Entrepreneurship, growth and unemployment: A panel VAR approach

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Entrepreneurship Targeting Policies, Technological Growth, and Unemployment

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ABSTRACT

Technological growth, entrepreneurship, and unemployment influence each other in numerous ways, forming a trio of inter-related components, yet the literature has traditionally emphasized the endogenous determination of one or two components of this trio. In this study we intend to elaborate on the interrelationship between entrepreneurship, unemployment and economic growth in a dynamic context using vector auto-regressions (VAR) with panel data across 30 OECD countries for a period covering 1970 to 2011. We use data from the Compendia dataset to estimate three empirical specifications for entrepreneurship, growth, and unemployment. On the right-hand side (RHS) of them there are lags of entrepreneurship, unemployment, and growth in our benchmark model, which we later enrich by including control variables according to the relevant literature. Each equation is estimated with Difference GMM and System GMM estimators. Moreover, an AR(2) model with additional control variables that include the degree of market capitalization and the equity level is estimated with system GMM. The results are enhanced by including macro-economic variables such as R&D spending, Taxes and Wage levels in our specifications. Finally, we use a Propensity Score Matching (PSM) estimator to overcome a selections bias in a country's decision to perform entrepreneurship targeting.

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1.Introduction

The notion of entrepreneurship has gained a place in the epicenter of economic thinking and empirical research during the past twenty years. Part of this development is the paradigm shift in the majority of the industrial countries, where small and medium-sized enterprises (SMEs) have increased their activity share after the 1970s (Wennekers & Thurik, 1999, Audretsch & Thurik, 2001). On top of that, the relationship between entrepreneurial activity and key macro-economic variables like economic growth, unemployment and interest rates has drawn the interest of economic scholars generating interesting results and policy propositions. The key in understanding these relationships is to realize their dynamic nature (Plehn-Dujowich, 2009). More specifically, entrepreneurship affects economic growth and employment, which in turn spur feedback effects as well as effects on one another (see for example Galindo&Mendez, 2013).

The purpose of this paper is to analyze the dynamic effects between entrepreneurship, economic growth and unemployment through a panel Vector Autoregressive Model (VAR) for 30 OECD countries during the period from 1970 to 2011. By looking at the estimates of the lagged coefficients we aim to gauge the potential positive impact of economic growth on future entrepreneurship as embedded in the increased number of business owners (Audretsch & Thurik, 2001). The employment of the VAR model also aims to simultaneously measure the feedback effect from entrepreneurship on economic growth. The hypothesis to be tested is that the shift towards self employment and the focus in SMEs in advanced economies can have growth enhancing effects. The latter result can be of great importance in the context of the recent recession in the Euro-zone and could provide fruitful policy implications towards the promotion of entrepreneurship. The postulated positive feedback channel from past unemployment to entrepreneurship could also be a key element in policy analysis given the high levels of unemployment in the OECD and especially the EU. The "refugee effect" ; that

is high unemployment leading to increases in the number of self employed could be seen as the initial force behind the transmission from entrepreneurship to growth. Hence, these relationships in common imply a virtuous circle towards economic growth and lower unemployment.

Apart from the aforementioned estimations, this paper focuses on other macroeconomic and institutional variables that affect entrepreneurship, growth and unemployment. This issue is addressed by estimating dynamic panels for each one of the dependent variables including two lags and independent variables to control for financial characteristics (market capitalization and equity financing) as well as tax revenues, population, R&D spending and wages.

According to Audretsch & Thurik (2001) the developed countries are undergoing a fundamental shift towards the knowledge-based economy after the two oil crises in the 1970s. Globalization and the innovations in the communication sector have diminished the comparative advantage of the developed countries in the traditional economic activities of the 20th century. This development is followed by the increased importance of SMEs in the OECD countries. Carree & Thurik (2002) recognize this shift as the sequence of the two Schumpeterian technology regimes[1].They authors summarize the recent developments as a move from a Schumpeter Mark II to a Schumpeter Mark I regime (see also Wennekers&Thurik, 1999). Complementary to Audretsch & Thurik (2001), Carree & Thurik (2002) identify the increased demand for variety as income and wealth rose in the advanced economies and deregulation as key drivers behind this creative destruction. In Europe the role of entrepreneurship and SMEs is highly valued and reflected in the 'Entrepreneurship 2020

[1] The Schumpeter Mark I regime describes the process of creative destruction, where the innovative new enterprise renders the existing technologies and enterprises obsolete. The Schumpeter Mark II regime describes the creative accumulation undertaken by large firms that outperform small ones by investing in R&D creating feedback mechanisms

Action Plan' (European Commission, 2012). In the context of the financial crisis of the past six years, SMEs are considered as a force of potential growth and job creation (European Commission, 2013), especially in the European South. Moreover, the Entrepreneurship 2020 Action Plan revolves along three pillars; incorporating entrepreneurship in the educational system and training, removing structural barriers to entrepreneurship and fostering the entrepreneurial culture in Europe. Darvas (2013) also addresses the problem of SME financing during this time of credit constraints and corroborates the view that entrepreneurial activity is a priority for solving the Euro-crisis.

Despite its importance the notion of entrepreneurship is not unambiguously defined theoretically and also difficult to measure empirically (Wong et al. 2005). Wennekers & Thurik (1999) describe it as an '[…] ill-defined, at best multi-dimensional concept', whereas in one of its publications OECD acknowledges that the organization has contributed to this confusion since it uses many different definitions in its reports (OECD, 2008). Galindo & Mendez (2013) underline that innovation is a similar but not synonymous aspect, because not all innovation takes place in new enterprises and not all entrepreneurs are innovators. Addressing and assessing the multiple definitions of entrepreneurship is beyond the scope of this paper[2], however measuring entrepreneurial activity is crucial in order to carry out an empirical project. It is quite evident that, given the theoretical drawback of a lack of definition, identifying the correct variable to measure entrepreneurship is a burdensome task. Braunerhjelm (2010) notes that it is a set of abilities embodied in an individual; hence every effort to measure entrepreneurship is bound to be erroneous to a point. Wong et al (2005) acknowledge the caveats in fully capturing a multi-dimensional concept. The absence of a consensus on the topic has lead empirical researchers to use different measures of entrepreneurial activity, which partly explains the variety of results (as noted by Acs & Desai,

[2] For a thorough overview of the various definitions of entrepreneurship see Braunerhjelm (2010) pp. 9-10.

2008) as we shall see in the following section. The strong connection between self-employment and entrepreneurship (see Plehn-Dujowich, 2010) has promoted the use of the share of self-employed over total employment as a popular measure (Salgado-Banda, 2005, van Stel et al. (2007), Acs et al, 2004 and Plehn-Dujowich & Li, 2008). Another variable of choice in the empirical literature is the entry and death rate of firms, which captures the concept of Schumpeterian creative destruction (see Plehn-Dujowich, 2010, Wennekers et al., 2005, Acs & Armington, 2004). Finally, the evolvement of the Global Entrepreneurship Monitor (GEM) since 1999 and the World Bank Group Entrepreneurship Survey (WBGES) since 2007 have provided datasets of variables measuring entrepreneurial activity in a variety of ways[3]. Van stel, Carree & Thurik (2005), Wong et al. (2005) and Galindo & Mendez (2013) use the GEM dataset in their research.

The empirical analysis consists of three steps: (1) a panel VAR(1) of three equations linking entrepreneurship, growth and unemployment, where each equation is estimated using differnence GMM (Arellano & Bond, 1991) and system GMM (Arellano & Bover 1995, Blundell & Bond, 1998), (2) an econometric model, which allows to take into account the endogeneity (by specifying a dynamic equation), estimated using the SystemGMM estimator, proposed by Blundell and Bond (1998) and (3) we use the Propensity Score Matching (PSM) technique to control for the selection bias problem. The policy characteristic we wish to observe is *entrepreneurship targeting,* that is if a country is determined to increase its levels of entrepreneurship as expressed by the ratio of business owners in the labor force. This paper is organized as follows. We review the literature in Section 2; describe the data sources and the choice of variables in Section 3; Section 4 deals with the econometric specifications and Section 5 discusses the results of the empirical procedure.

[3] A description of the two datasets, their similarities and differences can be found at Acs & Desai (2008).

2. Entrepreneurship and Economic Factors

In recent years a strong belief that 'entrepreneurship' is a crucial driver of economic growth for both developed and developing nations has emerged among both scholars and policy makers (see, for instance Audretsch, Keilbach and Lehmann, 2006 and, for a comprehensive survey, Van Praag and Versloot, 2007). However, moving from macroeconomic scenarios to the micro foundations of entrepreneurship, since the seminal contribution by Baumol (1990) we have known that 'Shumpeterian innovative entrepreneurs' coexist with 'defensive and necessity entrepreneurs', the latter being those who enter a new business not because of market opportunities and innovative ideas, but merely because they need an income to survive. For obvious reasons, this kind of 'survival-driven' self-employment is particularly diffused in the Developing Countries (DCs) (see Naudé, 2009 and 2010), where poverty and lack of formal opportunities in the wage sector often push a large number of people into 'entrepreneurial' activities ranging from street vending to traditional and personal services (in most cases within the informal sector of the economy, see Ihrig and Moe, 2004; Maloney, 2004). Empirically a world-wide research project, the 'Global Entrepreneurship Monitor' (GEM), has been collecting survey data using standardized definitions and collection procedures on potential and actual entrepreneurship since 1999, and now covers 60 developed and developing countries; see Zacharakis, Bygrave and Shepherd, 2000; Reynolds et al., 2005; Acs, Desai and Klapper, 2008. This project reports the rates of business start-up and of self-employment across different countries of the world, but makes it clear that these statistics comprise both 'opportunity-motivated' entrepreneurs and those driven by necessity, the latter being defined as those who have started their own firms as a consequence of the following personal situation: "because they cannot find a suitable role in the world of work, creating a new business is their best available option" (Reynolds et al., 2005, p.217).

