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Does entrepreneurship and its motives have an impact on economic and employment growth? A Panel VAR analysis on EU-15 countries

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Abstract: Entrepreneurship has historically played a major role on the growth of economies. Its impact on countries' economic and employment growth has been theoretically as well as empirically studied. The literature indicates a clear positive relation of entrepreneurship to those macro figures. Nevertheless, new evidence discusses that more entrepreneurs do not always signify a quick growth rate. In the developing world, where entrepreneurial motives are fuelled by the necessity to avoid unemployment or poorly-paid job positions, entrepreneurship is insignificant for growth. On the contrary, the innovation-implementing opportunity-motivated entrepreneurship of the developed world has a positive impact on growth. One can argue that those assumptions are based on the study of wildly heterogenic study objects, which can easily support such a statement. Can the same assumptions be confirmed for a more homogenic study group? To explore that issue, data for the trajectory of GDP, employment, entrepreneurship, opportunity and necessity-motivated ratios for the EU-15 group of countries during the period of 2004-2015 have been drawn from Eurostat and the Global Entrepreneurship Monitor (GEM). As we find out, entrepreneurship does indeed have a positive impact on economic and employment growth. However, when controlling for the motives and separating the study objects in more and less developed member states, we find that entrepreneurship does not affect the economic growth of developed countries. Additionally, contrary to the majority of previous research, neither necessity nor opportunity-driven entrepreneurship affect the growth of GDP and employment, regardless of the country group under focus. This study brings interesting findings on the macro-outcomes of entrepreneurship before and after the recession, carrying important messages for further research and entrepreneurial policy making.

Key words: Entrepreneurship, economic growth, employment growth, necessity, opportunity

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To my family and the loving
memory of my father

Table of Contents

List of Tables

Table of Figures

Table of Equations

1 Introduction

Entrepreneurship has historically played an important role for the growth of economies. From the VOC up until the innovational start-ups based in the Silicon Valley or the small grocery shop down the road, individuals' primal intention when starting a firm is to improve their income. In the process, firms might grow and expand, employing more personnel, being accountable for a small proportion of their country's economic growth. Some of them might even develop innovational products and practices which can assist the establishment of more lucrative firms in their region or even push the technological boundaries of their age, as industries in the 18th century did for England.

Scholarly writings have unanimously praised the entrepreneur as the bringer of economic employment and technological growth, as theoretical writings have been confirmed by modern empirical studies. On the other hand, the break-out of the recession in Europe deteriorated the economic condition of all its member states but was a hard hit for its less powerful member-states. Youth unemployment in the European south persists at figures over 30%. As a way to adhere to the issue, officials are continuously promoting entrepreneurship as a means of economic recovery. Entrepreneurship is supported at both the regional as well as the national level and several EU funds are allocated to the development of incubating facilities or the funding of currently existing similar institutions.

However, entrepreneurial ventures in a recession-struck economy showcase a very high risk of failure especially during the first years of operation. Moreover, it is a very common phenomenon that such firms employ a very small number of individuals, which unfortunately includes the founding team. It is clear that such firms are not born out of innovational ideas but more out of necessity for the improvement of the founders' income. What is the reflection of literature to what concerns the success rate of such ventures? To what extent can a country's economy rely on those firms for its recovery?

1.1 Research Problem

Acs (2006) divides entrepreneurs into two groups: necessity and opportunity driven ones and, with the help of data provided by the Global Entrepreneurship Monitor (GEM), studies the implications of both groups on a country's growth rate. The first group desserts to entrepreneurship as a way to overcome unemployment or small incomes, whereas the second invest in new ventures because they have come up with innovative products and services, or have discovered a market niche. He points out that in countries where the majority of entrepreneurs are necessity-driven ones, for example developing countries or ex-socialist countries, growth in the number of emerging firms does not indicate GDP growth. On the other

hand, entrepreneurship in developed countries is not that popular and fewer individuals desert to it as a source of income. But, since those who finally become entrepreneurs are opportunity driven, entrepreneurship indicates a stronger connection to growth.

With that statement in mind, the research questions of this essay are as follows. Does entrepreneurship cause GDP and employment growth? When considering the different motives that push individuals into entrepreneurship can Acs(2006) statements be verified for the EU-15? If we distinct the EU-15 countries into two separate groups based on their economic performance, can we observe a significant impact from opportunity driven entrepreneurship to GDP and employment growth in the more developed economies? Do the necessity driven entrepreneurs of the less developed European countries have any effect on their countries' employment and growth development?

In order to study these research questions the study will conduct a hypothesis testing.

> *Hypothesis 1. Entrepreneurship has a positive impact on GDP growth, in EU-15 countries.*
>
> *Hypothesis 2. Entrepreneurship has a positive impact on the employment growth rate, in EU-15 countries*.

The expected outcome, which would go in line with previous research, is that entrepreneurship has strong ties with GDP and employment growth.

> *Hypothesis 3. Necessity driven entrepreneurs in the less economically developed countries of the EU-15 do not affect their country's employment and growth rate.*
>
> *Hypothesis 4. Opportunity driven entrepreneurs in the more economically developed countries of the EU-15 have a positive impact on their country's growth and employment rate.*

The last two hypotheses examine the validity of Acs (2006) statement, elaborating on European countries. It is expected that due to the two-velocity economics of the European *North* & *South*, as well the motives of entrepreneurs in recession-struck societies, this contrasting image will be evident from our research.

1.2 Scope and Aim

In order to explore the issue, this essay constructs panels with data drawn from Eurostat and the Global Entrepreneurship Monitor, for 15 countries for the period of 2004-2015. The trajectory of GDP and employment rate growth are regressed against entrepreneurship, necessity and opportunity-driven entrepreneurship. with the help of Panel VAR methodology, to construct system of equations.

Due to the short time-series available by the GEM, previous studies (notably Acs, 2006; Stam et al., 2011; Wong et al, 2005) have relied on cross-sectional analysis of the issue, primarily

based on the observations of one or two years. More current research despite utilizing the availability of longer time-series, has also included wildly heterogenic study objects ranging from developing to developed countries (Bozoki & Richter, 2016). Findings from those study objects would certainly provide a clear image and prove the conclusions of existing literature. This study attempts to explore the concepts of opportunity and necessity driven entrepreneurship from a strictly homogenic European perspective, taking into account the rule-changing revision that was the 2008 recession.

Since official policy has relied so much on entrepreneurship as a tool for economic recovery, this study will provide a somewhat clearer view on its implications to economic and employment growth. We hope that the results of that essay will point that not all kinds of entrepreneurial ventures are helpful for economic recovery and empowerment. Instead, certain aspects of it should be under focus, as it is them which portray the biggest economic opportunities.

1.3 Outline of the Thesis

The present study is structured as follows, in the next chapter some of the major literature on the topic is discussed. More specifically, we elaborate on the definition of entrepreneurship and how it is measured only to move on to various empirical studies that correlated entrepreneurship with economic and employment growth. Furthermore, we discuss the debate of big vs small firms. The literature review finally focuses on how the various motives of entrepreneurs can influence economic and employment growth.

The third chapter is devoted to the analysis of data. Sources, limitations and how data was handled for the research is elaborated. The study then focuses on the methods employed. We briefly develop the theoretical aspect of the VAR, panel data models and discuss the steps of the methodologies utilized in this study.

The fifth chapter is devoted to the empirical analysis itself, with portrayal and discussion of the results. We conclude and sum up the study on the sixth chapter. After the reference list, Appendixes A and B are present to portray the precise outcomes of the Panel VAR methodology utilized on the first and second part of the empirical analysis, respectively.

2 Literature review

In this chapter, notable previous research on the field is explored. In order to grasp what entrepreneurship is about, we begin with the definition that was given for it by various scholars. Various definitions on what is and what is not entrepreneurship can to a certain point explain the disparities of findings that study the same phenomenon. Before we proceed to the presenting of empirical studies on the influence of entrepreneurship on economic and employment growth, it is important to elaborate on how it can be measured. A brief section that discusses the two way causality between unemployment and self-employment is also developed. Taking on from views that entrepreneurship poorly contributes to employment, since entrepreneurs are usually employers of themselves, we elaborate on the various results that explicitly study how concentration, or rather how small vs big firms influence macro-economic variables. Lastly, we discuss the literature on the concepts of necessity and opportunity-driven entrepreneurship and their impact on the economy.

2.1 Definition

Parker (2004) mentions the difficulty of defining entrepreneurship and explains that its definition derives from the context entrepreneurship will be used in. For example, for labour economics, self-employment indeed *is* entrepreneurship, since self-employed individuals need to risk and invest in the same way entrepreneurs do. However, this view has received critisism in the sense that it is only owners of business of a certain size and beyond who need to coordinate their staff and hence can receive the title of the entrepreneur. Parker (2004) also points other views which state that the introduction of innovation is crucial for an entrepreneur, in the Schumpeterian sense.

The Schumpeterian entrepreneur is a self-employed person, usually the sole individual behind his firm. Schumpeterian entrepreneurs invest, take risks and dynamically enter and exit markets, either moving on to becoming managerial business owners when their company succeeds and hires more staff, or founding new ventures, still remaining Schumpeterian entrepreneurs. In this sense, Carree & Thurik (2003) mention that despite the fact that to a great extent entrepreneurship is manifested in small businesses, it is not limited to them. They bring up the point of “intrapreneurs”, individuals who begin entrepreneurial ventures as part of their employment in big corporations, trying to “imitate smallness”. However, “intrapreneurship” contrasts their main principle of entrepreneurs not being tied to employed labour.

It should be noted that entrepreneurship, according to Wennekers & Thurik (1999), does not necessarily refer to small business, despite the fact that they are a great vehicle for the understanding of entrepreneurship. Instead they mention that entrepreneurship is mainly about

the entry of new firms in the market and secondly the implementation of innovation and innovative practises. Similarly, Acs & Armington (2004) comment on the disparities on what is considered to be entrepreneurship, as researchers can equate it to either high-growth firms or individual business-founders.

Moving on from the Schumpeterian aspect, Carree, et al. (2003) cite two more schools of thought that describe entrepreneurship. Kirzner (1997) and the Austrian school has linked entrepreneurship to a profit-seeking activity, whereas the Knightian view binds the entrepreneur with risk-taking. Such risks are strongly related to the foundation of new firms, exploration of new markets and release of new products into the market.

Audretsch et al.(2006) mention that the definition of entrepreneurship cannot rely on simplistic approaches which can always be ambiguated. First off, is there a need for a specific organizational structure that can be linked with entrepreneurship? Should big corporations capitalize on the term as small actors do? They state that entrepreneurship can be manifested by organizations of any size and type. Secondly, when discussing about the change that entrepreneurs bring forth, concerns arise on how those changes influence the industry as a whole and the markets, subsequently. Thus, they mention that change among other factors needs to be expressed in relative terms.

From that perspective, Audretsch et al.(2006) explain entrepreneurship as a multidimensional concept, with the acceptance of a common definition being a difficult task even for developed countries. Its definition usually relies on the concept it will be used upon, with economic and managerial applications standing out. Audretsch et al.(2006) quote the work of Hébert and Link (1989) who define the entrepreneur as the individual who decides on the allocation of resources and spatial, physical, functional, institutional aspects of production as well as the finished product. Covering the managerial spectrum, Audretsch et al.(2006) touch upon the work of Sahlman & Stevenson (1991) who try to discriminate the differences between entrepreneurs and managers and state that entrepreneurs are managers who always seek for profitable opportunities and exploit them by developing strategies and combining resources. Additionally, Audretsch et al.(2006) mention Audretsch (1995) and OECD (1998) that point out entrepreneurs stand out as the agents of change, with the innovational products and services they bring forth, when investing and risking.

On the same note, Carree & Thurik (2003) mention that the multiple dimensions that entrepreneurship has as a phenomenon complexes its definition. Its linkage to economic growth needs to take under consideration factors such as innovation, entries to and exits from the markets, etc. Carree & Thurik (2003) approach the definition of entrepreneurship inspired by Hébert and Link (1989), Bull and Willard (1993) and Lumpkin and Dess (1996). They mention that entrepreneurship is the manifestation of individual will and ability to create alone or together with others, inside or outside of traditional organizations, new products or services, new production and organizational methods or new market-product combinations, whose viability will be tested in their specific markets, along with the limitations, spatial and institutional context that describe those markets. Carree & Thurik (2003) strongly connect entrepreneurship with individual will, stating that entrepreneurs should not be considered as an occupational class.

Moreover, Carree & Thurik (2003) clarify the various categories an entrepreneur can fall under. As concerned with the employment status, an individual can either be a business-founder or employed. Then, they make two pragmatic distinctions about entrepreneurship. First-off they mention the entrepreneurial concept and the managerial concept to distinct the way of organizing activities. Thus, this double dichotomy encompasses 4 separate groups, 3 out of which stand out as entrepreneurs (Table 1).

Table 1 The three types of entrepreneurs in italics. Source: Wennekers & Thurik (1999)

	Business-owners	Employed labour
Entrepreneurial	*Schumpeterian entrepreneur*	*Intrapreneur*
Managerial	*Managerial business owner*	Business manager

2.2 Measurement of entrepreneurship

Braunerhjelm et al.(2010) brings up the issue of measurement of entrepreneurship, especially when start-up firms are at focus. The inconsistency of measurements among countries leads them to equate entrepreneurship with the non-agricultural self-employed, a well-established proxy for entrepreneurship according to Storey (1991). The figure has been extensively used in the scholarly study of entrepreneurship.

For the purpose of his study and due to the availability of data, Parker (2004) also uses self-employment as a synonym for entrepreneurship. However, the use of the term "self-employment" is not without drawbacks. Inconsistent formalities among countries and sectors complicate the distinction and comparison of what is considered to be self-employment or employed labour. Moreover, when data are collected, the attribute that will be recorded completely lies on the subject's discretion and impression of him/herself. Similarly, Parker (2004) refers to the works of Casey and Creigh (1988), Boden and Nucci (1997) to mention that individuals may choose to describe themselves as paid employees instead of self-employed for legal and/or tax reasons. Lastly, it should be taken under consideration that there is a "gray area" as Parker (2004) describes between the two terms. Shouldn't self-employed individuals primarily working for one contractor be counted as paid-employees? Should unpaid workers in family businesses be considered employed or self-employed ? Should small shop owners working under a franchise contract be considered self-employed or employees of the franchise-providing firm?

