.4058	

Obs: Dependent variable: natural logarithm of business ownership rate.

TABLE 9: INVERSE DECAY MODELS

	OLS		GMM			
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.2773	0.0039	-	-	-	-
L_1OR	0.9495	0.0000	0.9440	0.0000	0.5962	0.0000
ERRCORR	-	-	-	-	0.3854	0.0000
L_4INVGDPC	-0.2979	0.0045	-0.2301	0.0000	-0.6797	0.0000
L_4URB	-	-	-7.81E-05	0.0157	-7.68E-05	0.0001
L_4GINI	-	-	2.61E-05	0.0000	-1.11E-04	0.0000
R^2	0.9959		-		-	
Adj. R^2	0.9957		-		-	
$\sum resid^2$	0.0111		0.0199		0.0086	
F-stat.	6098.16		-		-	
Prob(F-stat.)	0.0000		-		-	
J-stat.	-		26.76		24.40	
Prob(J-stat.)	-		0.4768		0.4391	

Obs: Dependent variable: business ownership rate.

TABLE 10: CONVERGENCE TEST

Variable	OLS Coefficient	Prob.	Coefficient	Prob.
C	7.73	0.0000	0.2976	0.0000
OR_{1972}	-0.1932	0.0000	-0.1833	0.0000
$LOG(GDPC_{2010})$ - $LOG(GDPC_{1972})$	0.0035	0.0114	0.0036	0.0100
$LOG(URB_{2010})$ - $LOG(URB_{1972})$	-	-	-0.0107	0.0464
$LOG(GINI_{2010})$ - $LOG(GINI_{1972})$	-	-	0.0014	0.1744
R^2	0.9928		0.9970	
Adj. R^2	0.9907		0.9945	
$\sum resid^2$	4.83E-06		2.02E-06	
F-stat.	479.94		411.38	
Prob(F-stat.)	0.0000		0.0000	

Obs: Dependent variable:

TABLE 11: FOUR-YEAR GROWTH MODELS

Variable	Four-year growth			
	Coefficient	Prob.	Coefficient	Prob.
$\Delta^4 L_1OR$	0.7681	0.0000	0.4114	0.0000
Δ^4ERRCORR	-	-	0.5232	0.0000
Δ^4GDPC	-4.86E-09	0.9926	-2.57E-07	0.0000
Δ^4GDPC^2	-1.86E-12	0.9035	-	-
$\sum resid^2$	0.0335		0.0135	
J-stat.	28.06		22.54	
Prob(J-stat.)	0.3554		0.7093	

OBS: When tried -4-8 number of instruments higher than number of observations.

TABLE 12: TWO-YEAR GROWTH MODELS

Variable	Two-year growth					
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
$\Delta^2 L_1OR$	0.4966	0.0000	0.4924	0.0000	0.4812	0.0000
Δ^2ERRCORRL3	-	-	-	-	0.0593	0.0000
$\Delta^2 L_3GDPC$	-4.75E-07	0.0000	-3.93E-07	0.2812	-4.05E-07	0.0000
$\Delta^2 L_3GDPC^2$	2.03E-12	0.1024	-	-	-	-
$\Delta^2 L_3URB$	-	-	5.45E-04	0.0000	5.10E-04	0.1400
$\Delta^2 L_3GINI$	-	-	4.74E-04	0.0000	4.17E-04	0.0000
$\sum resid^2$	0.0287		0.0287		0.0269	
J-statistic	28.63		27.00		27.53	
Prob(J-statistic)	0.3792		0.3559		0.3299	

FIGURE 1: BUSINESS OWNERSHIP RATE VS. INCOME

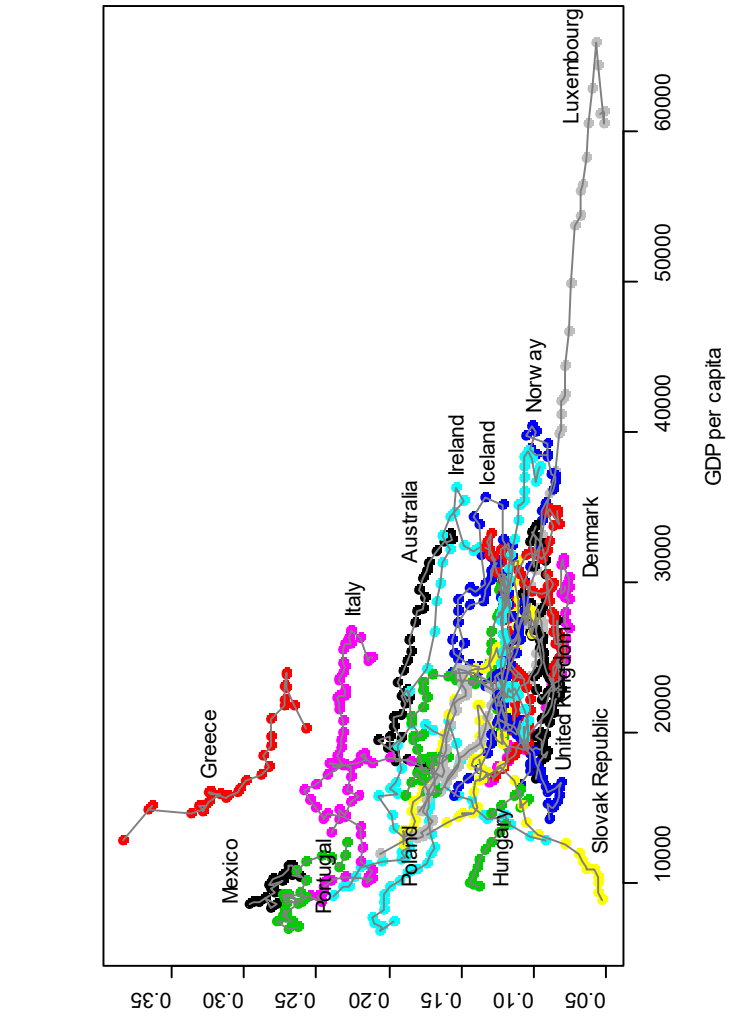

FIGURE 2: BUSINESS OWNERSHIP RATE MEAN AND STANDARD DEVIATIONS