Several studies have investigated the relationship between entrepreneurship and basic macro-economic variables, mainly economic growth and unemployment. Most of the studies, as we shall see below, examine these relationships in pairs, assuming a casual relationship with definite direction. Nevertheless, theoretical foundations as well as empirical research points out that the effects between these variables are most likely dynamic and have to be considered and estimated as such. In the relevant literature there exists a variety of papers considering these pair-wise relationships theoretically and empirically (Carree et al, 2007, Koellinger & Thurik, 2009, Salgado & Banda, 2005, Berthold & Grunder, 2012) .

The first channel estimated is the potential effect of entrepreneurship on economic growth. The traditional growth theory fails to acknowledge the value of entrepreneurship (Wennekers & Thurik, 1999), since in the market equilibrium there is no room for the profits of entrepreneurs. In the endogenous growth theory, however, emphasis is given to the role of the research sector as an engine of growth (Romer, 1986, 1990). Innovation is considered to be the driving force for technological change in a model of creative destruction, where incumbents are replaced by innovators who enjoy monopoly profits until the too become obsolete in the model developed by Aghion & Howitt (1992). Despite the fact that the two concepts are closely correlated, it must be underlined that entrepreneurship and innovation are not identical.

Acs & Varga (2004) elaborate on the function of entrepreneurship as reducing the 'knowledge filter'. In endogenous growth theory knowledge is assumed to be accessed by everyone serving as a public good (Audretsch & Keilbach, 2008), however the authors distinguish between this 'free' knowledge and tacit knowledge that cannot diffuse at its entirety. In this case entrepreneurs become the transmitters of this new knowledge, thereby increasing economic growth. Audretsch & Keilbach (2008) note that, it is because of the high degree of uncertainty related to knowledge that the entrepreneurs serve as a conduit for the

transmission of new ideas. They confront the risk of the aforementioned uncertainty and create new knowledge and therefore reduce the 'knowledge filter' that stands between knowledge and the commercialization of this knowledge. In the same line of theory, Block et al. (2012) emphasize the role of the entrepreneurs in creating innovations to transmit the new knowledge to the market. Innovations are divided into *new-to-market* and *new-to-firm*. The former are calculated as the shares of turnover attributable to new or improved products in the market, whereas the latter as the same amount in the firm level. Both of them are modeled against the rate of knowledge-intensive firms, the entrepreneurship rate and the level of GDP per capita in their analysis. Knowledge intensity appears to have a significant positive effect on new-to-market innovation; however the entrepreneurship coefficient is not significant. Nevertheless, the interaction of the two variables proves to increase innovation significantly, thus exposing a moderation effect of entrepreneurship in the transmission of new knowledge. Moreover, van Stel et al. (2005) add that apart from generating knowledge spillovers, entrepreneurs increase competition and work longer hours than wage-earners, thus enhancing economic performance. According to Braunerhjelm (2010), the positive effect of entrepreneurship and productivity in the micro level is well established in the empirical literature.

Salgado-Banda (2005) uses data for 22 OECD countries during 1975-1998 with GDP growth as the dependent variable and self-employment as a share of total employment and patents as proxies for entrepreneurship. Only patents appear to be positively correlated with growth in a dynamic panel including lagged growth. In the simple cross-section with average growth for 1980-1995 as the dependent variable, self-employment is insignificant and patents become insignificant once control variables are included. Berthold & Grundler (2012) estimate a

growth regression with a five-year moving average of economic growth as the dependent variable in a panel of 188 countries from 1980 to 2010. They include entrepreneurship in the standard growth regression model proposed by Barro & Lee (2005) either through the self-employment rate or through TEA. They adjust the self-employment rate by the percentage of micro firms (occupying less than nine employees) in the country to find significant effect on growth. The results are validated when TEA is included as the entrepreneurship variable. Galindo & Mendez (2013) estimate three separate panels for growth, innovation and entrepreneurship to find that both innovation (approximated by number of patents) and entrepreneurship represented by TEA from the GEM dataset prove to enhance growth significantly. Moreover, signs of feedback are presented since economic growth promotes entrepreneurship. This concept is addressed also by Carree & Thurik (2007) who argue that firms take time to adjust to new tastes and new technology. In their specifications with seven period lags, the immediate effects on growth are positive and significant, while the positive long-term effects fail to show significance. Audretsch & Keilbach (2008) argue that the 'entrepreneurship capital' of a certain region can increase growth through facilitating the knowledge spillovers and through enhancing regional diversity. The use data for 440 German regions and conclude that the rate of start-ups, especially high-technology ones, has a positive effect of growth. Mueller (2006) also hypothesizes that entrepreneurship 'penetrates the knowledge filter'. There is a gap between the creation of knowledge and its commercialization; that is transforming it into products and processes that contribute to growth. In his study for German regions from 1992-2002 he regresses regional gross values added on the number of new ventures per 1000 employees, private and public R&D spending to find that new ventures stimulate regional growth. As in Audretsch & Keilbach (2008), new firms in the high-tech sector prove more effective. Plehn-Dujowicj & Li (2008) highlight the two contradicting effects of entrepreneurship. On the one hand, there is the positive effect

through innovation (the 'entrepreneurship effect') and on the other there is the negative effect because workers leave production (the 'production effect'). They conclude that this leads to a non-monotonic effect of entrepreneurship effect on growth, more specifically an inverted U-shape effect. They test their theory using data from the NBER-CES manufacturing productivity database for the U.S. for 76 sectors from 1983 to 1999. To capture the non-linear relationship they add a quadratic term which proves to be negative and significant in all their estimations. The implication of these results is that an optimal level of self-employment exists. Acs et al. (2004) use a set of 20 OECD countries from 1981-2001 and define entrepreneurship as the share of non-agricultural self-employed over the total working force. The interaction term between entrepreneurship and R&D spending proves positive and significant underlining the complementarities between new ideas and entrepreneurship. Wong et al. (2005) use the GEM database and distinguish between different aspects of entrepreneurial activity (TEA). However, in their estimations they find that only High-Potential TEA causes more growth. Average annual growth (1999-2003) for 36 OECD countries is the dependent variable in the analysis of van Stel et al. (2005), who include initial GDP per capita and the Growth Competitiveness Indicator (CGI) from the Global Competitiveness Report of the World Economic Forum as controls. They also use an interaction term initial GDP with TEA to check for non-linearities. According to van der Zwan et al (2013) different types of entrepreneurs are concentrated in different countries according to the technological environment. That is, a high stock of knowledge in the economy attracts knowledge-specific activities. The authors employ data for 70 countries from 2001 to 2009 and distinguish between three types of TEA and the level of economic development. They conclude that it is high-technology TEA that drives the positive relationship between the two variables for all countries in the sample.

Apart from the conclusions on the positive effect of entrepreneurship on growth, it is of pivotal importance to understand the bi-directional causality in this nature. Wennekers & Thurik (1999) postulate a U-shaped relationship between a country's level of economic development and entrepreneurial activity. Wennekers et al. (2005) validate this result using a set of 36 advanced economies. Nascent entrepreneurship is the dependent variable and the concave relationship is confirmed both when per capita income and the innovative capacity index are used as a metric of economic development. The issue of reverse causality is addressed with two simultaneous equations for growth and entrepreneurship, estimated with 3SLS, in Audretsch & Keilbach (2008). Growth rate of GDP exhibits a positive significant coefficient in 75% of the specifications. On average a one percentage point increase in the growth rate increases the start-up rate by 50%. Given the dynamic nature of this relationship (see Plehn-Dujowich, 2010), a Vector Autoregressive (VAR) approach is also proposed in the literature. Holtz-Eakin & Kao (2003) estimate a three equation VAR(1) for Total Factor Productivity (TFP), birth rates and death rates of firms, to capture the notion of creative destruction and the forces behind it. The impulse response functions reveal that a productivity shock positively affects birth rates; however this effect dies out quickly. Galindo & Mendez (2013) reveal a strong feedback effect of growth on entrepreneurial activity in all of their specifications. A two equation VAR is implemented in the study of Carree et al. (2007), who deduct that the best fitted relationship is actually L-shaped, indicating that the fall of entrepreneurship with GDP is halted but does not seem to be reversed. Plehn-Dujowich (2010) estimates a three equation panel VAR to find that past growth increases the net entry rate in 4 out of 10 sectors (Granger-causality) and that none of the sectors shows negative feedback from TFP growth on entrepreneurship. Fritsch et al. (2013) include the HP filtered GDP in the regressors for and find that the cyclical component of GDP has a negative effect on the annual number of business registrations. This result is concomitant with the

implication that different stages of growth have different effect on entrepreneurship. The relationship between entrepreneurship and the business cycle is the epicenter of the work of Koellinger&Thurik (2009, 2012). They decompose the GDP series into trend and cycle components through the HP filter and estimate a VAR (2) model both in a sample of 22 countries (1972-2007) and for each country individually. The data reveal that an unexpected 1% rise in entrepreneurship (measured as the share of business owners over the labor force) is followed by a 0.19% increase in real GDP after one period in the global sample. Nevertheless, they fail to establish Granger-causality from economic growth to entrepreneurship neither in the global nor in the national level.