Indicators which closely measure innovational activities to limit their measurements to firms that bring forth change in their industries have been developed due to the demand of recent

studies. Such indicators include R&D expenditures, patent applications etc. and have, notably, been used by Acs and Audretsch (1988 and 1990). Lastly, in order to closely study the impact of high-growth firms, other studies have focused on firms known as *gazelles* (Birch; 1999, Bos & Stam; 2013) or GEM indicators which measure the share of nascent entrepreneurship in a country (Lundstrom & Stevenson, 2005).

2.3 Empirical studies

According to Carree & Thurik (2003), the effort of trying to link industrial organizations with the growth of macroeconomic figures dates back to Schumpeter (1934). The impact of Schumpeterian thought, stands out in the entrepreneurial literature (Parker, 2004; Carree & Thurik, 2003). Schumpeter (1934) has identified the entrepreneur as the vehicle for innovation and the subsequent economic growth that derives from it. Citing Schumpeter (1942), Wong et al. (2005) mention that the creative destruction caused by the constant foundation of new businesses destabilizes an economic system in equilibrium, creating opportunities for entrepreneurs. Creative destruction pushes firms to invest into new technologies and to come out with new products to avoid becoming obsolete. As a result, innovation stands out as a crucial aspect for the survival and growth of companies. However, Wong et al. (2005) cite Wennekers and Thurik (1999) to mention that growth doesn't solely derive from novelty but also from new entry of firms in the economy.

Since Schumpeter, scholars have tried to prove those theoretical ideas and have come closer to explaining how entrepreneurship influences growth and employment, utilizing various econometrical methods. In the sections below, some of the distinguished works on the field are mentioned. First-off, we commence with studies that explore the impact of entrepreneurship on economic growth and move on with similar studies on employment.

2.3.1 Entrepreneurship and economic growth

Wennekers & Thurik (1999) underline that entrepreneurship refers to the activities of individuals (also in Carree, et al.; 2003). On the other hand, economic growth is usually a term which is being used for the aggregate level. Thus the measurement of growth would require the linkage of micro data with the aggregate. A procedure Wong et al. (2005) explain is complicated. Evidently, entrepreneurship's impact on economic growth is a long-disputed and complex issue to tackle. To approach the phenomenon, it is important to choose the correct theoretical framework.

Wennekers & Thurik (1999) provide a study of entrepreneurship from various fields of research, including historical views on it, macro-economic growth theories, industrial and

management literature in their review, trying to structure the various strands of scholarly research. They argue that the most appropriate lens under which entrepreneurship should be studied is that of the Schumpeterian and Austrian school, rejecting the neo-classical prism of study. Carree, et al. (2003) explain that entrepreneurship was exempted from neo-classical models as discussed by Solow (1970) because in neo-classical thought technology is considered to be exogenous. On the other hand, endogenous models perceive the creation of knowledge and innovation as a profit-seeking activity, thus taking entrepreneurship into consideration. Notably, Carree, et al (2003) cite Aghion & Howitt (1997), Peretto (1998) and Schmitz (1989) as the most notable representatives of this scholarly school of thought.

Carree & Thurik (2003) as well as Carree et al. (2003) mention the basic strands literature follows when emprically studying entrepreneurship's impact on growth. First-off turbulence examines the new entries and exits in a region's economy. The size-distribution of firms in a region is also studied as is the number of firms. For example, when comparing the economic outcomes between two regions, a region with a big population of small firms indicates a flourishing entrepreneurial activity. Moreover, studies focus on the impact the number of self-employed people have on economic growth, as their population is a great indicator of entrepreneurial activity. Lastly, an aspect both studies chose not to elaborate on is the emergence of entrepreneurial ventures in post-soviet states.

Carree & Thurik (2003) provide an overview of the literature's empirical findings, coming from the vsious separate strands. First-off, on the matter of turbulence, they underline Caves' (1998) findings on the minimal impact the turnover from entries and exits makes on the industry's growth, in the short-run. In the long-run, the impact appears to be greater. On the contrary, the Bosma & Nieuwenhuijsen (2000; cited by Carree & Thurik, 2003) study of 40 Dutch regions mentions that the productivity growth from turbulence was greater in the manufacturing sector as opposed to the service sector.

On the issue, Wong et al. (2005) cite Wennekers and Thurik (1999) to mention that growth doesn't solely derive from novelty in products, services and organization methods, but also from new entry of firms in the economy. To avoid generalizations, Wennekers and Thurik (1999) insist that the achieved level of growth depends on the qualities of the industry the newly-born firm works with. Such aspects include the share of new firms among the industry's ranks, its macro-economic developments and its knowledge structure. New entries in industries with stabilized technological regimes tend to be less important, due to the capital-intensive procedures a new firm has to face upon its foundation.

Additionally, the argument that a dynamic activity in entries and exits of firms indicate a rapidly growing economy is further explored by the studies of European regions. Carree & Thurik (2003) cite the Callejon & Segarra study of 1999 which linked the turbulence of Spanish firms to the growth of total factor productivity. Similarly, Foelster (2000) also uses Swedish data to confirm the argument, based on his study on the impact of self-emloyment on employment growth. As documentned, most new job positions came from SME's as did most of the losses. On the contrary, based on the fourth strand of empirical analysis and studying self-employment panel data from various OECD counrties, Blanchflower (2000) proves that there is no link between self-employment and economic growth. However, Carree & Thurik (2003) critisize

the validity of his model as well as the comparability of data collection across countries and years.

The studies represented so far have found a positive impact between the variables of new firm emergence and economic growth. On the contrary, Audretsch & Fritsch (1996) conclude to opposite findings, when focusing on the 1980's German economy. They comment that a high degree of turbulence in a region can lead to a low growth rate, a point commonly shared with Fritsch (1997). It is the low growth rate in itself which pushes individuals to form businesses, which may not perform well, being a part of a region in recession. As also commented by Carree & Thurik (2003), such contrasts in findings are expectable, when considering how differently innovation was integrated in the activities of start-up firms.

Additionally, the conclusions of studies from a regional point of view are also cited by Carree & Thurik (2003). Reynolds (1999) as well as Acs and Armington (2002) reach similar results when studying US regions, concerning the positive impact of entrepreneurial activity on growth rates, by pointing out the objective nature of the latter study, as well its inclusion of a bigger sample of the economy. The performance of German firms in the 90's started to converge their US peers, as the German model moved towards the entrepreneurial economy as the basis for growth.

Carree et al. (2002) study how an entrepreneurship rate above or below a country's equilibrium can be correlated with its observed economic growth, taking into account the country's stage of economic development. Rates below the equilibrium can hold back GDP growth, whereas there is no evidence to support a lagging GDP in case of levels higher than the equilibrium. Wong et al. (2005) criticize this approach by mentioning that the study focused on the equilibrium adjustment mechanism instead of studying the absolute rate of entrepreneurship, thus giving contrasting results to previous researches by Reynolds et al. (2000, 2001, 2002). Those studies by Reynolds et al. documented a positive relationship between Total Entrepreneurship Activity and economic growth. It should be mentioned, however, that cross-sectional studies similar to the ones by Wong et al. (2005) include non-homogenous study subjects which can bear misleading regression results, as the comprising characteristics of the economies vary greatly.

A more recent study by Stam, et al.(2011) sheds more light on the impact of entrepreneurship on macro-economic growth, controlling for the impact of high-growth firms and does so in both low and high-income countries, using the GEM database. According to their fndings, entrepreneurship is not significantly important for high-income countries, contrary to low income ones, in which entrepreneurship seems to have a very significant impact on growth. To explain this finding they desert to the complexity that describes the institutional framework of low-income countries which affects the prevailing types of entrepreneurship and their multi-dimensional effects. Their research contrasts previous ones by Van Stel et al. (2005) and Stam et al. (2009), but seems to be more reliable due to the implementation of panel data as opposed to cross-sections. Moreover, when focusing on the impact of ambitious entrepreneurship on both low and high-income countries, they mention that it is the main contributor to economic growth, for both cases, but apparently does not affect employment growth.

Bögenhold et al. (2016) also link the impact entrepreneurial ventures have in a country's growth, considering its development level. They cite studies (Audretsch & Thurik, 1997, 2001; Acs & Szerb, 2009; Wennekers et al., 2010) which have concluded that entrepreneurship in poor countries has a small impact on growth, as opposed to the innovation-driven ventures of more developed countries (Wennekers et al., 2005). In order to study that claim, they focus on the case of Sweden from 1850 to 2000. They reason that Sweden has underwent a massive transformation, from being an agricultural economy to an innovation-driven industrialized one. They apply VAR techniques accompanied by Granger causality tests, taking into account the structural breaks that occur over such a long time series. Overall, they conclude by mentoning that there is a positive causal relationship between self-employment and growth, especially prior to 1949.

2.3.2 Entrepreneurship's impact on employment

Economic growth and employment growth seem to be correlated. Ideally, a country that enjoys a flourishing economy will generate more job positions, due to the capital available for investment and the overall positive impression for the economic stability in the future. However, Acs & Armington (2004) mention that the regional employment rate does not increase simply because of a firm hiring more staff, but also because of the firm's positive externalities to the region, with employment growth not always going in line with productivity growth. To elaborate on the issue, this section focuses on previous studies that explored how entrepreneurship influenced employment.

As already discussed the choice of the prism of study is crucial for research. Acs & Armington (2004) utilize the concept of independent entrepreneurship, a firm founded by a person or a group of people, without any infrigiment to an established organization. Studying data from firms in 394 US regions, they mention that the majority of job positions came from firms younger than 5 years, whereas established ones were following. Moreover, a small number of rapidly growing young firms also generated more positions than a much bigger number of slower-growing established ones. However, that is not the case for all sectors, as Acs & Armington (2004) agree with Geroski (1995) that new start-ups in manufacturing are of less importance for employment growth and comment the validity of previous research which has generalized findings from manufacturing to the whole economy. Accordingly, Wong et al. (2005) cites Kirchhoff (1994), Storey (1994), Westhead & Cowling (1995) and Birch et al. (1997) to support the fact that it is the high growth firms which are significant for job creation. However, Wong et al. (2005) explains the complexity of documenting such firms, due to their small population. Instead Wong et al. (2005) support the terminology also used by the GEM, firms with high-growth potential.

Wennekers & Thurik (1999) quote the study of Audretsch & Thurik (1999) who have discovered that the increasing number of entrepreneurs in the labor force has opposite results to the unemployment ratio, in 23 OECD countries from 1984 to 1994. They point out that the renewed interest in scholarly review of entrepreneurship derives from the attention it has recently received by official circles. Government officials emphasize on the role

entrepreneurship has on the GDP as well as employment growth. Wennekers & Thurik (1999) use graphic vocabulary to describe how European politicians "rely on the salvation provided by entrepreneurship" that prevents unemployment ratios from being delivered to the hands of "endless efficiency and cost-cutting operations".

The significance that government officials attribute to entrepreneurship is also visible from the number of various vocational and entrepreneurial training programs that have emerged to promote it among unemployed individuals (Pfeiffer & Reize, 1990; Lundstrom & Stevenson, 2005). However, it is often questionable how these newly born firms can positively affect employment. To extend this concern, is there a two way-causality between the figures of self-employment and unemployment ? Do those two variables keep feeding back each other? The issue is discussed below.

Two way causality: self-employment and unemployment

Parker (2004) studies the impact of unemployment on self-employment. According to him, the most conventional explanations given to the phenomenon are that people start a business venture either because they are pushed by recession or pulled by prosperity. In the first category, also given the name of *refugee* or *deseration effect* by Thurik et al. (2008), due to the massive waves of unemployment, individuals desert to self-employment. Similarly, Bögenhold et al. (2016) cites Blanchflower (2000) and Lindh & Ohlsson (1998) to state that self-employment rates usually increase during times of economic recession, high unemployment and instability. Moreover, the barriers of new firm entry are reduced due to the increasing number of firms shutting down, making the purchase of second-hand capital more affordable (Binks and Jennings, 1986; cited by Parker, 2004). However, Thurik et al. (2008) critises that unemployed individuals might lack the required skills which would grant them employment status. Thus, due to their poor skills, the firms they found have an inherently low survival rate.

It shouldn't go without mentioning that individuals are likely to be pulled out of self-employment, or rather have decreased incentives towards it, in times of high unemployment. The risks that a new firm has to encounter are higher, since market demand is decreased due to lower income. In times of recession, the availability of capital is also decreased and entrepreneurs have lower chances of returning to paid employment, if their ventures fail (Parker, 2004).

Lastly, Thurik et al. (2008) try to explore the relationship between unemployment and self-employment. Quoting studies such as Parker (2004), they mention that unemployed individuals are more likely to form businesses, but are those businesses able to reduce the rate of unemployment in a society? Studying lagged panel data on self-employment and unemployment figures from 23 OECD countries from 1974 to 2002, their models describe dynamic interrelationships between the figures. Their main finding is that both phenomena take place, with the reduction of unemployment by firms owned by previously unemployed individuals being a more prominent effect. However, they discuss that results of such attempts require more than eight years to be evident.

2.4 Concentration vs "smallness"

After explaining how formerly unemployed individuals form small firms, it is interesting to examine how the common (mis)conception of small firms having no significant impact on growth is discussed in literature. The distinctive difference between large and small firms stands primarily on the type of ownership and management. Contrary to the various levels of management a large corporation usually houses, small firms are managed by one person or a little group of individuals.

As Bögenhold et al. (2016) mention, ever since the 60's, Western economies have started to move away from few high concentration firms into the entrepreneurial economy. According to them, this is a transformation of major importance for the current level of economic growth. This view is partly supported by Wennekers & Thurik (1999) as well as Braunerhjelm et al. (2010), who mention that entrepreneurship has grew since the 90's as supported by their study on US and other OECD countries, respectively. Similarly, the 2012 Parker et al. study agrees with such statements, based on evidence from the UK. Interestingly, Carlsson (1992 and 1999) mentions that the empoyment share of the 500 largest US companies fell from 20% in 1970 to 8,5% in 1996, supporting the evidence of concentration's falling importance.