Another interesting relationship is the one between entrepreneurship and employment. Two diverging forces are recognized in this relationship (Thurik et al., 2008): The 'Refugee effect' according to which high unemployment leads to higher rates of self-employment (through the unemployment-push effect) and the 'Entrepreneurial effect', which captures the employment opportunities created by start-up firms. Nevertheless, both effects should be approached with caution, according to the authors. The unemployed usually possess little human capital and wealth to start a business. Furthermore, high unemployment usually coincides with periods of economic downturns, where opportunities for new business formation are restricted. A far as the creation of employment by new firms, their low survival rates renders the total contribution to employment modest at best. Van Stel & Storey (2004) point out that new firms create jobs through increased competition to the incumbent firms and through innovation which leads to higher long-term growth. On the other hand, they underscore the small proportion of the job rate that the new firms account for, the modest innovation experienced in practice and the variation of employment creation as mitigating factors. Carree & Thurik (2007) recognize both positive and negative effects of start-ups on employment. The immediate, direct effect is definitely positive but the medium-term effect

governed by the low survival rate and the crowding-out of incumbents is negative. In the long term, however, supply side effects kick in and generate employment through innovation and greater competition in the market. In their seminal paper, Audretsch & Thurik (2001) test the effect of lagged entrepreneurship (measured by share of self-employed per labor force) on unemployment change for 23 OECD countries for the period 1974-1994. The data is organized into three time cohorts (1974, 1984, 1994) to capture long-run effects. Lagged entrepreneurship change proves to reduce unemployment in their calculations. Carree & Dejardin (2011) distinguish between market-room and unemployment push self-employment using data from Belgian firms for a period between 1999 and 2001. What spurs entrepreneurship is the deviation from the 'equilibrium' number of firms in a specific industry in a local market, as well as the local unemployment rate. In their findings we can see a moderate support of the error-correction mechanism (the convergence to the equilibrium rate of self-employment) and strong indication of unemployment-push effects in the entry and exit of firms. Van Stel & Storey (2004) use two different sets of equations for the 1980s and 1990s in Great Britain. Employment change is regressed on the sectorally adjusted start-up rate, population growth and wage growth to reveal an interesting result. Only the 1990s set indicates a positive effect of entrepreneurship on employment, possibly revealing the paradigm shift observed in advanced economies towards self employment. Also, augmenting the lag length shows that long-run effects are more prominent. The same consensus is reached by Audretsch & Fritsch (2003) for Germany during the same time period. Carree & Thurik (2007) find an S-type relationship when examining the effect of the change in business owners on employment. Their data for 21 OECD countries foe a time span between 1972 and 2002 give support to the positive direct effect on job creation, which dies out. Nevertheless, the coefficient for the 6-year lag of entrepreneurship appears positive which indicates a reversal of the relationship and the consolidation of long-run supply side

effects of entrepreneurial intensity. Noseleit (2011) highlights that the channel through which entrepreneurship spurs employment is the sectoral reallocation of factors of production. The existing firms fail to restructure due to high costs and nascent firms usually operate in new sectors. He analyses data for German regions between 1975 and 2002 using two measures as proxies for sectoral reallocation. First, the similarity between the activity of new firms and incumbents and second the similarity between the structure of entering firms and the initial sectoral structure in the region. The dependent variable is the long-run employment change between 1983 and 2002. Reduced similarity between entering and existing firms reduces unemployment significantly and so does low similarity with the initial structure in the region. Acs & Armington (2004) emphasize on the role of entrepreneurship as a conduit for knowledge spillovers. They also find that new birth rates significantly ameliorate unemployment. Thurik et al (2008) argue that there exists an optimal level of entrepreneurship and that deviation from that threshold has a negative effect on employment. However, according to their calculations, the majority of countries exhibit a lower-than-threshold entrepreneurship level (as measured by the share of self-employed). Hence an increase towards that threshold is expected to have a diminishing effect on unemployment. The authors estimate a two equation VAR(2) with unemployment change and entrepreneurship change as the left-hand side variables. Self-employment is shown to Granger-cause unemployment to decrease and high unemployment Granger-causes entrepreneurship to increase, giving support to the 'Refugee effect' described above. Fairlie (2013) reaches a similar conclusion in his examination of 250 metropolitan areas in the U.S. from 1996-2009. The probability of becoming an entrepreneur is the dependent variable in his empirical specification. An increase in the local unemployment rate by five percentage points is estimated to increase this probability by 0.04 percentage points. The currently unemployed are more likely to start a new business than wage earners according to the

results. Fristch et al. (2013) also find that lagged unemployment increases entrepreneurship and Plehn-Dujowich (2010) concludes that unemployment Granger-cause entrepreneurship in three out of ten sectors in his 3 equation VAR described above.

Finally, the relationship examined in this stream of literature is the one between growth and unemployment. The nature of this relationship remains ambiguous (Plehn-Dujowich, 2010, Elsby & Shapiro, 2011). In their seminal work Pissarides & Vallianti (2004, 2007) argue that the effect of rises in TFP depends on the extent to wgich new technology is embodied in new jobs. The simultaneous development of falling productivity and growing unemployment after the 1970s in developed economies provides the incentive to test whether these developments are correlated. According to Pissarides & Vallianti (2007) technological improvements generate two choices for a firm: either to upgrade the existing jobs and keep their employees or to lay off part of its working force. The two choices obviously have contradictory effects on total employment. In their empirical analysis they show that the semi-elasticity of employment with respect to TFP growth is 1,23 and significant. This goes to show that a substantial portion of changes in unemployment can be attributed to decreasing productivity. Blanchard & Wolfers (2000) argue that it is the interaction of adverse shocks and adverse labor market conditions that explain the surge in unemployment since 1960. One of these shocks is the deceleration of TFP growth. Using a panel of 20 OECD countries for a period covering 1960 to 1996, they fins that a fall of 3 percentage points in TFP growth increases unemployment by 1,5%. Hatton (2002) also considers the institutions and the shocks as decisive factors in the labor market. He uses a rich dataset for the U.K. covering a period from 1871 to 1990, because productivity growth changes over long time periods. He estimates a two equation model with real wage change and unemployment as dependent variable. They are both affected by productivity growth as well as the lagged deviation between productivity and real wage. An increase in productivity is shown to slow down

unemployment; however TFP alone cannot explain the variation in employment dynamics over time. Benigno & Ricci (2011) implement a three equation VAR model with drifting coefficients for productivity growth, real wage growth and unemployment. Their calculations show that a one standard deviation rise in TFP reduces the unemployment rate by 0.47 percentage points. They also add the volatility of TFP as an explanatory variable to find that a one standard deviation increase in TFP volatility actually increases unemployment by 0.25 percentage points. According to Moreno & Galbis (2012) the effect is non-linear in the sense that a positive TFP growth change increase unemployment for unskilled workers and not for skilled or unskilled workers who are getting trained.

3. Data Sources and Descriptive Statistics

The empirical analysis uses data for 30 OECD countries that cover a time span from 1970 until 2011. All data are taken from the Entrepreneurs International (COMPENDIA) Dataset which combines information from OECD and ILO databases as well as the European observatory for SMEs. The main variables we use are entrepreneurship, economic activity and unemployment.

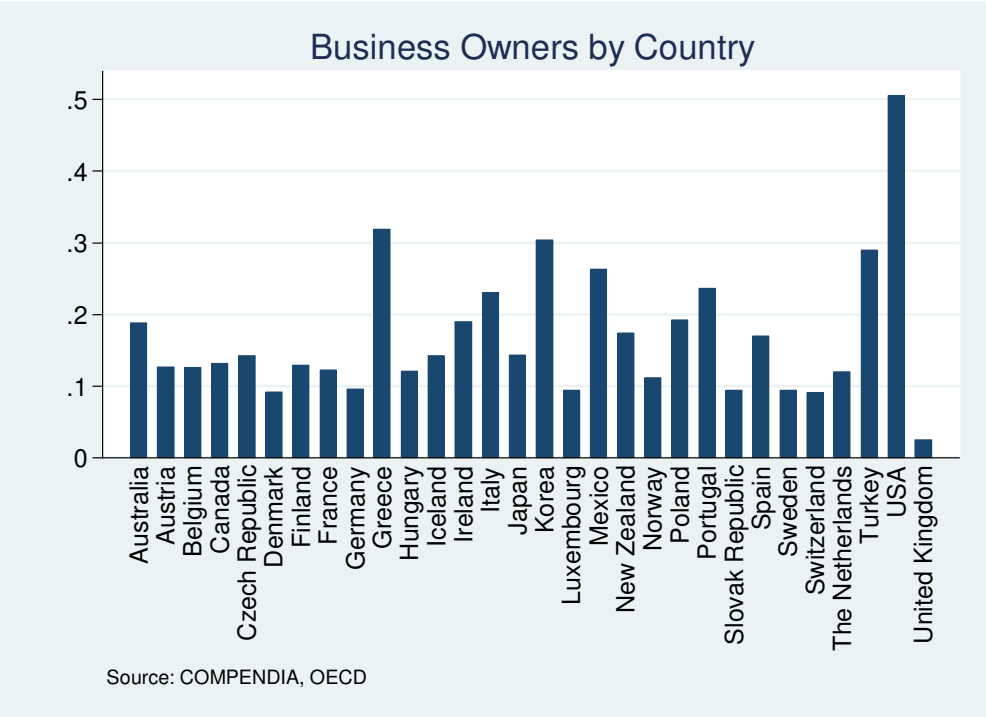
Following Carree& Thurik (2007), Plehn-Dujowich & Li (2008), Acs et al. (2004) among others, we use the number of business owners as a measure of entrepreneurship (bow). The COMPENDIA Dataset provides o harmonized series of business owners, since the standards of measurement of the variable vary across OECD countries. The total number of self-employed in the private sector is included as well as the number of business owners excluding agriculture, hunting, and forestry and fishing (bowx). To capture economic activity we include GDP per capita, which is taken from OECD National Accounts and measured in millions of US dollars at constant prices of 2000, using Purchasing Power Parity (PPP) of the same year (gdp). The unemployment variable (unemp) measures the number of

unemployed divided by the labor force. The main source for the unemployment data is OECD Main Economic Indicators.

A first review of the data indicates the key variables included in the model. The variable through which we approximate the notion of entrepreneurship is the number of business owners in the private sector, to begin with. The mean value in our panel is nearly two-and-a half million people, with the USA exhibiting the highest value throughout the relevant years with more than fourteen million business owners in the whole of the private sector of the economy. The lowest number comes from Iceland, which averages nineteen thousand during the forty years of our sample. Portugal and Greece stand out from the smaller countries as they present a higher number of business owners than, for example Sweden or Austria. To extend our analysis and control for the country size we construct a variable that shows the number of business owners as part of the labor force for each country. Again, the USA account for the highest share with almost 50%, while the Slovak Republic, Sweden, Denmark and Switzerland are the only countries with an average of less than 10%. It is interesting to compare the findings for the absolute number of business owners and the one with the share of business owners over the total of the labor force in each country. While USA and Turkey lead in both categories, we see that smaller countries like Greece and Ireland have a substantial share of entrepreneurs if compared to the labor force in Figure 1:

Figure 1:

Entrepreneurship by country



We then differentiate the dataset into two sub-groups according to the mean value of the GDP per capita. Rich countries average more than 20000$ (the mean value in our sample). It turns out that poor countries outperform the richer ones in terms of both business owners in total and as a share of the labor force. According to our data unemployment averages near 6%, so we use this threshold to divide the countries into high and low unemployment. Countries with relatively high unemployment (average 9%) appear to have a higher number of self-employed both in absolute as well as in relative terms. Moreover, we use expenditures in Research & Development (R&D) by the state as a divisive factor between countries. It turns out that the share of business owners is 3 percentage points lower for countries with R&D expenditures higher than 1,6% of GDP, thus implying that poor performance in research by the government motivates agents to pursue self-employment. Finally, two sub-groups emerge if we account for the share of tax revenues relative to GDP. It is this categorization that provides with the most robust result, since a share of tax revenues above

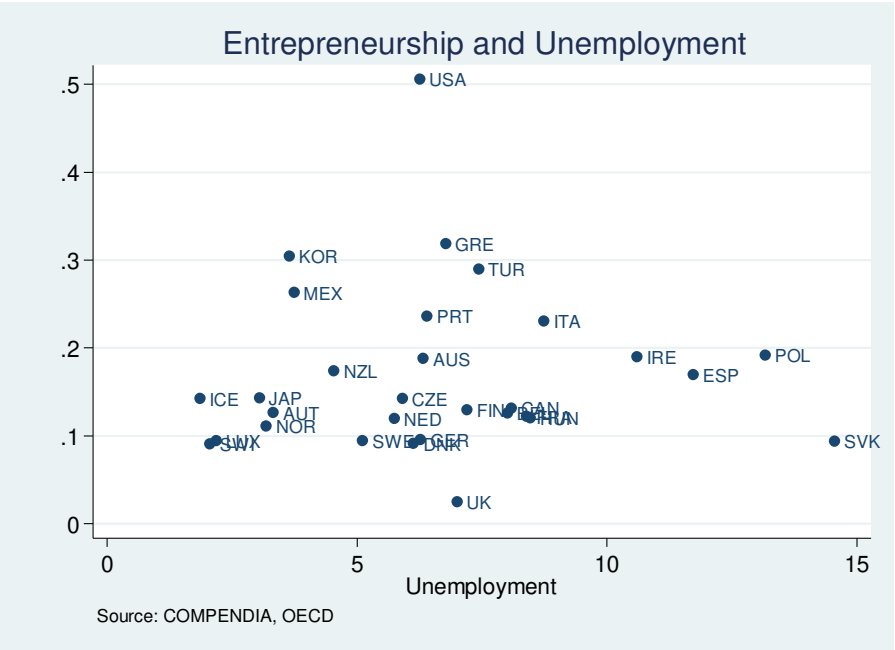
33% of GDP is associated with a share of business owners ten percentage points lower than the share of low taxation countries.

As described above the mean value for GDP per capita in our sample is 20900$ with Norway and Switzerland standing at the top of the table. The level of unemployment averages around 6,2%, which is expected given the construction of our panel from OECD countries. The average unemployment rate for rich countries (as defined earlier) is 6,6 percentage point in comparison to 5,9 for poorer ones. Furthermore, the differential widens between high and low R&D economies to three percentage points higher unemployment for high R&D countries.

There are some stylized facts that are worth mentioning. Firstly, taking country averages over time reveals a modest negative relationship between unemployment and business ownership (Figure 2). Again, the USA stands out as an observation with a high level of business owners per labor force and relatively low unemployment.

Figure 2

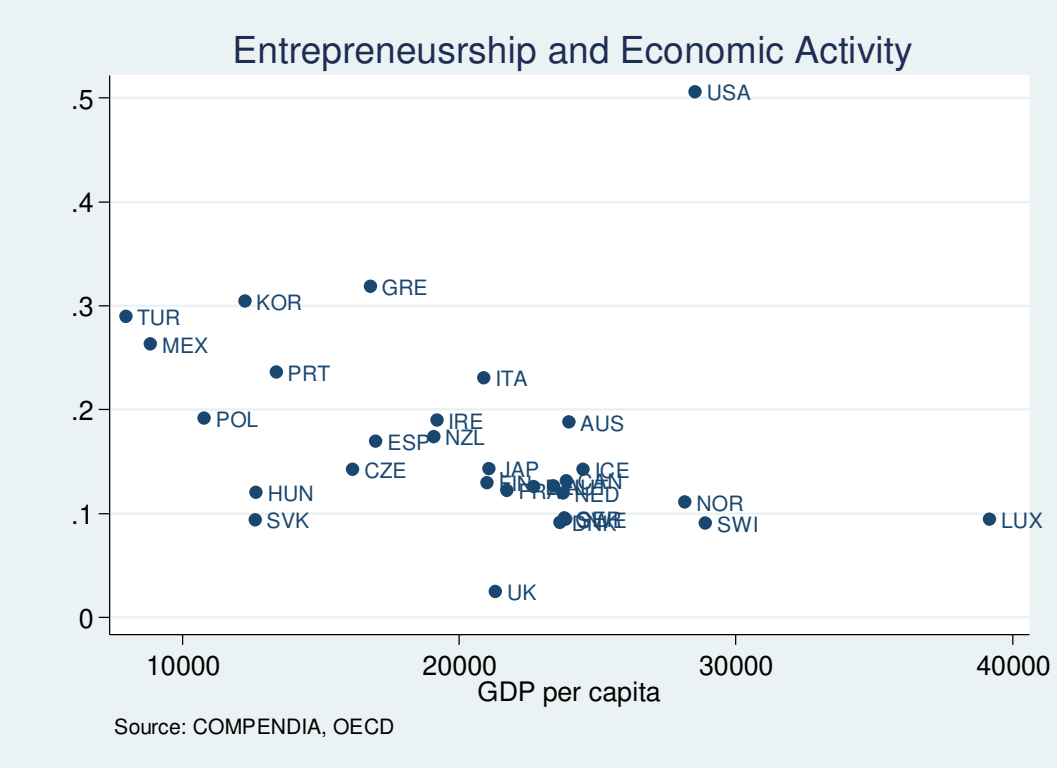
Entrepreneurship and Unemployment – Country Means



The mapping of the data on GDP against the level of entrepreneurship (Figure 3) produces a somewhat unexpected outcome, since it indicates that there is a negative relationship between the number of business owners and economic activity. The effect is more solid once the outliers of USA and Luxembourg are removed as can be seen below.