Audretsch & Thurik (1998) comment that the growing importance of technology in the later decades of the 20th century has aided the emergence of small eligible organizations. Acs (1992) hails small firms as the carriers of innovation, stimulators of industrial evolution and major contributors to job position growth. A point also noted by Picot et al. (1998) as well as Pfeiffer & Reize (2000) who mention that small firm growth is subsequently leading to the decrease of unemployment. Reinforcing findings can also be extracted by the studies Thurik (1996) and Carree & Thurik (1998 and 1999) executed which reflected the increase of output in European industries upon the increased share of small new firms.

An interesting study of how variables such as firm size, age and growth correlate is executed by Haltiwagner et al. (2013). Contrary to Gibrat's law of growth being independent of firm size, they explore the statements of various national statistical bureaus which commonly agree that most job positions are generated by small businesses. More specifically, they study the impact of US non-agricultural business sector firms in job creation, from 1976 to 2005. In their empirical study they also take into consideration the possibility of ownership change and merges, acquisitions etc. Such phenomena would falsely describe a firm as a newly established one and distort its results in contrast with the real image.

Haltiwagner et al. (2013) confirm that there is an inverse relationship between the firm size and their documented growth. On the other hand, their study suggests that when firm age is considered, no systematic relationship between growth and size can be proved. Since most start-up firms start running with a very small number of employees they are expected to achieve high growth rates in their very first years. As their model suggests start-ups grow quicker than their established peers and are responsible for nearly 20 % of gross job creation. Haltiwagner et al. (2013) mention that startups are not only important carriers of job position growth in the US economy, but they are also attributable for a large percentage of job destruction, since such ventures are prone to failure during their early years of existence. More specifically, the most

crucial year of their survival is the second one, with many exits taking place at that point. Accordingly, after 5 years nearly 40 % of the jobs generated by startups will be lost 5 years after their birth, due to the firm exiting the market.

In light of the above, Haltiwagner et al. (2013) mention that policy makers need to carefully examine the framework surrounding those firms. Startups play an important role in the creation of innovation, employee mobility, knowledge generation and exchange. Such qualities and externalities are proven to be crucial for the economy as a whole. On the same note, Thurik et al. (2008) suggest that public policy should focus on the promotion of innovative and high-growth entrepreneurship which is rather likely to decrease unemployment ratios.

2.5 Opportunity & necessity driven entrepreneurship

Having already discussed how the state of unemployment can push individuals into the formation of firms, it is important to elaborate on the literature that contrasts the performance of firms founded because of necessity and those founded because of the discovery of a profitable market niche. We begin by elaborating on the GEM, which provides national data on the afore-mentioned motives and continue with the studies that have utilized the GEM database.

One of the various organizations that measure aspects that influence entrepreneurship is the Global Entrepreneurship Monitor. As the name suggests the GEM is a multi-national annual survey, measuring representative samples of adults for each nation under focus. The importance of the GEM lies on the coherent method of data collection which eases the work of the scholar interested in cross-section comparison.

Acs (2006) as chair of the Global Entrepreneurship Monitor project shares some of the insights the Monitor's research has come across. Contrary to the wide-spread literature findings on the impact of entrepreneurship which correlate the growing number of entrepreneurs with a high level of GDP growth, he underlines the significance entrepreneurial motives have on the achieved level of growth and showcases a paradox. Countries whose labor force is to a large extent entrepreneurs such as Uganda, Peru and Ecuador, have small levels of per capita income. On the contrary, countries such as Germany, France and Finland have a much smaller share of entrepreneurs among their labour force, but enjoy a bigger per capita income. Similar results are showcased by the study of Sternberg and Wennekers (2005).

Taking on from the "paradox" of countries with high level of entrepreneurial activity and poor GDP growth, Carree & Thurik (2003) mention that future analysis needs to stress the incentives behind entrepreneurial activity and how they can be linked with the observed level of growth. Acs(2006) does so by observing that in the first group of countries, most entrepreneurs are necessity-driven and have started their own ventures in order to address the issue of massive waves of unemployment or poorly paid job positions. Examples of such countries also include post-socialist states whose labor market faces structural issues and unemployment ratios skyrocketed. In those economies, individuals quickly started one-person firms characterized by

a low level of competency and equally low implementation of innovation. It should be mention that Parker (2004) states that the unemployment rate is only one proxy for the incentives that describe an individual's willingness to form a business. Other factors such as the technological level of a country and worker know-how can also very well describe the trajectory of a country's self-employment rate. Nevertheless, recession-struck economies are one side of the coin.

On the other hand, in the second group of countries studied by Acs (2006), the majority of entrepreneurs seem to be opportunity-driven, usually rejecting a well-paid job position in favor of being manager-owners in their own firm. Those firms are usually founded after the owner has discovered a promising market niche or expects profits from releasing an innovational product. Moreover, the stable economies and high wages of developed countries allow the establishment of such firms.

Wong et al. (2005) tried to relate the impact of innovation, entrepreneurship and entrepreneurial motives to a country's growth rate, using 37 cross-sections from GEM's 2002 dataset. More specifically, they tested, among others, the impact innovation, entrepreneurship, opportunity and necessity driven entrepreneurship have on growth, using a modified Cobb-Douglas production function. According to their models, innovation has a positive impact on economic growth. On the other hand, higher entrepreneurship rates do not have a significant effect on economic growth. Lastly, neither the indicators of opportunity nor necessity driven entrepreneurship indicate a major impact on economic growth, with both them being insignificant. According to them, the insignificance of the opportunity driven ratio can be partly explained because of the inclusion of developing countries in the model. Opportunity-driven entrepreneurship in such countries derives from market imperfections and oligopolies which ultimately negate the positive effects this indicator would be expected to have on economic growth. Using the same database but with additional indicators controlling the development of countries, Van Stel et al. (2004) explore that entrepreneurship has an impact on the country's development. Similarly, when inserting a dummy to control for the income level Wong et al. (2005) conclude that the sample size is too small for that kind of analysis.

Comparing among developed and developing countries based on GEM data of 2002 Wennekers et al. (2005) mention that the opportunity-driven entrepreneurship of developed economies has a positive and significant impact on economic growth, as opposed to the necessity-sparked entrepreneurial ventures of the developing countries which seem to negatively affect growth. He concludes that policy in the latter should not promote entrepreneurship as a way to catch-up, but rather improve institutions, infrastructure and seek for foreign direct investments which build on the development of scale economies of young firms. Upon the commentary of their similar results, Acs et al. (2008) consults that public policy should not simply promote entrepreneurship, but study the complex national entrepreneurial environment, the institutions etc. and primarily work on their improvement.

To what can we attribute the differences in the ratios among various countries? The variance of differences in the types of entrepreneurship has its roots in demographics, cultural and institutional differences among countries. (Acs & Armington 2004; Rocha 2004; Bhola et al. 2006; Wong et al. 2005). More recent studies by Hechavarria and Reynolds (2009) as well as Liñán, Fernández-Serrano, and Romero (2013) Liñán, et al. (2013) explore the impact of culture & national values have on necessity and opportunity driven entrepreneurs. Similarly, combined

with the national values, education is of significant importance when exploring the decisions of individuals and their impact on the success rate of entrepreneurial ventures. Studies in the field include those which were developed as part of the human capital theory (Becker, 1975; Bosma et al., 2004; Gimeno et al., 1997), signaling theory (van der Sluis et al., 2004) and knowledge spillover theory (Audretsch & Lehmann, 2005). On the contrary, Solomon et al.(2008) cite Minniti, et al. (2004) and Neck, et al. (2003) and mention that the decision of an individual to be an entrepreneur is not affected neither by low nor by high levels of education.

Komisar (2017) explores an interesting perspective of necessity driven entrepreneurship that relates its prevalence to the lack of democratic institutions in a country. Despite the fact that individuals may observe a lack of democratic traditions in the public life of their countries or might have concerns about the quality of public governance, they showcase their trust in the democratic nature that defines the operation of the market. As a result, they choose to become entrepreneurs to promote social change and he pinpoints the example of Chile. To him, more than the infrastructure, the culture of entrepreneurs is crucial for the establishment of both successful ventures and the settlement of the entrepreneurial tradition.

From a similar perspective, Hessels, Van Gelderen, and Thurik (2008) explore the motives of entrepreneurs with the help of GEM data as well as using socioeconomic variables to describe the profile of each country. Their main finding is that entrepreneurs with increase-wealth motives are connected to export-oriented production and high growth of job positions. On the other hand, countries that enjoy high standards of social care negatively affect the establishment of prevalence of such entrepreneurial efforts. Thus, governments face the challenge of altering their social security systems of their countries in such a way that both ensures the high quality of living standards and promotes the development of ambitious entrepreneurial ventures that promote economic and employment growth.

It should be noted that Fernández-Serrano et al. (2017) discuss that even countries with similar development characteristics can have differences in their levels of entrepreneurship. For this reason, the inclusion of more variables is crucial for the improved understanding of this phenomenon.

3 Data

The development of a reliable econometric model relies on the variables it utilizes and their validity. In this chapter, the reader is informed on the data this essay utilizes and what actions were made to overcome obstacles and limitations. First-off, we begin with the analysis of the construction of the non-agricultural self-employed variable and continue with the real GDP per capita and employment rate variables, only to conclude on the variables that describe the incentives of entrepreneurs. The reasoning of studying this specific group of countries under this time frame is also provided. Lastly, this chapter provides a visual representation of the variables under focus with the use of descriptive statistics and graphs, ending with a brief commenting of said descriptive statistics.

3.1 Source material

3.1.1 Non-agricultural self-employed

The issue of measurement of entrepreneurship and the complexity surrounding it has been frequently brought up in the literature. Most studies utilize the number of non-agricultural self-employed as a proxy for entrepreneurship. One of the primal reasons is that the figure is usually widely available for long time series and after the proper handling can be used as a comparing tool among different cross-sections (notably: Van Stel, 2005).

For the purpose of this research the figure has been drawn from Eurostat data. However, Eurostat provides the absolute number of self-employed in an economy. The absolute number will distort the models and needs to be scaled down by dividing it to the country's workforce, as also noted by Acs and Armington (2004).

Unfortunately, data on a country's workforce population is not available through Eurostat and needs to be estimated from population statistics. At this point we assume that every person between 20 and 64 of age is considered to be part of the workforce. Thus, we neglect the possibility of various social groups that are unable and/or unwilling to work, such as students, women on mother's leave, individuals with mental and physical disabilities etc. The percentages of people belonging to three separate age groups (20-24, 25-49, 50-64) were summed and then multiplied by the corresponding's country population. This way the population between the ages of 20-64 for every year under examination is obtained.

It should be noted that the data referring to the youngest age group this study examines (20-24) is not directly available through Eurostat. Rather, the 15-24 age group is documented. Assuming

that the distribution of ages in the group is equal among its participating ages, the percentage of people aged 15-24 was divided by 2 to obtain the percentage of people aged 20 to 24.

Thus, as a way of proportioning self-employed individuals to their respective economy, the number of self-employed individuals was divided by the number of the respective workforce of the year and proceedingly multiplied by a thousand. Thus, the number of non-agricultural self-employed individuals between 20 and 64 per thousand of workforce, regardless of sex, is obtained.

3.1.2 Employment rate, Real GDP per Capita

The next variables used in this study's models are the growth of the employment rate and real GDP per capita growth rate, in chained link volumes, with 2010 as the base year. Both have been widely used as the primal indicators of employment and economic growth in a country's economy.

3.1.3 Entrepreneurial motives

For the second part of the empirical study, we utilize Global Entrepreneurship Monitor indicators which describe the entrepreneurial profile of the countries under focus. One of the most crucial variables under focus by the GEM is Total Early-stage Entrepreneurial activity rate (TEA). TEA refers to the percentage of the workforce who are either owner-manager of a new "established" business or a nascent entrepreneur. Established firms are those one to three years old firms which have revenues and might employ personnel, whereas a nascent entrepreneur is the individual who is actively involved in setting up a business he/she will own or co-own. The nascent entrepreneurial firms have not paid salaries, wages, or any other payments to the owners for more than three months. (GEM; 2017)

The Global Entrepreneurship Monitor also reports variables which touch upon the incentives behind an individual's choice to commence an entrepreneurial venture. Acs, et al. (2008) comment that GEM data capture the informal aspect of their observations, as opposed to the data documented by the World Bank and, for this reason, are considered to be more precise. Thus, the phenomena of necessity and opportunity driven entrepreneurship, needed for this study, are closely observed with the help of the corresponding variables provided by the GEM, necessity and improvement-driven ratio of entrepreneurs. The GEM portrays those variables as percentages of the Total Early-stage Entrepreneurial activity rate (TEA). Thus, when multiplied with the TEA ratio of each country for the corresponding year, we acquire the percentage of necessity and opportunity driven entrepreneurs in the workforce. Those variables are named as *NERA* and *OPRA* in our models.

It should be mentioned that due to the incomplete cross-sectional observations of the year of 2004, the second part of the empirical study (see section 4.3 which elaborates on the models) focuses on the period between 2005-2015. Moreover, some of the GEM indicators which examine Luxemburg's profile of entrepreneurship are missing. Thus, the second part focuses

on 14 instead of 15 countries. As can be implied from the above, the second part of the empirical study focuses on a balanced panel of data from 14 cross-sections for 11 time-periods.

3.1.4 Handling, Abbreviations

Lastly, the variables that refer to absolute values have been converted to difference in log, whereas percentages and rates that moderately fluctuate have been left unaltered. This way, we acquire the variables *DLGDP* and *DLNASE*. The former is the difference in log of real GDP per capita whereas the latter expresses the difference in log of the non-agricultural self-employed per thousand of workforce. Asteriou & Hall (2011) mention that time series of economic variables can be trended and usually have an underlying growth rate, which is not always constant. With the transformation of a time serie into a log, we turn it into a series that has a linear trend. Lastly, this technique has been similarly used by Braunerhjelm et al.(2010), among others, when studying the contribution of entrepreneurship on GDP growth.

The Table below presents the abbreviations used in this essay.

Table 2 Abbreviations of variables used in the empirical study

DLGDP	Difference in log real GDP/capita, chained link volumes (Base=2010)
DLNASE	Difference in log of non-agricultural self-employed per thousand of workforce
EMPLGR	Employment growth rate (%)
OPRA	Opportunity driven ratio of entrepreneurship (% of workforce)
NERA	Necessity driven ratio of entrepreneurship (% of workforce)
GEM	Global Entrepreneurship Monitor

3.2 Selection of time frame, study subjects

In an effort to develop a complete time-series for the 15 countries under focus, the data used are from the 2004 to 2015 period. Evidently, the availability and inclusion of data prior to 2004 would grant a more reliable result. However, the year of 2004 was chosen as a starting date for the study because it marks the point since when we have complete data for every participating country and the application of coherent measurement and reporting methods for every member state, according to Eurostat. Thus, we have created a balanced panel of data with 15 cross-sections for 12 time periods.

The reader's next concern would touch upon the inclusion of more cross-sections, also documented by Eurostat, which could improve the results' reliability. When studying such a complicated and broadly defined concept as entrepreneurship, the direct comparison of quantitative as well as qualitative data is fruitless, in most of the cases. The reason for that being that elements which comprise the entrepreneurial profile of each region and, consequently,

country can vary to a large extent, making cross-section comparison worthless and easy to misinterpret (Acs, 2006)

One can mention that the factors that can be included in a country's entrepreneurial environment look very much alike to the national system of innovation which has already been extensively studied and discussed by scholars (Edquist, 1997; Edquist, 2005; Edquist & Johnson, 1997; Lundvall, 2008, among others). Briefly, it is a blend of formal and informal institutions, knowledge and its diffusion. Formal institutions mainly refer to the legislative framework on which entrepreneurship relies on, with every limitation as well as motives it provides for early-stage entrepreneurship as well as established firms. Informal institutions describe the mindsets of potent entrepreneurs, the social context as well as the general public perception towards entrepreneurship. Additionally, knowledge as a term in that context can refer to a country's educational level and the initiatives towards its improvement. It can also refer to the velocity of the diffusion knowledge and information that derives from new innovative technologies as well as new organizational and consumer patterns. Lastly, the economic context of the country itself affects its firms. Low & high regional as well as national opportunities for conducting of business, the macroeconomic condition of the country, etc. are all things that should be considered.

When trying to touch upon such a complicated issue, the inclusion of widely dissimilar entrepreneurial environments that range from developing to developed economies, conservative to liberal legislative frameworks, high and low inclusion of women in the work environment etc. can question the trustworthiness of the econometric models. For this reason, the decision to focus on the EU-15 group of countries is a conscious choice towards including study subjects which to a certain extent portray convergence, share educational standards, a common institutional framework and have as similarly structured markets as possible.

3.3 Descriptive statistics

In this section, the reader can be informed on the trajectory of the various variables included in the model. For the ease of presentation, countries are ranked and divided in two groups, after examining their mean GDP growth rate and mean employment rate, weighed by 50% each (Also look at the development of the models for the second part of the empirical study, section 4.3). Thus, we obtain two groups, low and high-performing economies. Each country's time serie is presented along with the time-series of countries from their respective group. Lastly, a graph of means and std. deviation for each country group is presented.

3.3.1 Non-agricultural self-employed per thousand workforce growth rate

Figure 1 Non-agricultural self-employed/1000 workforce growth rate (%) of the 7 low performing economies of the EU-15. Source:Own calculations based on Eurostat data

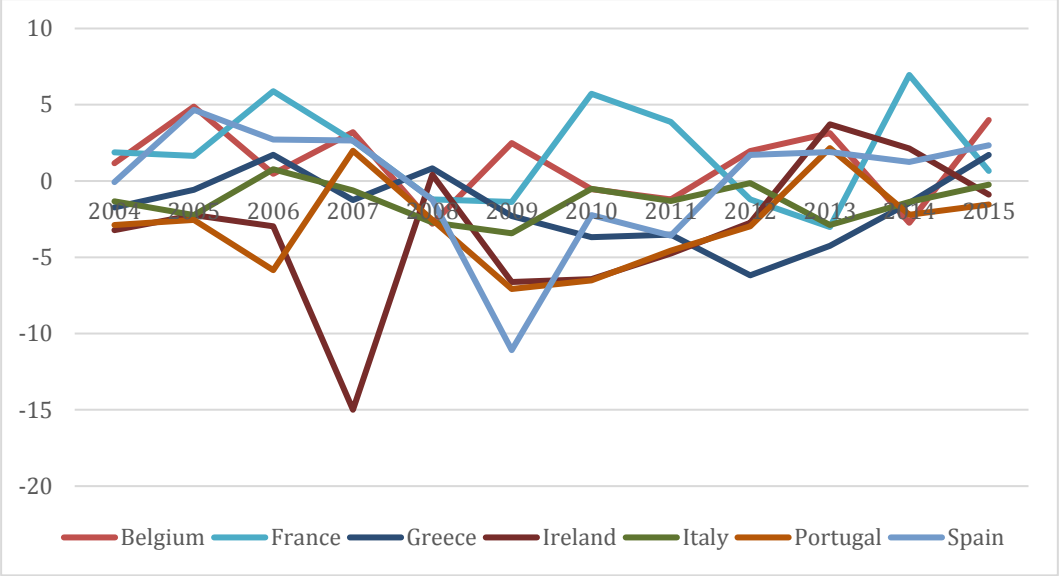


Figure 2 Non-agricultural self-employed/1000 workforce growth rate (%) of the 8 high performing economies of the EU-15. Source: Own calculations based on Eurostat data

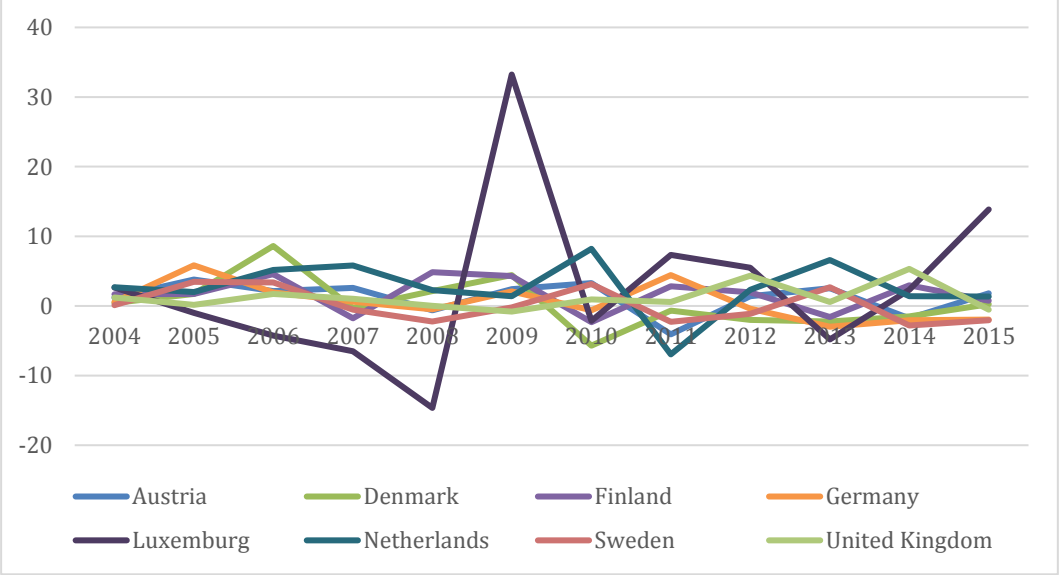
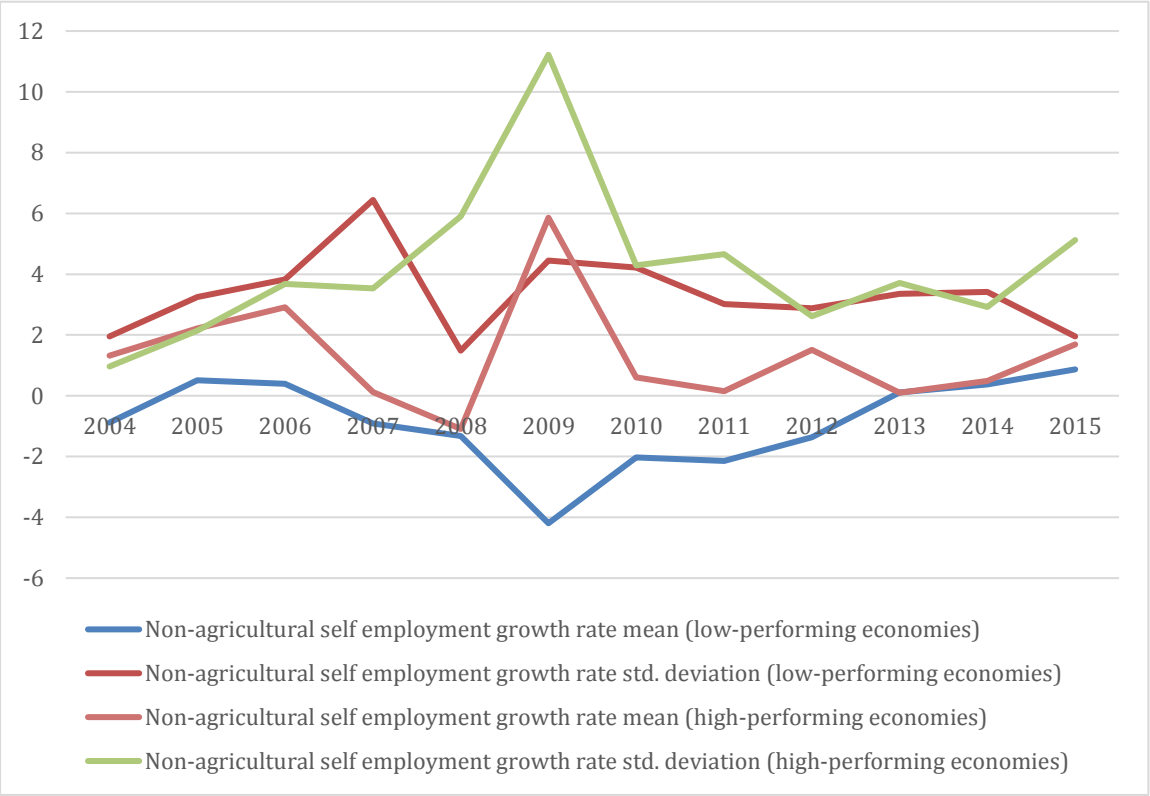


Figure 3 Non-agricultural self-employment/1000 workforce growth rate means and std. deviations for low and high-performing EU-15 economies. Source: Own calculations based on Eurostat data



3.3.2 Real GDP/capita growth rate

Figure 4 Real GDP/capita growth rate (%) for the 7 low-performing countries . Chained link volumes, base=2010. Source: Own calculations based on Eurostat data

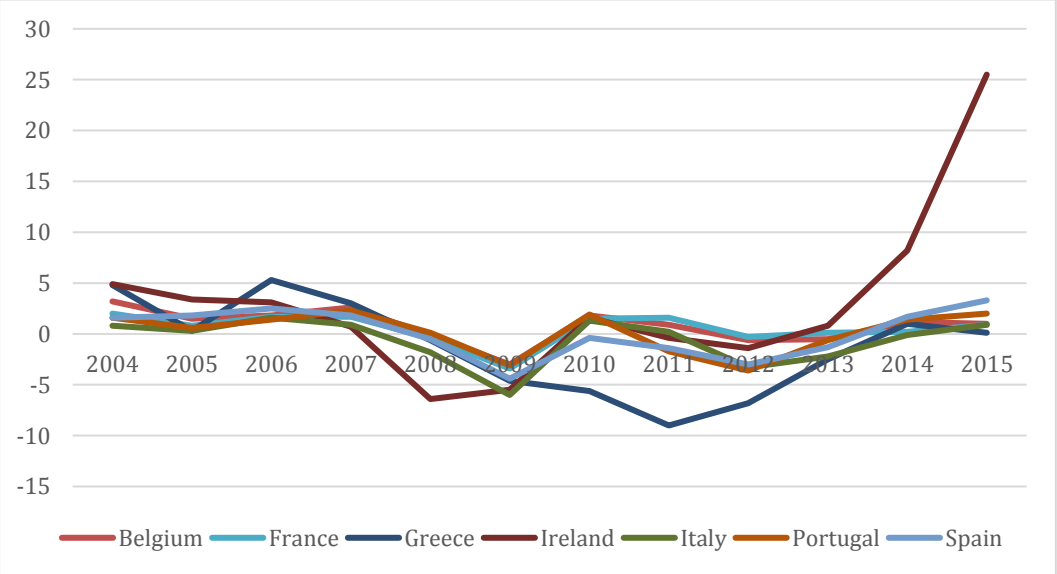


Figure 5 Real GDP/capita growth rate (%) for the 8 high-performing countries . Chained link volumes, base=2010. Source: Own calculations based on Eurostat data