Figure 3

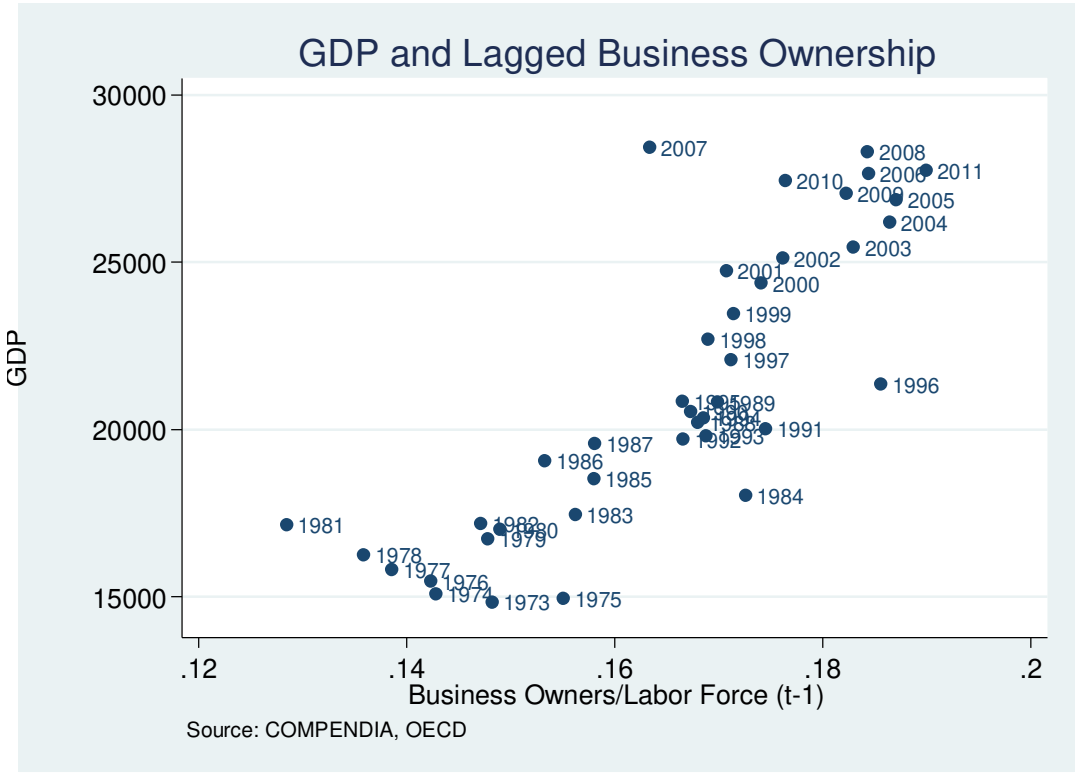
Entrepreneurship and GDP – Country Means



Nevertheless, we have to bear in mind that the relationship between economic activity and entrepreneurship is a dynamic rather than a static one (Carree et al. 2007, Holtz-Eakin & Kao, 2003, Koellinger & Thurik, 2009). It comes as no surprise then that the nature of this relationship changes once we deploy yearly means in our analysis. The following graph (figure 4) verifies a robust positive correlation between GDP and the one-period lagged value of business ownership.

Figure 4

Entrepreneurship and GDP – Yearly Means



4. Empirical Analysis

The data construct an unbalanced panel with 30 cross section units (countries) and 42 time observations. Given the dynamic nature of the relationship between the variables in question we estimate a three-equation Vector Autoregressive Model (VAR) with one lag. The presence of a lagged dependent variable in the right-hand side of each equation renders First Difference (FD) and Fixed Effects (FE) estimators biased. Verbeek (2012) illustrates how the Fixed Effects Estimator is biased and inconsistent and Nickel (1981) shows the magnitude of this bias as the cross sections of the panel reach infinity. Taking first differences does not solve the problem since lagged values of the dependent variable are obviously correlated with lagged values of the idiosyncratic error term. Hence, some form of instrumenting is required to estimate each regression. Anderson & Hsiao (1981) proposed the two-period lagged value of the dependent variable ($y_{i,t-2}$) as an instrument for the first difference ($y_{i,t} - y_{i,t-1}$) since it is uncorrelated with $u_{i,t} - u_{i,t-1}$. Nevertheless, Verbeek (2012) underlines that this IV estimator

imposes only one moment condition in the estimation process. In order to increase the efficiency of the estimators we follow the methodology suggested by Arellano & Bond (1991) who use a list of instruments to exploit additional moment conditions in the first-differenced model. For example for t=2 we have one instrument y_{i0} since

$E[(u_{i2} - u_{i1})y_{i0}]=0$ **(1)**, for t=3 we have two instruments because

$E[(u_{i3} - u_{i2})y_{i0}]=0$ and also $E[(u_{i3} - u_{i2})y_{i1}]=0$. **(2)**

This results into a total of 1+2+3+…T-1= T(T-1)/2 moment conditions. The instruments are the elements of each row of the (T-1xT-1) matrix Zi so that $E(Zi'\Delta u_i)=0$. The GMM estimator proposed by Arellano & Bond (1991) minimizes the following expression

$[N^{-1} \Sigma Z_i' (\Delta y_i - \Delta y_{i,-1})] ' W_N [N^{-1} \Sigma Z_i' (\Delta y_i - \Delta y_{i,-1})]$ **(3)**

, where W_N is a positive definite weighting matrix.

In our results this is referred to as the Dynamic GMM Estimator.

Arellano & Bover (1995) and Blundell & Bond (1998) move one step further from the Dynamic GMM Estimator and impose more moment conditions to improve the efficiency of the estimators. The authors keep the set of exogenous instruments for the differenced equation and add lagged differences of the endogenous variable as instrument for the level equation as

$E(\Delta y_{i,t-1} u_{it}) = 0$ **(4)**

The estimation of this system of two equations yields the System GMM Estimator which we also report in our set of results.

5. Results

Our results from the estimation of the three equation Panel VAR(1) follow the lines of Plehn-Dujowich (2009). It is well known that the magnitude of the coefficients in the VAR has no significant interpretation. Nevertheless, the sign of these coefficients gives us the indication of Granger-causality of one endogenous variable to another (Greene, 2003). The results are summarized in Tables (1) and (2) to differentiate between the use of total business owners and business owners excluding fishing, forestry and agriculture as the entrepreneurship variable. The odd columns represent difference GMM and the even columns represent system GMM estimation.

The estimation reveals a positive and statistically significant coefficient for the effect of past entrepreneurial activity on GDP per capita growth. This effect is more pronounced once the number of business owners excluding forestry, fishing and agriculture is used as the entrepreneurship variable. The results show robustness between Difference and System GMM estimations. These findings corroborate the ones of Plehn-Dujowich (2009) as well as Galindo & Mendez (2013). The feedback effect seems to hold as lagged values of GDP per capita are estimated to have a positive and significant effect on entrepreneurship as in Holtz-Eakin & Kao (2003) and Audretsch & Keilbach (2008). On the other hand, this result does not hold once the System GMM estimator is chosen for the model.

The effect of past unemployment on entrepreneurship is positive yet significant in only two out of six specifications. The inverse relationship is also somewhat inconclusive. In the VAR where business owners excluding fishing, forestry and agriculture is the preferred entrepreneurship variable, it is shown to significantly reduce unemployment as predicted also by Audretsch & Thurik (2001). The use of the total number of business owners does not yield statistically significant estimators.

Probably the most robust result is the one describing the effect of past unemployment on GDP growth. In all specifications the coefficient is positive and significant at a 1% level. Moreover, economic growth is observed to have a positive effect on employment. The coefficient of GDP per capita in the unemployment regressions is negative and significant in

half of them. This provides evidence to the case of Pissarides&Valliante (2004, 2007) who find strong positive effects of Total Factor Productivity on employment.