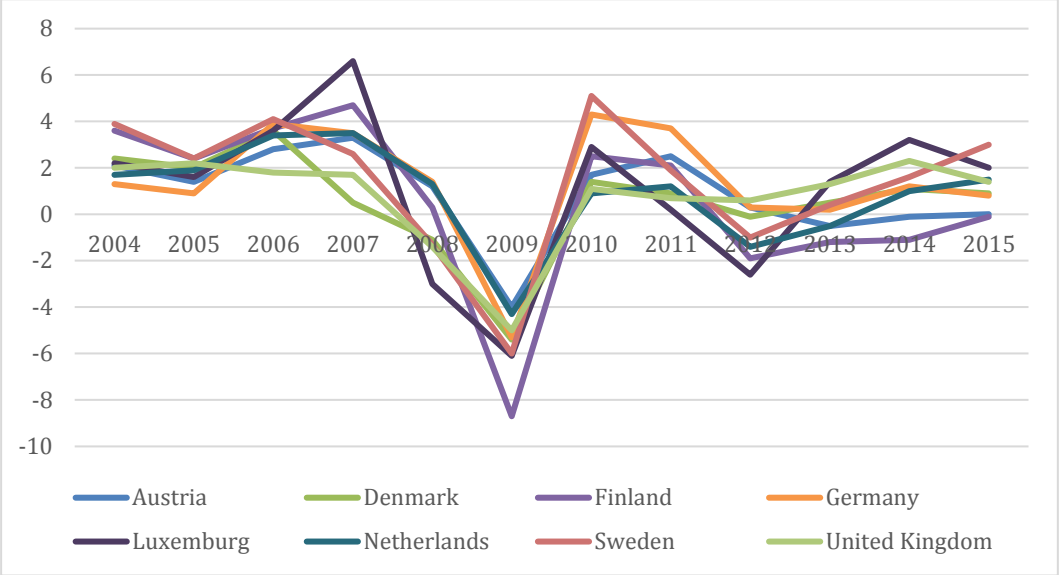
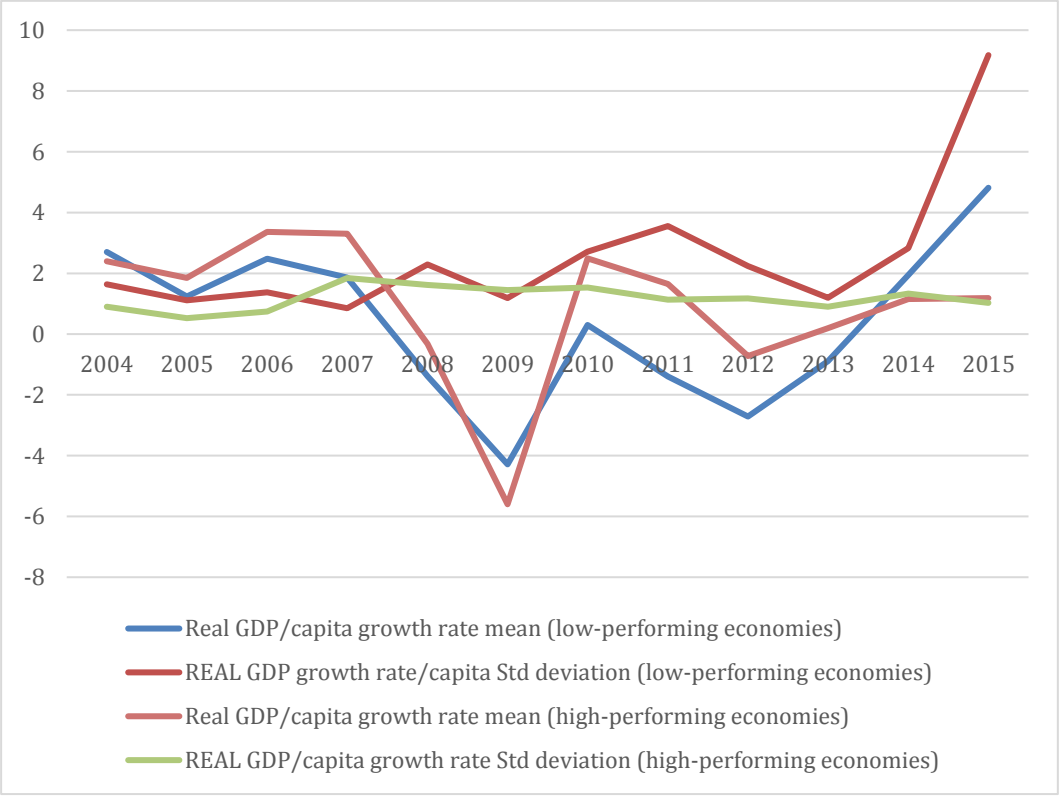


Figure 6 Real GDP/capita growth rate means and std. deviations for low and high-performing EU-15 economies. Source: Own calculations, based on Eurostat data



3.3.3 Employment growth rate

Figure 7 Employment growth rate (%) for the 7 low-performing economies. Source: Own calculations based on Eurostat data

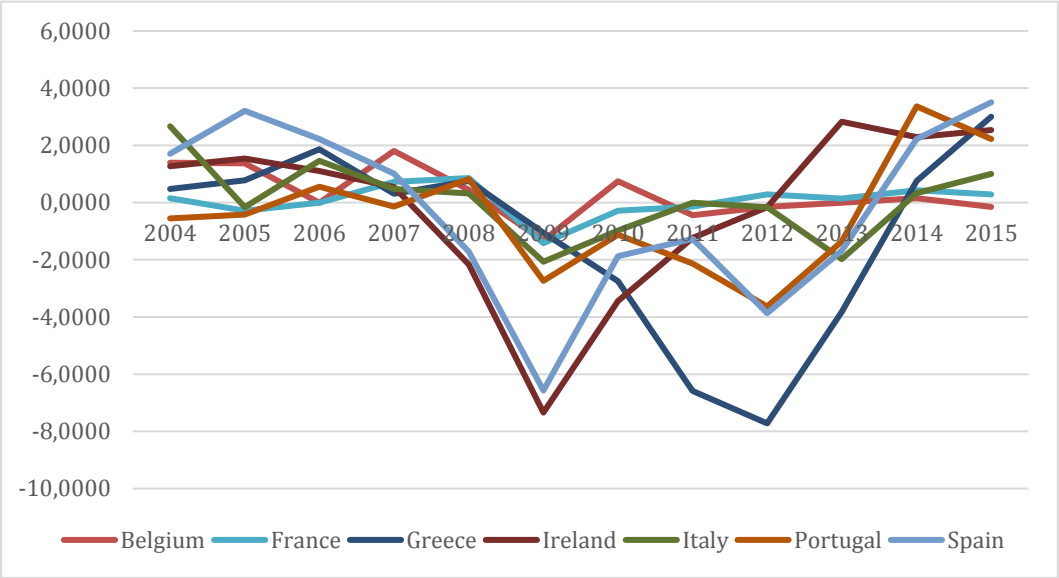


Figure 8 Employment growth rate (%) for the 8 high-performing economies. Source: Own calculations based on Eurostat data

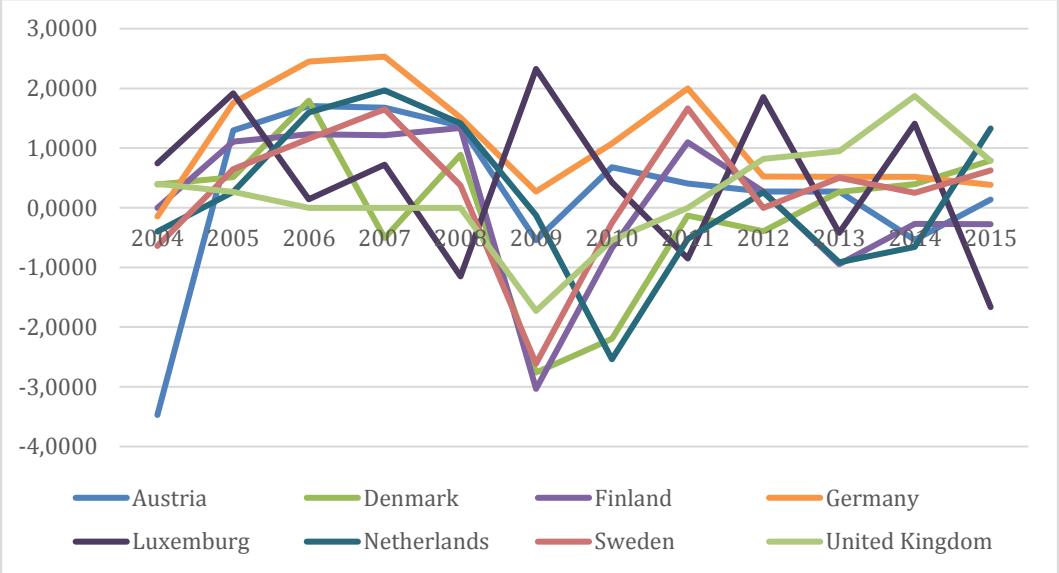
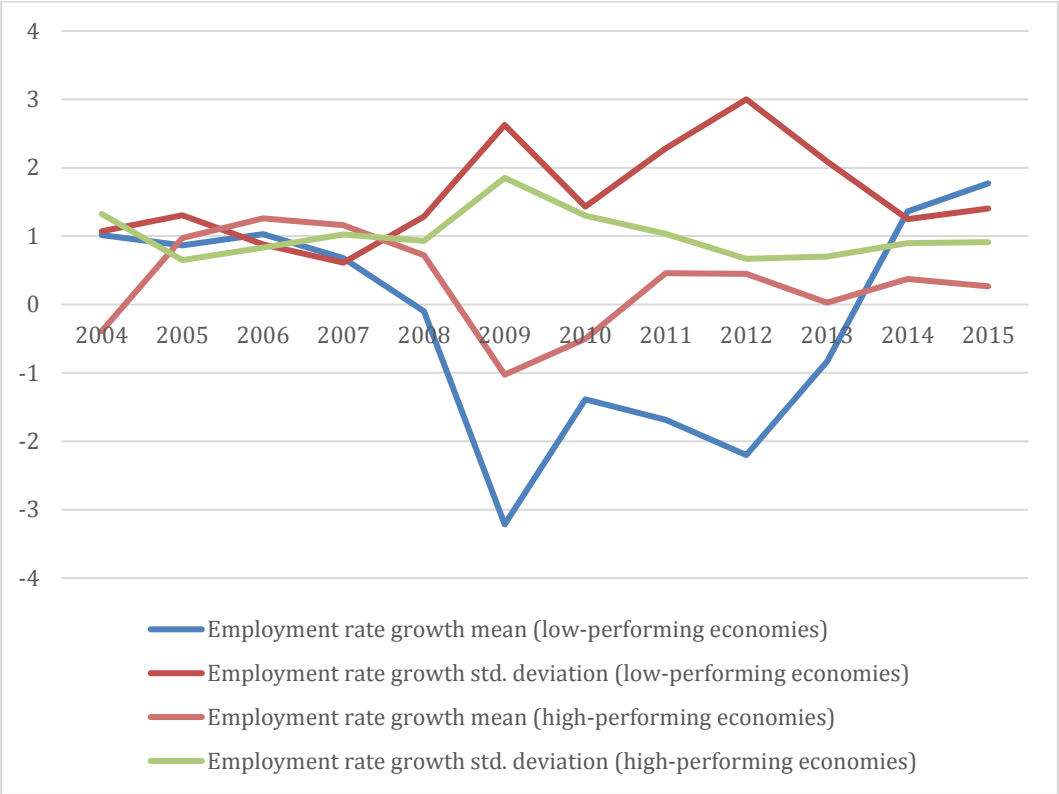


Figure 9 Employment rate growth means and std. deviations for low and high-performing EU-15 economies. Source: Own calculations, based on Eurostat data



3.3.4 Necessity-driven entrepreneurship

Figure 10 Necessity-driven entrepreneurship (as % of the whole workforce) for the 7 low-performing countries. Source: Global Entrepreneurship Monitor

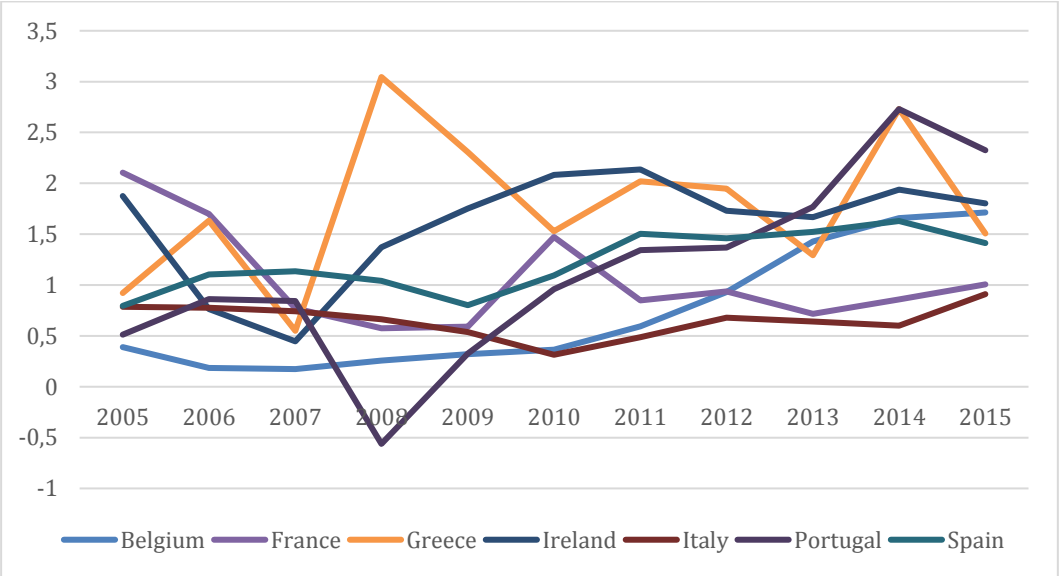


Figure 11 Necessity-driven entrepreneurship (as % of the whole workforce) for the 7 high-performing countries. Source: Global Entrepreneurship Monitor