Table 1

Panel VAR with total number of business owners

	Entrepreneurship			GDP			Unemployment		
Model	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Estimator	Difference GMM	System GMM	AH-IV	Difference GMM	System GMM	AH-IV	Difference GMM	System GMM	AH-IV
Entrepreneurship (-1)	0.911***	1.000***	0.441***	0.0238***	-0.000572	0.0540*	0.0801	-0.0507	-2.252**
	(0.00899)	(0.00190)	(0.103)	(0.00774)	(0.00237)	(0.0288)	(0.232)	(0.0857)	(1.026)
GDP (-1)	0.0255***	-0.00407	0.103**	0.963***	0.961***	0.541***	-0.236*	-0.406***	-14.51***
	(0.00433)	(0.00346)	(0.0417)	(0.00354)	(0.00259)	(0.202)	(0.125)	(0.0939)	(1.871)
Unemployment (-1)	0.000563	0.00178***	0.000526	0.00251***	0.00292***	0.00458	0.884***	0.937***	-0.0178
	(0.000374)	(0.000363)	(0.00127)	(0.000309)	(0.000274)	(0.00320)	(0.0105)	(0.00906)	(0.0786)
Constant	0.354***	0.0358	0.000760	0.208***	0.387***	0.00756	2.664**	4.896***	0.446***
	(0.0502)	(0.0355)	(0.00155)	(0.0439)	(0.0282)	(0.00469)	(1.325)	(1.018)	(0.0577)
Observations	1,013	1,043	984	1,013	1,043	1,012	1,013	1,043	1,011
Number of countries	30	30	30	30	30	30	30	30	30

Standard errors in parentheses

*** p<0.01 ** p<0.05 * p<0.1

Table 2

Panel VAR with Business owners excluding agriculture, fishing and forestry

	Entrepreneurship			GDP			Unemployment		
Model	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Estimator	Difference GMM	System GMM	AH-IV	Difference GMM	System GMM	AH-IV	Difference GMM	System GMM	AH-IV
Entrepreneurship (-1)	0.717***	0.948***	0.284***	0.0421***	0.00451**	0.0463**	-0.282	-0.135*	-1.658**
	(0.00876)	(0.00352)	(0.0265)	(0.00613)	(0.00224)	(0.0220)	(0.183)	(0.0804)	(0.841)
GDP (-1)	0.172***	-0.0119**	0.134***	0.943***	0.961***	0.522***	-0.000826	-0.335***	-14.11**
	(0.00747)	(0.00569)	(0.0486)	(0.00494)	(0.00283)	(0.194)	(0.167)	(0.103)	(1.879)
Unemployment (-1)	0.00178***	1.23e-05	-0.000820	0.0022***	0.0028***	0.00435	0.884***	0.934***	-0.00394
	(0.000507)	(0.000579)	(0.00130)	(0.000306)	(0.000277)	(0.00301)	(0.0108)	(0.00926)	(0.0806)
Constant	0.133***	0.471***	0.00723***	0.296***	0.361***	0.00763*	2.712***	4.747***	0.449***
	(0.0464)	(0.0535)	(0.00167)	(0.0282)	(0.0252)	(0.00445)	(1.019)	(0.925)	(0.0601)
Observations	1,019	1,049	993	1,019	1,049	1,017	1,019	1,049	1,015
Number of countries	30	30	30	30	30	30	30	30	30

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results in Table (3) refer to the estimation of the linear dynamic panel data model with the use of the System-GMM estimator (Blundell & Bond, 1998). All three dependent variables show a strong persistence, which is highlighted by the positive significant coefficient of the lagged dependent variable, as depicted in the first row of the table. Columns 2,4 and 6 report the results with the inclusion of a second lag, however it appears to be insignificant in all specifications. The same conclusion holds for the binary variables indicating common language and the participation in the monetary union. The final two rows of the table yield significant results for two categorical variables. Firstly, the degree of market capitalization ($d^{MARK\ CAPIT}$) appears to be positively correlated with the share of business owners and GDP. More specifically, column 1 indicates that an upward shift of one unit in the degree of market capitalization increases the share of business owners in the labor force by 3,2%. It is noteworthy that the same variable appears to raise unemployment significantly (columns 5,6). Finally, the degree of equity as a share of leveraging for enterprises is characterized by positive and significant coefficients for the regressions with business ownership and GDP as the dependent variable but not so for unemployment. We also perform the diagnostic check for serial correlation (Arellano-Bond test) in the error terms. Given the fact that the test is performed in the differenced specification, the null hypothesis of no autocorrelation is strongly rejected for the AR(1) model. No autocorrelation for the differenced error terms implies that the original error terms follow a random walk (Greene, 2003). Second order autocorrelation would imply misspecification in the model; however we fail to reject the hypothesis of no autocorrelation in our specification. In addition, the output of the Hansen J-test for over-identification is presented at the bottom of the table. The p-values indicate that we fail to reject the hypothesis that the instruments implemented are valid.

Table 3

Baseline Model

	Entrepreneurship		GDP		Unemployment	
Model	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Estimator	GMM -SYS	GMM-SYS	GMM-SYS	GMM-SYS	GMM-SYS	GMM-SYS
Lagged Dependent Variable	0.979* (0.402)	0.932* (0.473)	0.785** (0.286)	0.937** (0.285)	0.522* (0.217)	0.595*** (0.057)
Lagged (2) Dependent Variable		0.002 (0.012)		0.289 (0.415)		0.595 (0.667)
d^{LUG}	0.398 (0.332)	0.452 (0.332)	0.348 (0.501)	0.654 (0.459)	0.657 (0.476)	0.816 (0.537)
d^{UNION}	0.102 (0.065)	0.175 (0.128)	0.117 (0.230)	0.338 (0.602)	-0.489 (0.544)	-0.366 (0.244)
$d^{MARK\ CAPIT}$	0.032* (0.014)	0.047* (0.023)	0.039* (0.025)	0.057* (0.032)	0.507** (0.120)	0.697* (0.320)
$D^{EQUITY\ LEV}$	0.185* (0.086)	0.197* (0.102)	0.305* (0.171)	0.426* (0.185)	0.161 (0.746)	0.266 (0.847)
Constant Time dummies	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
N. instruments	64	72	72	75	71	71
Arellano-Bond serial correlation tests						
AR(1)	-7.653	-5.924	-5.367	-6.737	-6.884	-7.781
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-1.097	0.264	0.293	0.198	-0.359	-0.538
p-value	[0.272]	[0.792]	[0.769]	[0.843]	[0.720]	[0.591]
Overidentification test (Hansen J)						
Chi-squared	62.852	107.547	105.190	153.722	83.255	77.310
p-value	[0.976]	[0.285]	[0.268]	[0.003]	[0.963]	[0.980]

Notes: each equation assumes time dummies as exogenous variables and the lagged y and d as predetermined variables. The second, third and fourth lags of *y* and all lags from t-3 of *d*s are used as instruments

Table (4) enhances the results by taking into consideration key macro-economic variables. Before turning to their effects, it is worth mentioning that the autoregressive component remains positive an statistically significant for all dependent variables. On the other hand, the indicator variable capturing market capitalization loses its significance in all but three regressions and is smaller in magnitude compared to the results from table 1. The most robust results from the inclusion of macro-economic variables comes from the R&D expenditures which appear to increase business ownership as well as GDP, a result compatible with endogenous growth theory. Notably they also have an implied negative effect on employment, perhaps indicating a substitution effect between new technology and labor. Finally, wages only have a significant effect on unemployment-positive as expected. The same specification tests are applied in this set of estimations. Again, we fail to reject the hypothesis of no serial autocorrelation of order 2 for the error terms and also the results of the Hansen J test point towards valid instruments used in the estimation.

Table 4

Model with Macroeconomic control variables

	Entrepreneurship			GDP			Unemployment		
Model	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Lagged Dependent Variable	0.549***	0.962***	0.925***	0.966***	0.944***	0.784***	0.817***	0.584***	0.520***
	(0.121)	(0.079)	(0.097)	(0.062)	(0.067)	(0.116)	(0.093)	(0.062)	(0.055)
$d^{MARKET\ CAP}{}_{i,\,t-1}$	-0.004	-0.013	-0.004	0.028*	0.023*	0.031*	0.269	0.197	-0.052
	(0.020)	(0.014)	(0.014)	(0.016)	(0.008)	(0.015)	(0.377)	(0.664)	(0.531)
d^{LUG}	0.015	0.009	0.041	0.023	0.021	0.243	-0.260	-0.171	-0.086
	(0.035)	(0.031)	(0.033)	(0.032)	(0.034)	(0.234)	(0.255)	(0.336)	(0.330)
Pop_{it}	0.024	0.025	0.040	0.518	0.519*	0.367*	0.710***	0.762**	0.766*
	(0.034)	(0.034)	(0.034)	(0.232)	(0.245)	(0.170)	(0.254)	(0.378)	(0.423)
$Tax_{i,\,t-1}$	-0.030	0.016	0.042	0.054	0.071	2.353	2.343	0.510	0.519
	(0.041)	(0.012)	(0.027)	(0.073)	(0.073)	(2.356)	(3.172)	(1.466)	(1.452)
RD_{it}		0.291***	0.178***		0.139***	0.101***		0.342*	0.303*
		(0.030)	(0.035)		(0.030)	(0.026)		(0.157)	(0.156)
$Wage_{it}$			0.078			0.131			0.351*
			(0.097)			(0.105)			(0.152)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. instruments	53	69	51	67	67	65	47	74	90
Arellano-Bond serial correlation tests									
AR(1)	-3.482	-5.713	-5.329	-8.407	-8.230	-5.021	-5.605	-6.408	-6.535
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.368	0.447	0.102	2.150	2.112	1.368	1.663	-0.690	-0.822
p-value	[0.713]	[0.655]	[0.919]	[0.032]	[0.035]	[0.171]	[0.096]	[0.490]	[0.411]
Overidentification									
Chi-squared	44.934	103.527	81.151	116.268	107.451	71.598	57.635	91.144	117.891
p-value	[0.949]	[0.306]	[0.891]	[0.700]	[0.855]	[0.986]	[1.000]	[1.000]	[1.000]

In the final set of estimations we perform the Propensity Score Matching (PSM) technique to control for the selection bias problem. The policy characteristic we wish to observe is *entrepreneurship targeting,* that is if a country is determined to increase its levels of entrepreneurship as expressed by the ratio of business owners in the labor force. In order to take this issue into account, several solutions have been proposed in the literature. In particular, considering that our measure of investment is dummy taking value 1 when a country changes status from non-entrepreneurial to entrepreneurial, one could apply *propensity score matching* and *difference-in-difference* estimators (Blundell and Costa Dias, 2000). The idea of these techniques is that endogeneity can be accounted for by selecting a control group of countries with characteristics very similar to the sample of countries actually increasing their share of business owners. Following the literature (Rosenbaum & Rubin, 1983, Heckman, Itchimura & Todd, 1998) we estimate a logit model to assess the impact of several economic variables on the probability of adopting entrepreneurship targeting. The second step is to estimate the difference in the outcome variable, here GDP and Unemployment between a country in the treatment group and its nearest neighbor in the control group.