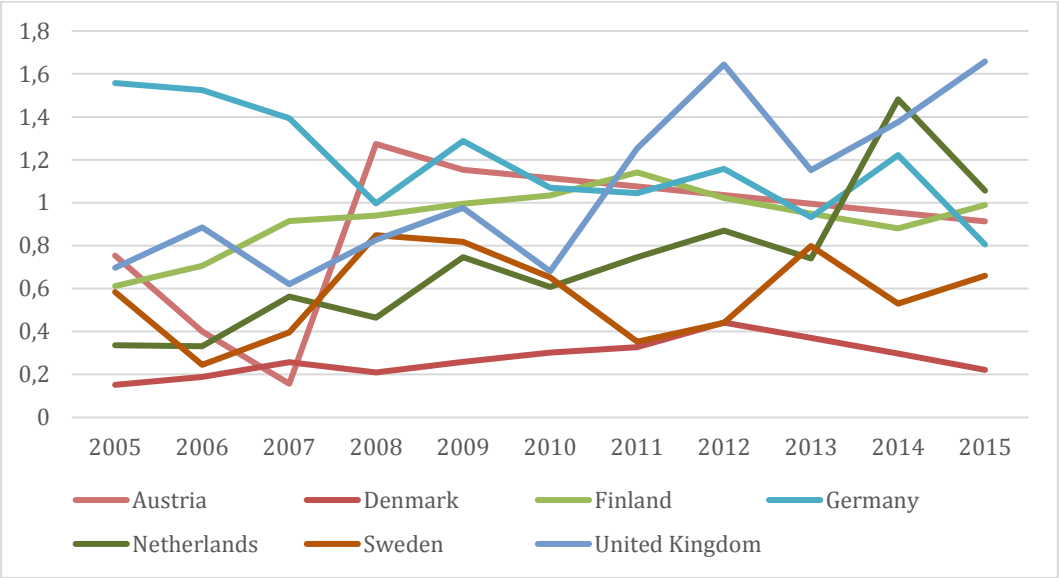
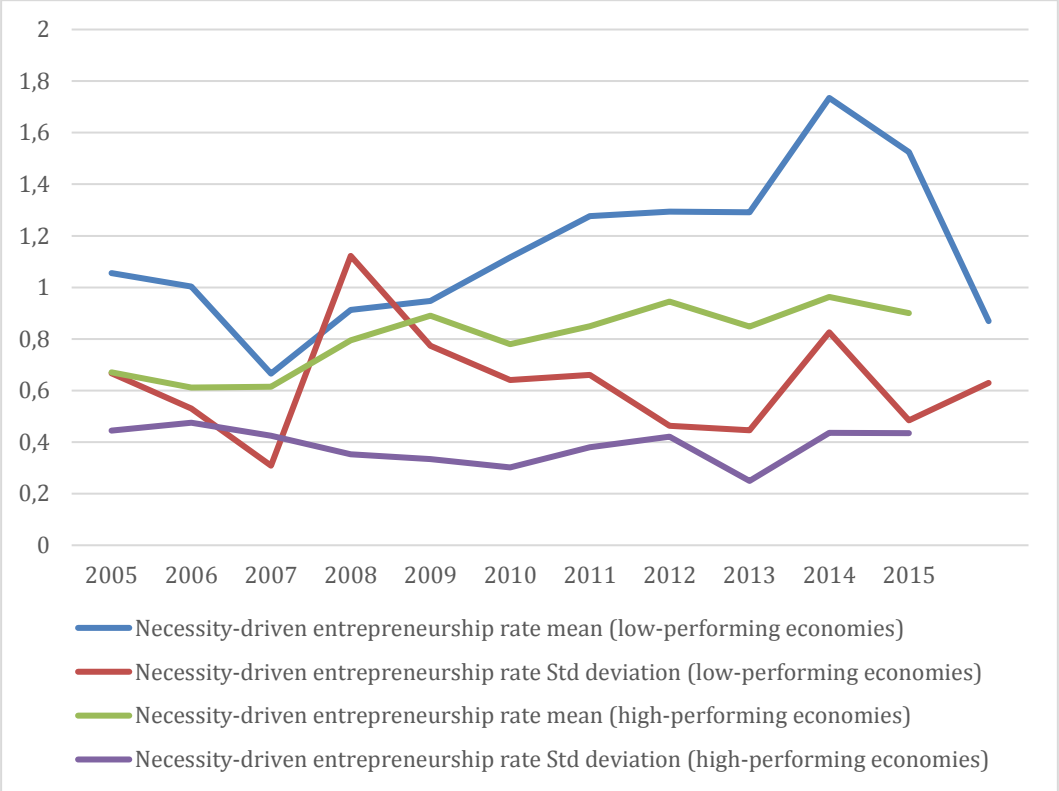


Figure 12 Necessity-driven entrepreneurship means and std. deviations for low and high-performing EU-15 economies. Source: Own calculations, based on Global Entrepreneurship Monitor



3.3.5 Opportunity-driven entrepreneurship

Figure 13 Opportunity-driven entrepreneurship (as % of the whole workforce) for the 7 low-performing countries. Source: Global Entrepreneurship Monitor

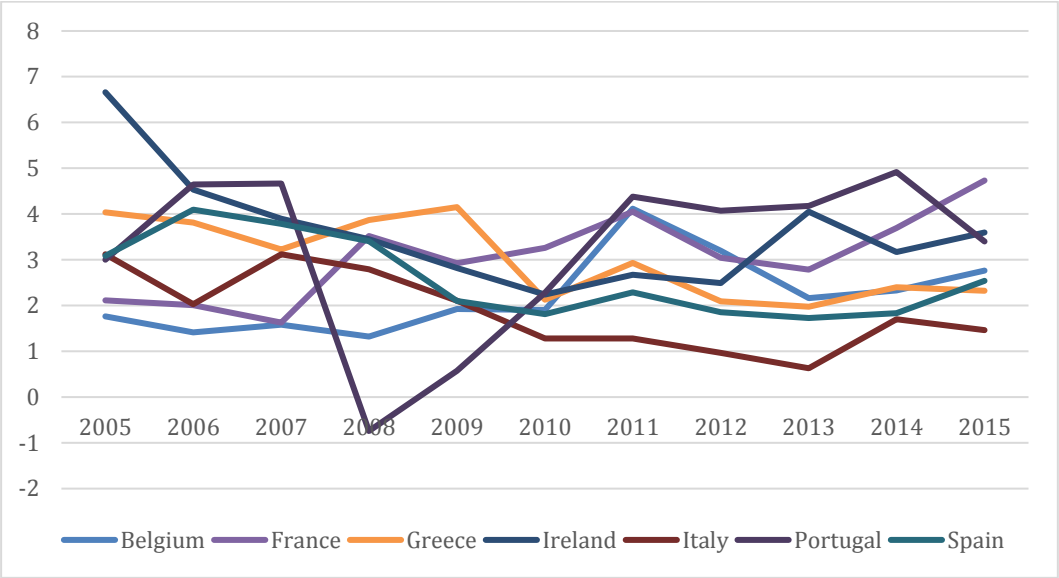


Figure 14 Opportunity-driven entrepreneurship (as % of the whole workforce) for the 7 high-performing countries. Source: Global Entrepreneurship Monitor

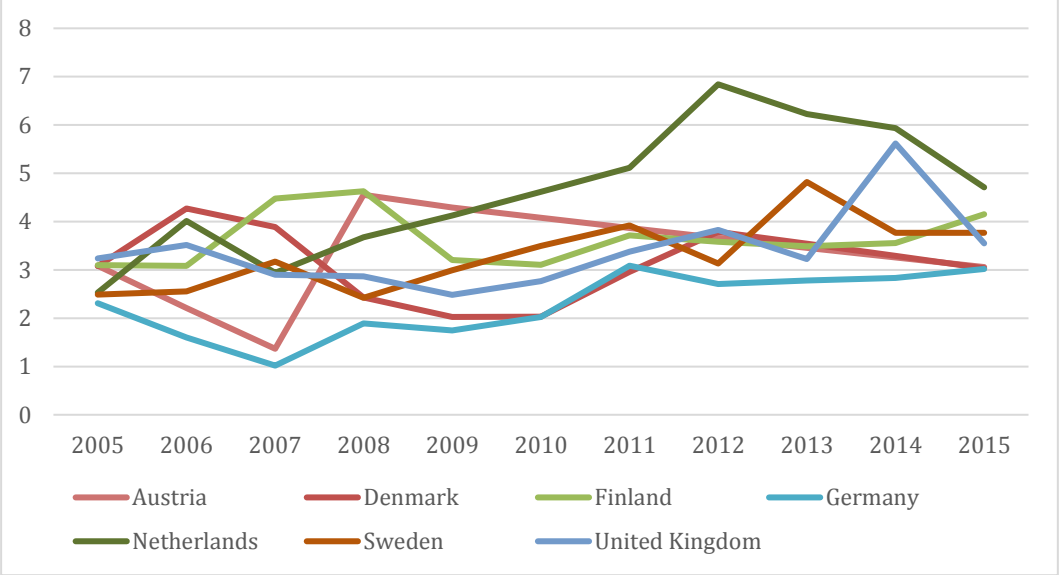
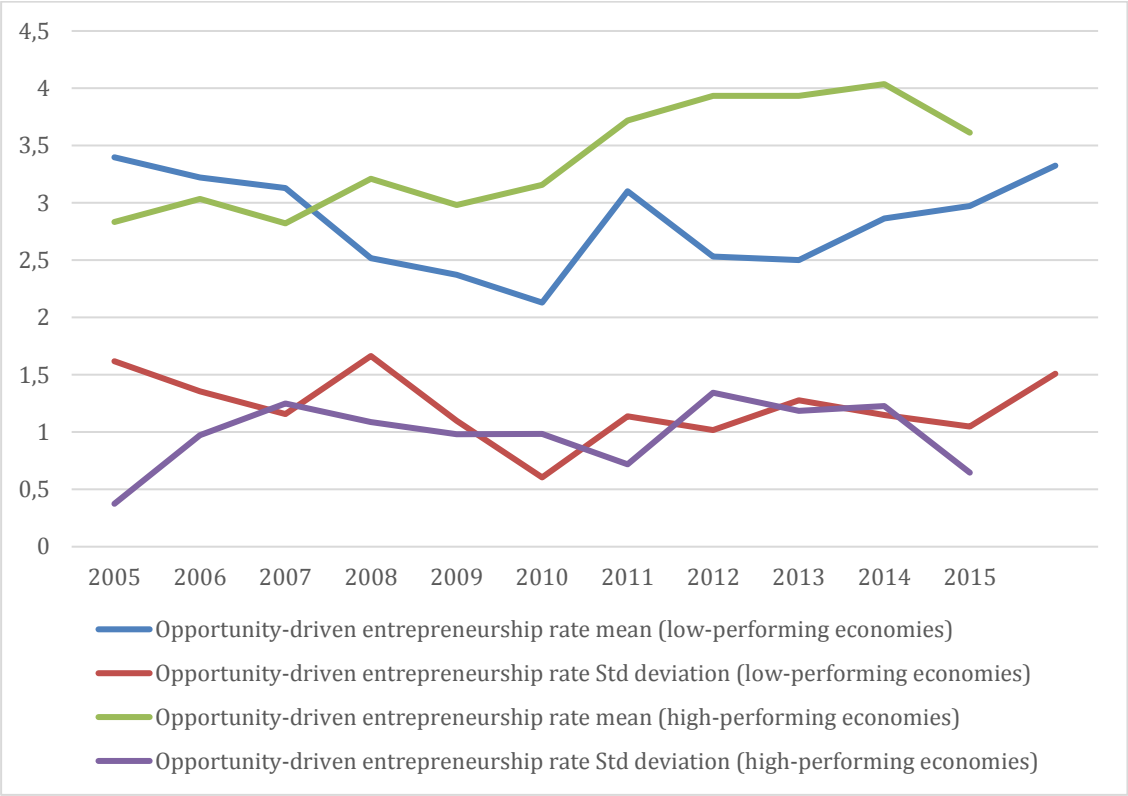


Figure 15 Opportunity-driven entrepreneurship means and std. deviations for low and high-performing EU-15 economies. Source: Own calculations, based on Global Entrepreneurship Monitor



3.4 Reflection on descriptive statistics

To begin with, observing the trajectory of non-agricultural self-employed growth rate means, we observe that contrary to the literature statements Acs (2006), the figure has a higher level in the more developed countries (Figure 3). Moreover, the standard deviation is comparable post-2010. Taking on from the literature, one would expect to see a bigger rise in entrepreneurial activity of less developed economies, especially considering the post-2008 credit crisis and austerity measures the workforce had to deal with in those countries.

The real GDP/capita growth rate graphs showcase a similar image on the performance of countries belonging in the same group. Exceptions that stand out are the dive of the Greek growth rate between the 2009-2013 period and the rapid recovery of Ireland post-2013 (Figure 4). Judging from the means in Figure 6, the "high-performing" economies had a quicker recovery of GDP growth in the post-recession period, as compared to the other country group, despite the fact that such a statement is somewhat disputable judging from the relatively high level of standard deviation displayed on the low-performing countries.

Employment rate growth is also a figure which seems to lag behind in the low-performing economies, whereas high-performing economies display a more high-level and consistent (judging from std. deviation) performance (Figure 9).

Reflecting the entrepreneurial motives behind firm establishment, our data goes in line with literature statements (notably Acs, 2006). Countries that face high unemployment rates and low incomes are more susceptible to bear higher levels of necessity-driven entrepreneurship, a statement which is visible in Figure 12. Moreover, the validity of those statements can be verified by Figure 15 where readers can observe the difference of the opportunity-driven ratios between the two country groups, with a very low standard deviation. High performing economies have more opportunity-driven entrepreneurs compared to the low performing ones.

4 Methods

This section explains the steps towards the development of Panel VAR econometric models. The primary purpose of those quantitative methods is the tracing of causality running from DLNASE and its motives to DLGDP and the EMPGR, to conduct the hypotheses testing. In this chapter, we briefly develop some of the theoretical aspects of the econometric approaches applied and continue by explaining the steps of the method utilized.

4.1 The VAR (Vector Auto-regressive) model

Asteriou & Hall (2011) mention that due to the interplay of variables included in economic theories and models, a variable can not only be an explanatory for the dependent, but the dependent can also influence the explanatory's trajectory. For this reason the development of models of simultaneous equations is suggested, with the clear identification of endogenous vs exogenous or predetermined values being needed.

However, Asteriou & Hall (2011) quote Sims (1980) to mention his critique as concerns the differentiation among variables. Sims states that all variables should undergo the same treatment, as long as there is simultaneity among some of the variables. Thus, he proposes that every variable should be treated as an independent. This is indeed the common practise when utilizing VAR models. In order to simplify the description of estimation outputs and since this essay focuses on the trajectory of GDP and employment, the convention of "dependent variable" shall be used when refering to either one of two, when being part of the "left-most" part of the equation.