The logit models are estimated using variables chosen to reflect the characteristics of an economy accounted for in the decision of whether to be an entrepreneurship targeter or to adopt some other type of policy, such as low unemployment targeting. The goal of estimating the propensity score is not to find the best statistical model to explain the probability of policy adoption as the conditional independence assumption implies that it is legitimate to exclude variables that systematically affect the probability that a country adopts entrepreneurship targeting but do not affect the economic outcomes in the logit regressions (Persson, 2001). All

variables are expected to be positively correlated with the probability that a country will adopt entrepreneurship targeting.

Table 5

Logit Model Propensity Score Estimates

	High Market Capitalization Countries		Low Market Capitalization Countries	
Model	Model 1 Baseline	Model 2 Low Unemployment Countries	Model 1 Baseline	Model 2 Low Unemployment Countries
Lagged Entrepreneurship	0.397***	0.460	0.103***	0.091**
	0.170	0.13	1.280	1.340
R&D	0.019	1.653*	1.110***	-1.111
	0.040	2.160	3.190	-3.050
Lagged Tax	2.84	2.020	-2.940	-2.510
	0.003	0.004	-0.18	-0.019
Wage	-0.010**	-0.023**	-0.020	-0.020
	-1.96	-2.750	-3.190	-3.120
Population	1.114	1.305	1.658	1.447
	0.005	1.504	0.008	0.009
Constant	-1190	1.540	2.413***	2.359***
	-1.810	1.480	4.040	3.870
Pseudo-R square	0.123	0.281	0.140	0.139

Note: t-statistics are reported below the coefficients *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively

The results of the estimation of the propensity scores of the baseline model of equation (1) are reported in Table (5). Past entrepreneurship is undoubtedly a key driver towards entrepreneurship targeting in all specifications. Also R&D spending has a positive effect on the probability of increasing business ownership, while wages seem to have the opposite effect. Most of the coefficient estimates from the model for both the High Market capitalization countries and Low Market capitalization countries group have signs in accordance with expectations. The main exception is for the entrepreneurship term for the developed countries

which is positive here in contrast to negative coefficients in Ball and Sheridan (2004); Lin and Ye (2007, 2009); de Mendonça and de Guimarães e Souza (2012); and three of the four cases in Samarina et al. (2014). The lag-wage term for the low-unemployment countries is negative and consistent with the literature. R&D expenditure is positive but insignificant for all country types. To ensure that the treated units and control units are comparable, the estimated propensity scores are sorted and the control units with estimated propensity scores which are less than the lowest score of the treated units are discarded.

The results for the range of matching methods considered for the baseline model are illustrated in Table (6). The first column reports the nearest neighbor matching results. The next three columns contain the radius matching results with radian of r = 0.01, 0.02, and 0.03. The final two columns contain the results of the kernel and stratification matching. Table (6) presents the results of the propensity score matching for both the high and low unemployment countries for both high and low capitalization countries. The evidence regarding the effectiveness of entrepreneurship targeting in these cases is a little less strong for the low unemployment countries than when only the high unemployment countries are included. The GDP growth rates are relatively strong and significant. The majority of the matching methods indicate that this additional increment to the growth rates for the entrepreneurship targeting countries is significant. In turn, the estimated treatment effects on the R&D spending and wages are found to be significant for all matching methods and are related to the adoption of entrepreneurship targeting. In terms of population there are no significant effects no matter the matching method.

The second panel of Table 6 presents the results of excluding the low unemployment countries from the propensity score matching for the low capitalization countries. The results of the

Table 6:

Estimates of the average treatment effect of entrepreneurship targeting on economic variables in the baseline model

Average Treatment Effect on Economic Growth

	Nearest Neighbor Matching	Radius Matching			Kernel Matching	Stratification Matching
		r = 0.01	r = 0.02	r =0.03		
Entrepreneurship	2.016 ***	0.871 *	0.799 *	1.229**	1.362***	1.191 ***
	(2.901)	(1.724)	(1.95)	(2.412)	(2.742)	(2.678)
Tax	-0.812	-0.723**	-0.968***	-0.677***	-0.184**	-0.824***
	(-1.873)	(-0.142)	(-0.328)	(-0.048)	(-0.042)	(-0.039)
GDP (-1)	2.817*	2.996	2.367*	2.322	2.68	2.552
	(1.857)	(1.437)	(1.675)	(1.585)	(2.319)	(2.739)
R&D	1.684**	1.196*	0.851*	0.912*	1.36*	1.239**
	(2.253)	(1.769)	(1.674)	(1.645)	(2.07)	(2.193)
Wage	-2.818	-4.709**	-4.916***	-4.636***	-4.13**	-4.906***
	(-1.178)	(-2.042)	(-2.692)	(-2.686)	(-2.323)	(-2.775)
Population	1.437**	2.328	1.625	4.292	3.339	3.689
	(0.188)	(0.218)	(0.42)	(0.292)	(1.154)	(1.096)
Low Market capitalization countries						
Entrepreneurship	-0.603	-0.691	-1.070	-1.198*	-0.856*	-0.996*
	(-0.677)	(-0.894)	(-1.471)	(-1.775)	(-1.375)	(-1.658)
Tax	-1.074	-0.287*	-0.472*	-0.504**	-0.184***	-0.247***
	(-1.045)	(-0.121)	(-0.284)	(-0.119)	(-0.005)	(-0.019)
GDP	2.249**	1.052	1.215	1.226*	1.334*	1.019
	(2.378)	(1.283)	(1.561)	(1.759)	(1.782)	(1.474)
R&D	2.447*	4.014**	2.376**	2.363**	1.685*	1.495*
	(2.198)	(2.879)	(2.051)	(2.04)	(1.657)	(1.702)
Wage	-7.425***	-4.801**	-4.771***	-5.106***	-5.802***	-4.921***
	(-2.757)	(-2.548)	(-2.969)	(-3.154)	(-3.094)	(-2.927)
Population	0.327	1.229	1.638	6.021	7.357	7.484*
	(0.058)	(0.292)	(0.417)	(0.97)	(1.609)	(1.953)

Note: Bootstrapped t-statistics are reported below the ATT coefficients *, **, and *** indicate significance at the 10%, 5%, and 1% level respectively.

baseline model in Table 5 effectively still hold. Entrepreneurship outcome for entrepreneurship targeting countries are lower, and in conjunction with a statistically significant lower GDP, entrepreneurship targeting does not appear to work for low capitalization countries.

6. Concluding Remarks

We are interested in the dynamic inter-relationship between entrepreneurship, growth and unemployment, given the increased importance of self employment in OECD countries over the past 25 years (Audretsch & Thurik, 2001). For this purpose we use data for 30 OECD countries for a period from 1970 to 2011, obtained from the COMPENDIA dataset, the OECD and the IMF. The descriptive statistics outlined in section 3 of the paper give us a first taste of the feedback mechanism between the three key variables. Once we take averaged values for each year we observe a clear positive pattern from past entrepreneurship (as measured by the ratio of business owners in the labor force) to economic activity (as measured by GDP per capita). Furthermore, past unemployment seems to spur entrepreneurship, giving vigor to the notion of refuge entrepreneurship and also, not surprisingly GDP growth is found to reduce future unemployment.

Moving on to the parametric analysis, we use a panel VAR(1) model in the lines of Plehn-Dujowich (2009) and Holtz-Eakin & Kao (2003). To overcome the endogeneity issues we use the IV estimator proposed by Anderson & Hsiao (1981) and the GMM estimator introduced by Arrellano & Bond (1991), commonly referred to as Difference GMM. Furthermore, we use the System GMM estimator following Arrelano & Bover (1995) and Blundell & Bond (1998). This first set of results is presented at Table 1 and Table 2 of section 5. All variables show a strong autoregressive component and the most robust relationship is the positive one of past entrepreneurship on GDP, with a positive and significant coefficient in five out of six specifications. In four out of six cases the feedback effect from GDP to entrepreneurship is statistically significant, while past entrepreneurship significantly reduces unemployment in half of the specifications. Finally, as expected GDP significantly lowers the unemployment rate in all but one specifications.