An example of the reduced form VAR model as developed by Asteriou & Hall (2011) follows below.

Equation 1 Reduced form VAR model, Source: Asteriou & Hall (2011, p.321)

$$y_t = a_{10} + a_{11}\, y_{t-1} + a_{12}\, x_{t-1} + e_{1t}$$
$$x_t = a_{20} + a_{21}\, y_{t-1} + a_{22}\, x_{t-1} + e_{2t}$$

4.1.1 Advantages and disadvantages of VAR model

According to Asteriou & Hall (2011), the development of VAR models has major advantages. First-off, the VAR approach of "everything causes everything" simplifies the work of the economist. Secondly, since equations can be estimated with the OLS method, their estimation is easy. Lastly, they quote Mahmoud (1984) and McNees (1986) who mention that the VAR-produced forecasts are much more accurate when compared with those produced by the more intricate methods of simultaneous equation models. Additionaly, VAR models are great tools when trying to trace the causality running to and from various variables, especially when using the Granger or Sims causality test.

However, the application of VAR models is not without critisism. The simplistic approach of considering everything as an indipendent variable, is considered to be without foundations, since the econometrician does not base the model's structure on economic theory. Sure enough, variables can be dropped out of the model if their coefficients are insignificant, thus improving the model's theoretical basis. Moreover, the lack of theoretical foundations of VAR models makes their interpretation and commenting difficult. Asteriou & Hall (2011) suggest the use of impulse response functions to examine the response of the dependent variables to shocks in the error terms. Last but not least, Asteriou & Hall (2011) mention that the inclusion of big number of lags will consume many degrees of freedom and generate problems during the model's estimation.

4.2 Panel data

Panel data derive from collecting time-series data for various cross-sections. Baltagi (2008) mentions that some of the main advantages that come with the use of panel data is first off allowing the econometrician to control for individual heterogeneity, unlike what cross-sectional data and time series would permit. They also provide more informative data, more reliable results and give scholars the ability to study dynamics of adjustment as well as "decode" phenomena and identify effects which would not be easily detectable in cross-sections.

It should not go without mention that their usage is not without limitations. First off, the collection of data to construct balanced panel data is dependent on the funds available for research, the participant's willingness etc. Additionaly, the distortion of measurements refers to the phenomenon arising after incosistent data collection techniques, which is commonly evident for macro-economic figures, as definitions and measurement methods can vary amongst the various national statistical agencies. Moreover, one of the issues Baltagi (2008) stresses is the estimation of short time-series which affect the reliability of the estimated model. Lastly, he mentions that panels of countries or regions might suffer from cross-section dependence. However, a number of unit root test have been developed to adhere to that situation.

4.2.1 Methods of handling panel data

According to Asteriou & Hall (2011), the traditional methods of handling panel data are the common constant method, the fixed effects method and the random effects method. Since we deal with panel data, with time-series of various cross-sections, the utilization of such methods is required, with the added implementation of the VAR approach for the theoretical basis stated above and the reasoning of the model that will be provided below.

As implied by the name, the common constant method estimates a common constant for all cross-sections included in a model. Despite being useful for homogenous study objects, the model in its nature is quite restrictive and will not be used in our analysis. On the other hand, fixed effects method treat the constant as a group or section specific, thus estimating a separate constant for each section.

Lastly, the random effects model handles each section's constants as random parameters but the econometrician needs to make assumptions that concern the distribution of the random component. Nevertheless, random effects models require the estimation of fewer parameters as compared to the fixed effects method and adittionally allows the inclusion of dummies in the model, as explanatory variables that have a stable value. With the random effects model the econometrician presumes that the fixed effects are uncorrelated with the explanatory variables and each study subject has different error terms. In order to make the selection between the two, one must run the Hausman test. In light of the above, for the purpose of this essay and for the theoretical implications that one must reflect upon when studying a heterogenous group of study objects, we will utilize the Fixed Effects method. The Fixed effects can be written down as:

Equation 2 The fixed effects panel model, Source: Asteriou & Hall (2011, p.418)

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \ldots\ldots + \beta_k X_{kit} + u_{it}$$

Or, in panel notation form

$$Y = D\alpha + X\beta' + u$$

Where D is a Dummy variable which allows for a different coefficient for each group.

4.3 The models

In our specific models we use the Panel VAR approach, which includes the lagged independents into the estimation of the "dependent". The first part of the empirical study focuses on a system of three Panel VAR equations which include the variables of DLGDP, DLNASE and EMPGR. Since every variable included in this approach is cosidered to be an independent, when applying VAR models scholars display a system of equations. Those systems include as many equations as the the endogenous variables of the models. Lastly, scholars who have conducted similar research on the effects of entrepreneurship on growth have also utilized VAR models (notably, Thurik et al., 2008; Bos & Stam, 2013; the latter utilize a panel VAR approach). The first system of equations is of that form, assuming a 2 lag length is optimal.

Equation 3 First system of equations

$$DLGDP_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + u_{it}$$

$$EMPGR_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + u_{it}$$

$$DLNASE_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + u_{it}$$

With i=15, t=12

The reasoning for the inclusion of those variables is the following. We can argue that the growth of a country's employment rate can severly affect its GDP growth and this is why it is included in the model. Countries with massive waves of unemployment are expected to have poorly performing GDP growth, due to the low -if any- income of the unemployed. Moreover, the GDP growth rate is affected by the previous years' levels. Lastly, the variable of DLANSE is of course included in the model to check if it causes the behaviour of DLGDP. On the other hand, when considering EMPGR as a dependent for the second equation in the group, we include the lags DLGDP in the equation, arguing that a growing GDP is the basis of more savings and thus investments which lead to the creation of more job positions. Similarly with the previous equation, the variable of DLNASE is included to check for the causality running from it to the employment rate and the lags of employment itself are included since the employment rate of previous years will sure have an impact on its current level. Lastly, the equation of DLNASE as the "dependent" including its lags along with the lags of the other variables is also included in the system of equations.

For the second part of the empirical research the fourteen countries will be ranked and divided into two separate groups, based on their GDP per capita growth and employment growth rate figures. As already mentioned Luxemburg was exempted from the analysis due to small availability of GEM indicators documented. To form the two country groups, we calculate the mean GDP growth rate and the mean employment growth rate for each country. Each rate is weighed by 50%. Then we rank the weighted average rates of each country. The first group consists of six nations which are named as "less developed". Those countries are Belgium, France, Greece, Italy, Ireland, Portugal, Spain. On the other hand, Austria, Denmark, Finland, Germany, Netherlands, Sweden and UK are part of the "developed" group of countries, based on their GDP per capita growth and employment rate growth.

The second part also marks the inclusion of the Opportunity & Necessity ratio of entrepreneurship into the equations (OPRA & NERA). Again, we check for causality running from the independent variables to the "dependent". This time we combine the variables used in the first system of equations with the new ones. The second system of equations utilizes data from the "less developed" countries group, whereas the third system of equations is developed based on the data provided for the "developed" country-group.

In the first equation the "depended" is DLGDP regressed against its own lags along with the lags of EMPGR, DLNASE, OPRA and NERA. In the second equation our "depended" variable is EMPGR, regressed against its own lags and the lags of DLGDP, DLNASE, OPRA and NERA. The rest three of the equations included in the model utilize DLNASE, OPRA and NERA as the "dependents", regressed against their own lags and the lags of DLGDP and EMPGR. The second and third system of equations are displayed in Equation 4, assuming a 2 lag length is optimal. The difference between the two is the distinct study object they utilize.

The models of this essay include lags of their variables as a way to take into account that changes of macro-economic variables usually require time before they influence the trajectory of other variables in the future. Changes are not instantaneous (Thurik et al.; 2008). For example, a person will probably require to have a number of years of steadily high wage or income and will take time to consider an investment which, if successful, will ultimately cause the increase of job positions in the market. The inclusion of lagged variables that represent the incentives of new entrepreneurs (OPRA & NERA) in our models can be reasoned by the time required for a new business to find or even create its market, set its standards etc, and ultimately thrive. For example, there is a certain amount of time needed before a necessity-driven entrepreneur makes satisfactory profit and hires more personel in his/her firm. With the lagged OPRA & NERA variables we take that statement under consideration.

Equation 4 Second and Third system of equations

$$DLGDP_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + \beta_6 NERA_{it-1} + \beta_7 NERA_{it-2} + \beta_8 OPRA_{it-1} + \beta_9 OPRA_{it-2} + u_{it}$$

$$EMPGR_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + \beta_6 NERA_{it-1} + \beta_7 NERA_{it-2} + \beta_8 OPRA_{it-1} + \beta_9 OPRA_{it-2} + u_{it}$$

$$DLNASE_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + \beta_6 NERA_{it-1} + \beta_7 NERA_{it-2} + \beta_8 OPRA_{it-1} + \beta_9 OPRA_{it-2} + u_{it}$$

$$NERA_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + \beta_6 NERA_{it-1} + \beta_7 NERA_{it-2} + \beta_8 OPRA_{it-1} + \beta_9 OPRA_{it-2} + u_{it}$$

$$OPRA_{it} = \alpha_i + \beta_1 DLGDP_{it-1} + \beta_2 DLGDP_{it-2} + \beta_3 DLNASE_{it-1} + \beta_4 DLNASE_{it-2} + \beta_5 EMPGR_{it-1} + \beta_5 EMPGR_{it-2} + \beta_6 NERA_{it-1} + \beta_7 NERA_{it-2} + \beta_8 OPRA_{it-1} + \beta_9 OPRA_{it-2} + u_{it}$$

With i=7, t=11

4.4 Methodology

This section analyzes the steps of the econometric procedure the study follows. Data are handled with the help of EViews 9.

4.4.1 Stationarity, Lags

Prior to the development of our models we need to check our variable's stationarity at level. That will be done by consulting the Levin, Liu & Chu test, using Schartz Info criterion of automatic lag selection. The null hypothesis mentions that the variable has a unit root and is not stationary.

If all our variables are stationary at level, we can execute the classic regression method of OLS, since estimates are BLU (Asteriou & Hall, 2011). However, we proceed with the estimation of the VAR (Vector Auto Regressive) model, with the reasons behind that decision stated above.

4.4.2 Development of the VAR model

To make the optimal selection of lags to include, for the VAR model, we experiment with regressions including various number of lags. More specifically, we run test regressions with 2,3 and 4 lags. The model that has the lowest number of Akaike Info Criterion as well as Schwarz Info criterion is the one that will be utilized, eventually.

4.4.3 Causality

In this section we discuss the steps towards exploring the direction of causality. The current study uses a modified Wald test on the coefficients of the lagged "independent" variables. Before elaborating on the MWald test, some of the major drawbacks behind the utilization of other causality tests for this study are presented. As already mentioned, a widely-used test for causality in empirical studies is the Granger causality test. When developing Panel VAR models for their study of the impact of Dutch high-growth firms in their respective industry, Bos and Stam (2013) underline that to their knowledge a Granger causality test for Panel VAR model does not exist. Instead, they treat their panel data as pooled time-series and run the Granger causality test, warning the readers that this way their results might be seriously biased.

Moreover, Eviews provides a Granger causality test for panel data, with two options. The first option would run the Granger causality test with a common coefficient for all cross-sections. This option does not take into account the heterogeneity of our data and is considered not to be suitable. Secondly, the Dumitrescu-Hurlin option allows for individual coefficients for each cross-section to be estimated and lags to be included. This is considered much more suitable to our analysis. However, working in pairs of variables, it traces the probability of one variable *not* causing the other. For this reason, it goes by the name of Dumitrescu-Hurlin *non-causality test*. Even when rejecting the non-causality null hypothesis, one cannot safely state that there is a causality running from the "independents" towards the "depended". This grants its results not usable for the purpose of this study. Nevertheless, the results of the Dumitrescu-Hurlin non-causality test will be provided for the first part of the empirical study. Due to the limited number of observations and the inclusion of more variables in the second part of the empirical study, the Dumitrescu-Hurlin test cannot be run.

On the other hand, Hacker & Hatemi-J (2006) propose the alternative of the Modified Wald test as developed by Toda and Yamamoto (1995). The Modified Wald test suggests the use of an augmented VAR(p+d) model, with p being the number of lags used in the initial model and d being the maximum order of integration displayed by the variables. The null hypothesis of the test states that the coefficients of the lagged in the model are jointly equal to zero. This would mean that the lags of the independent don't cause the behavior of the dependent. When rejecting the null, the lagged coefficients of the "independent" are not jointly equal to zero.

Thus, we prove that the lags of the "independent" cause the behavior of the "dependent". For our case, in order to execute the MWald test, we estimate a new VAR model with one more lag than the initial, since all of our variables are I(0). Hacker & Hatemi-J (2006) mention that the inclusion of more lags (a higher value d) does not distort the results of the test.

Hacker & Hatemi-J (2006) comment that this method is more reliable than the standard Granger causality test in VAR models where the variables integrate in the same order. However, ways to improve the reliability of the results would be testing a longer time-series, and when this is not possible, using the bootstrap distribution instead of the chi-square (χ^2) .

It should be mentioned that due to the limited number of observations, cross-sections and time-periods included in the study, a significance level of α=0,1 will be favored instead of the literature standard of α=0,05.

5 Empirical Analysis

In the sections below we briefly comment on the estimation of models. Data are handled with the help of EViews 9. The estimation outcomes are displayed in Tables 3 to 5. Moreover, Modified Wald tests are used to check for the existence of causality running from the lagged "independents" to the "depended" of each model. The collective outcomes of the Modified Wald tests for causality running from the "independents" towards the "dependent" variables of interest are displayed in Table 6.

5.1 Model estimations

5.1.1 Stationarity tests

After examining the stationarity of data with the Levin, Lin & Chu test, it can be stated that all our variables are stationary, meaning that they have no unit root at level. The test was executed with a significance level of α=0,05. Thus, we can state that every variable for every examination period is I(0).