Table 3 reports results with separate AR(1) and AR(2) models for each of the three aforementioned variables. The second autoregressive lag proves insignificant in all three cases but the first lag is still significant. Dummy variables for common language between the entrepreneur and the host country and participation in a currency union are included, nevertheless do not exhibit significance. We also include to categorical variables to capture the degree of market capitalization and equity as financing source of enterprises. Both of them significantly increase business ownership and GDP per capita. A higher degree of market capitalization is also connected with an increase in unemployment. The second lag is dropped for the specifications reported in Table 4 and the control variables are augmented by including macroeconomic variables. What stands out is the positive effect of population n unemployment and the increase in all variables caused by R&D spending.

Finally, we use the Propensity Score Matching method (Rosenbaum & Rubin, 1983) to overcome the self selection bias in determining a country's policy decision towards entrepreneurship targeting. The Average Treatment Effects reported in Table 6 show that countries adopting entrepreneurship targeting as a growth policy exhibit significantly higher economic growth rates and lower unemployment

References

Acs, Z., Audretsch, D. B., Braunerhjelm, P. & Carlsson, B., 2004. The Missing Link: The Knowledge Filter and Entrepreneurship in Endogenous Growth. *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 0805

Acs, Z. & Arington, C., 2004. Employment Growth and Entrepreneurial Activity in Cities. *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 1304

Acs, Z. & Varga, A., 2004. Enrepreneurship, Agglomeration and Technological Change. *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 0604

Audretsch, D.B. & Fritsch, M, 2003. Linking Entrepreneurship to Growth: The Case of West Germany. *Industry and Innovation,* 10 (1)

Audretsch, D.B. & Keilbach, M., 2008. Resolving the Knowledge Paradox: Knowledge-Spillover Entrepreneurship and Economic Growth. *Research Policy,* 37

Audretsch, D.B. & Thurik, A.R., 2001. Capitalism and Democracy in the 21st Century: From the Managed to the Entrepreneurial Economy. *Journal of Evolutionary Economics,* 10

Ball, L. & Moffitt, R, 2001. Productivity Growth and the Phillips Curve. *NBER Working Paper Series,* 8421

Benigno, P, Ricci, L.A. & Surico, P., 2011. Unemployment and Productivity in the Long Run : The Role of Macroeconomic Volatility. *NBER Working Paper,* 16374

Blanchard, O. & Wolfers, J., 2000. The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence. *The Economic Journal,* 110

Brauninger, M. & Pannenberg, 2000. Unemployment and Productivity Growth. *Institute for the Study of Labor (IZA) Working Paper,* 136

Carree, M., van Stel, A., Thurik, R. & Wennekers, S., 2007. The Relationship Between Economic Development and Business Ownership Revisited. *Cranfeld University Research Papers,* 8

Carree, M. & Thurik, R., 2008. The Lag Structure of the Impact of Business Ownership on Economic Performance in OECD Countries. *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 0206

Carree, M. & Thurik, R., 2002. The Impact of Entrepreneurship on Economic Growth. In Acs, Z. & Audretsch, D. (eds.) *International Handbook of Entrepreneurship Research*

Carree, M. & Dejardin, M., 2011. Firm Entry and Exit in Local Markets: Market Pull and Unemployment Push. *University of Namur Working Paper Series,* 1114

Fairlie, R. W., 2013. Entrepreneurship, Economic Conditions, and the Great Recession. *CESIFO Working Paper*, 4140

Fristch, M., Kritikos, A. & Pijnenburg, K, 2013. Business Cycles, Unemployment and Entrepreneurial Activity: Evidence from Germany. *Institute for the Study of Labor (IZA) Working Paper,* 7852

Galindo, M. A. & Mendez, M. T., 2013. Entrepreneurship, Economic Growth and Innovation: Are Feedback Effects at Work?. *Journal of Business Research,* 07984

Holtz-Eakin, D. & Kao, C., 2003. Entrepreneurship and Economic Growth: The Proof Is in the Productivity. *Center for Policy Research Maxwell School of Citizenship and Public Affairs Syracuse University Working Paper,* 50

Koellinger, P. D. & Thurik, R., 2012. Entrepreneurship and the Business Cycle. *The Review of Economics and Statistics,* 94 (4)

Mueller, P., 2006. Exploring the Knowledge Filter: How Entrepreneurship and University-Industry Relationships Drive Economic Growth. *Research Policy,* 35

Neumark, D., Wall, B. & Zhang, J., 2008. Do Small Businesses Create More Jobs? New Evidence for the United States from the National Establishment Time Series. *Institute for the Study of Labor (IZA) Working Paper,* 3888

Noseleit, F., 2011. Entrepreneurship, Structural Change, and Economic Growth. *Paper prepared for the 7th European Meeting on Applied Evolutionary Economics (EMAEE) ―Evolutionary Perspectives on Technical Change and Industrial Dynamics‖, February 14-16, 2011, Sant'Anna School of Advanced Studies, Pisa*

Pissarides, C. A. & Vallianti, G., 2007. The Impact of TFP Growth on Steady-State Unemployment. *International Economic Review,* 48 (2)

Plehn-Dujowich, J. M., 2009. The Dynamic Relationship between Entrepreneurship, Unemployment, and Growth: Evidence from U.S. Industries. *Frontiers of Entrepreneurship Research,* 29 (16)

Plehn-Dujowich, J. M. & Li, D., 2010. The Impact of Entrepreneurship on Schumpeterian Endogenous Growth: Theory and Evidence. *Mimeo*

Salgado-Banda, H., 2005. Entrepreneurship and Economic Growth: An Empirical Analysis. *Dirección de Estudios EconómicosDirección General de Investigación Económica Banco de México*

Thurik, R, Carree, M. & Audretsch, D., 2008. Does Self-Employment Reduce Unemployment. *Journal of Business Venturing,* 23 (6)

van Stel, A., Carree, M. & Thurik, R., 2005. The Effect of Entrepreneurial Activity on National Economic Growth. . *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 0405

van Stel, A. & Storey, D. J., 2004. The Link Between Firm Births and Job Creation: Is there a Upas Tree Effect? *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 3304

Wennekers, S., van Stel, A., Thurik, R. & Reynolds, P., 2005. Nascent Entrepreneurship and the Level of Economic Development. *Discussion Papers on Entrepreneurship, Growth and Policy . The Max Plank Institute for Research into Economic Systems, Group Entrepreneurship, Growth and Public Policy,* 1405

Wong, P.H., Ho, Y. P. & Autio, E., 2005. Entrepreneurship, Innovation and Economic Growth: Evidence from GEM Data. *Small Business Economics,* 24

van der Zwan, P., Hessels, J. & Sanders, M., 2013. Entrepreneurial activity, industry orientation, and economic growth. *Panteia*

Becker, S. O. & Hvide, H. K., 2013. Do Entrepreneurs Matter? *CESIFO Working Paper*, 4088

Berthold, N. & Grundler, K., 2012. Entrepreneurship and economic growth in a panel of countries. *Wirtschaftswissenschaftliche Beiträge des Lehrstuhls für Volkswirtschaftslehre, Wirtschaftsordnung und Sozialpolitik, Universität Würzburg*, 118

Szabo, Z. & Herman, E., 2012. Innovative Entrepreneurship for Economic Development in EU. *Procedia Economics and Finance*, 3

Ahmad, N. & Seymour, R., 2008. Defining Entrepreneurial Activity: Definitions Supporting Frameworks for Data Collection. *OECD Statistics Working Paper*

European Commission, 2013. Entrepreneurship 2020 Action Plan: Reigniting the entrepreneurial spirit in Europe

Darvas, Z., 2013. Banking System Soundness is the Key to More SME Financing. *Bruegel Policy Contribution,* 10

Romer, P. M., 1990. Endogenous Technological Change. *Journal of Political Economy*, 98 (5)

Romer, P. M., 1986. Increasing Returns and Long-Run Growth. *Journal of Political Economy*, 94

Aghion P. & Howitt, P., 1992. A Model of Growth through Creative Destruction. *Econometrica,* 90

Barro, R. J. & Lee, J-W., 2005. IMF Programs: Who is Chosen and What are the Effects? *Journal of Monetary Economics,* 52 (7)

Verbeek, M., 2012. *A Guide to Modern Econometrics 4th Edition,* Wiley

Arellano, M. & Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies,* 58

Blundell, R. & Bond, S., 1998. GMM Estimation with Persistent Panel Data: An Application to Production Functions. *The Institute for Fiscal Studies Working Paper,* W99/4

Arellano, M. & Bover, O., 1995. Another look at the instrumental-variable estimation of error-components models. *Journal of Econometrics*, 68

Anderson, T. W. & Hsiao, C., 1981. Estimation of Dynamic Models with Error Components. *Journal of the American Statistical Association,* 76

Blundell, R. & Costa Dias, M., 2000. Evaluation Methods for Non-Experimental Data. *Fiscal Studies,* 21 (4)

Barba Navarretti, G. & Castellani, D., 2003. Investments Abroad and Performance at Home Evidence from Italian Multinationals. *Centro Studi Luca D'Agliano Development Studies Working Papers,* 180

Rosenbaum, P. R. & Rubin, D. B., 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika,* 70 (1)

Heckman, J.J. , Ichimura H. & Todd, P., 1998. Matching as an Econometric Evaluation Estimator. *The Review of Economic Studies*, 65 (2)