5.1.2 First part: EU-15 countries, 2004-2015

Since the stationarity of all variables at level was ensured we can proceed with the estimation of the VAR model. After experimenting with models of various lags, the one that bears the minimum AIC and SIC is the two-lag model. We proceed with the estimation of the fixed effects model for every equation in the model. Then, we execute the pairwise Dumitrescu Hurlin Panel Causality Tests for the first part of the empirical study. Its results indicate that the only non-causality running between the pairs of variables of the models is between the pair of DLGDP and EMPGR. Bearing in mind that the test simply focuses on the non-causal relationship, we can point out that according to the results, DLGDP *might* cause EMPGR. As will be documented later by the MWald test results of Table 6, this statement is true. The complete DHPCT results can be found in Appendix A.

5.1.3 Second part, EU-14 divided into two groups, 2005-2015.

For the second part of the empirical research the fourteen countries are divided into two separate groups, based on their GDP per capita and employment rate figures. As already mentioned

Luxemburg was exempted from the analysis due to small availability of GEM indicators for the country. The first group consists of six nations which are named as “less developed” and are included in the second system of equations. Those countries are Belgium, France, Greece, Italy, Ireland, Portugal, Spain. On the other hand, Austria, Denmark, Finland, Germany, Netherlands, Sweden and UK are part of the “developed” group of countries, based on their GDP per capita and employment rate growth and are included in the third system of equations.

Moreover, from this point on, we insert the GEM entrepreneurship indicators which document entrepreneurial motives. Those indicators include the opportunity driven ratio of entrepreneurship (OPRA), the necessity ratio of entrepreneurship (NERA). All the variables of both groups have been tested with the Levin, Lin & Chu test and are stationary at level, or I(0).

Second system of equations – Less developed countries

We develop a 2 lag fixed effects panel VAR, after observing the AIC and SIC for all the equations of the system.

Third system of equations – Developed countries

After ensuring the stationarity of the variables, we can estimate the Panel VAR models for the “developed” country-group. The AIC and SIC indicate the development of a 4 lag fixed effects equation which considers GDP as the “dependent”, whereas the rest of the equations are developed with 2 lags.

5.2 Results

Below the reader can observe the estimation outcomes of the fixed effects Panel VAR models.

Table 3 Panel VAR System of equations #1. Estimation outcomes of the Panel VAR System of equations developed for the First part of the empirical study. EU-15 (2004-2015). Source: Own calculations

First System of Equations EU-15 (2004-2015)

Dependent / Independents		FE 2 lags DLGDP	FE 2 lags EMPGR	FE 2 lags DLNASE
	R-squared	31,64%	39,84%	22,02%
	Constant	0.0014 (1,2852)	-0.1078 (-0,675296)	0.0008 (0,4940)
DLGDP	lag 1	0,4367*** (3,3502)	43,3343*** (2,8516)	-0,2895 (-1,5432)
	lag 2	-0,3352** (-2,5206)	3,2107 (0,2071)	-0,0283 (0,1480)
	lag 3			
	lag 4			
DLNASE	lag 1	0,2573*** (3,5901)	9,8423 (1,1778)	-0,2891*** (-2,8030)
	lag 2	0,0696 (0,9378)	11,3599 (1,3127)	-0,0656 (-0,6142)
	lag 3			
	lag 4			
EMPGR	lag 1	-0,0006 (-0,5750)	0,3086** (2,3167)	0,0039 (2,4214)
	lag 2	0,0012 (1,8104)	-0,2458** (-2,2195)	-0,0005 (-0,4358)
	lag 3			
	lag 4			

***=0,01 significance , **=0,05 significance, *=0,1 significan FE= Fixed effects

t-statistics in parentheses

Table 4 Panel VAR System of Equations #2. Estimation outcomes of the Panel VAR System of equations developed for the Second part of the empirical study. EU-14 (2005-2015), "Less Developed" country group. Source: Own calculations

Second system of equations EU-14 (2005-2015) "Less developed" country group						
Dependent / Independents		FE 2 lags DLGDP	FE 2 lags EMPGR	FE 2 lags DLNASE	FE 2 lags NERA	FE 2 lags OPRA
	R-squared	58,17 %	55,68 %	34,42%	53,74 %	44,62 %
	Constant	0.0070 -0.9732	-0.2175 (-0.2182)	-0.0095 (-1.1186)	0.6877** 2.3001	1.8214*** (3.4704)
DLGDP	lag 1	0.8847*** -3.6800	60.3866* (1.8322)	0.1416 (0.5009)	-9.3959 -0.9501	9.1718 (0.5283)
	lag 2	-0.7238*** (2.8335)	-1.2995 (-0.0371)	-0.3398 (-1.1307)	4.2668 (0.4060)	-22.4021 (-1.2145)
	lag 3					
	lag 4					
DLNASE	lag 1	0.3124** (-2,2061)	23.8076 (1,2264)	-0.2045 (-1,2279)	0.2568 (0,0440)	-11.2250 (-1,0978)
	lag 2	0.1848 (-1.0731)	32.7925 (1.3891)	-0.2288 (-1.1299)	5.5363 (0.7816)	0.2903 (0.0233)
	lag 3					
	lag 4					
EMPGR	lag 1	-0.0020 (-1.3137)	0.3176 (1.4926)	0.0023 (1.2687)	0.0215 (0.3373)	0.1125 (1.0040)
	lag 2	0.0029* (1,7302)	-0.3979* (-1,6967)	0.0020 (1,0199)	-0.1009 (-1,4339)	0.0403 (0,3095)
	lag 3					
	lag 4					
NERA	lag 1	0.0027 (0.6296)	-0.0527 (-0.0894)	0.0052 (1.0295)	0.3060 (1.7286)	0.0962 (0.3095)
	lag 2	-0.0005 (-0.1149)	0.3825 (0.6143)	0.0050 (0.9496)	0.0280 (0.1502)	-0.1955 (-0.5960)
	lag 3					
	lag 4					
OPRA	lag 1	-0.0010 (-0.4769)	0.1721 (0.5492)	0.0008 (0.3006)	0.0679 (0.7223)	0.4540*** (2.7508)
	lag 2	-0.0015 (-0.7653)	-0.3072 (-1,1407)	-0.0033 (-1.4445)	-0.0332 (-0.4117)	-0.0945 (-0,6667)
	lag 3					
	lag 4					

***=0,01 significance , **=0,05 significance, *=0,1 significan FE= Fixed effects
t-statistics in parentheses

Table 5 Panel VAR System of Equations #3. Estimation outcomes of the Panel VAR System of equations developed for the Second part of the empirical study. EU-14 (2005-2015), "Developed" country group. Source: Own calculations

Third system of equations EU-14 (2005-2015) "Developed" country group						
Independents \ Dependent		FE 4 lags DLGDP	FE 2 lags EMPGR	FE 2 lags DLNASE	FE 2 lags NERA	FE 2 lags OPRA
	R-squared	83,04 %	49,17 %	34,42%	66,09 %	62,90%
	Constant	-0.0195* (-1.9138)	-0.3952 (-0.5940)	-0.0095 (-1.1186)	0.4006** (2.3807)	2.1718*** (4.1330)
DLGDP	lag 1	-0.8655*** (-4.0548)	58.3481*** (3.0070)	0.1416 (0.5009)	-0.0051 (-0.0010)	19.0352 (1.2420)
	lag 2	-1.0946*** (-5.0097)	-8.6485 (-0.4651)	-0.3398 (-1.1307)	-2.7225 (-0.5789)	-5.0109 (-0.3412)
	lag 3	-0.7022*** (-3.0761)				
	lag 4	-0.3607** (-1.8759)				
DLNASE	lag 1	-0.0598 (-0,4884)	1.1715 (0,1023)	-0.2045 (-1,2279)	-0.5181 (-0,1790)	-15.6671* (-1,7336)
	lag 2	-0.0181 (-0.1291)	14.9892 (1.2520)	-0.2288 (-1.1299)	0.7241 (0.2391)	-13.0672 (-1.3819)
	lag 3	-0.1830 (-1.2405)				
	lag 4	-0.2435* (-1.8947)				
EMPGR	lag 1	0.0017 (0.7753)	-0.1204 (-0.5504)	0.0020 (1.2687)	0.0117 (0.2118)	-0.1624 (-0.9394)
	lag 2	0.0054** (2,5386)	0.0838 (0,4393)	0.0020 (1,0199)	0.0261 (0,5406)	0.0575 (0,3815)
	lag 3	0.0018 (0.7656)				
	lag 4	0.0007 (0.4026)				
NERA	lag 1	0.0026 (0.3880)	0.3187 (0.4806)	0.0052 (1.0295)	0.2523 (1.5040)	-0.2567 (-0.4899)
	lag 2	0.0101 (1.5326)	0.8173 (1.2212)	0.0050 (0.9496)	0.0782 (0.4622)	0.1773 (0.3355)
	lag 3	0.0027 (0.4258)				
	lag 4	-0.0044 (-0.6561)				
OPRA	lag 1	0.0051 (2.2023)	-0.0804 (-0.3833)	0.0008 (0.3006)	0.0590 (1.1120)	0.4257** (2.5684)
	lag 2	-0.0016 (-0.7538)	-0.0686 (-0.3385)	-0.0033 (-1.4445)	-0.0098 (-0.1928)	0.0213 (0.1333)
	lag 3	0.0006 (0.3063)				
	lag 4	-0.0001 (-0.0745)				

***=0,01 significance , **=0,05 significance, *=0,1 significan FE= Fixed effects

t-statistics in parentheses

Summing up, an overview of the causality influences amongst variables is portrayed below. A check mark indicates causality running from the lags of the independent to the behavior of the dependent, whereas an x point indicates that the MWald test reveals no causal relationship.

Table 6 Causality of "independents" towards the "depended", based on the results of the modified Wald (MWald) test. Source: Own calculations.

Dependents / Independents	System of equations #1		System of equations #2		System of equations #3	
	DLGDP	EMPGR	DLGDP	EMPGR	DLGDP	EMPGR
DLGDP	.	✓***	.	✓***	.	✓***
DLNASE	✓**	✓*	✓**	✓*	✗	✓*
EMPGR	✓**	.	✓**	.	✗	.
NERA	-	-	✗	✗	✗	✗
OPRA	-	-	✗	✗	✗	✗

5.3 Discussion

For the first part of the empirical study, DLNASE shows a clearly positive effect on GDP as well as on EMPGR (Table 3). Moreover, as the MWald suggests (Table 6), there is a causal relationship running from DLNASE to both DLGDP as well as EMPGR. This goes in line with the findings in literature that suggest that entrepreneurship has a positive effect on GDP and employment rate.

As can also be expected, there is a two-way causality in the pair of GDP and employment growth rate (Table 6). In a flourishing economy, the number of job positions is expected to rise. On the other hand, since we are considering developed countries, a satisfactory growing employment rate, most of the times, guarantees a good income for citizens and promotes the feeling of trust in the economy, attracting more investments that further boost GDP.

As we move along to the second part of the empirical study, we focus on the separate country groups. We observe that the main contrast is evident in the models which consider GDP as their "depended". In the "less developed" country group (second system of equations, Table 6) the lags of DLNASE and EMPGR clearly have an impact on DLGDP, whereas that is not the case with the "developed" countries, whose DLGDP does not seem to be affected by any of the variables included in the model. Additionally, DLNASE has a positive and significant coefficient (Table 4).

However, in both system of equations, the ratios of Necessity and Opportunity driven ratios of entrepreneurship do not reveal to have any causal relationship with GDP's trajectory (Table 6). One can also mention that in neither of the models are they statistically significant (Table 4 & 5).

Furthermore, the models that consider EMPGR as their dependent exhibit similarities in both groups. First-off, as already analyzed in the first system of equations, there is a causal

relationship running from DLGDP and DLNASE towards the trajectory of EMPGR, as expected. However, once again we observe that the necessity and opportunity ratios of entrepreneurship have neither an impact on the "depended", nor have statistically significant coefficients. It should also be mentioned that comparing them to the rest of the coefficients, their numerical values are rather low and fluctuate around zero, in most of the cases.

An interesting fact is also present when closely observing the signs of necessity and opportunity driven ratios of entrepreneurship. We observe that necessity driven entrepreneurship coefficients have a positive sign, in most of the cases. This signifies that they positively contribute to the trajectory of DLGDP and EMPGR. That is a result which does not go in line with previous studies (Acs, 2006), as it would be expected of them to negatively affect GDP growth. Moreover, the coefficients of opportunity driven entrepreneurship have a negative sign, also contrasting our expectations and previous literature findings. However, when reflected upon the insignificance of coefficients and non-causality results from the MWald test, it is questionable if the positive and negative signs should be taken under consideration.

5.3.1 Reflection of the results on the research hypotheses

To wrap up, we compare our research results with our initial hypothesis.

> *Hypothesis 1. Entrepreneurship has a positive impact on GDP growth, in EU-15 countries.*
>
> *Hypothesis 2. Entrepreneurship has a positive impact on the employment growth rate, in EU-15 countries*.

As also pinpointed by the majority of scholarly writings, our research has explored that this statement is valid. GDP growth and employment growth rate go in line with the trajectory of entrepreneurship.

> *Hypothesis 3. Necessity driven entrepreneurs in the less economically developed countries of the EU-15 do not affect their country's employment and growth rate.*

Due to the fact that the MWald test does not indicate an impact coming from necessity-driven entrepreneurship towards the GDP and employment rate, we shall agree with that statement.

> *Hypothesis 4. Opportunity driven entrepreneurs in the more economically developed countries of the EU-15 have a positive impact on their country's growth and employment rate.*

Again, based on the fact that the MWald tests do not showcase a clear image, due to the absence of causality, we shall respond that from our research this statement cannot be verified.

Overall, this empirical research verifies the majority of academic results which mentions the positive impact of entrepreneurship to growth. On the other hand, our findings are not that clear concerning the motives of entrepreneurs. Despite the fact that the indifferent impact of necessity-driven entrepreneurship to growth comes up in our research, we fail to explore

indications for the opposite fact for the case of opportunity-driven entrepreneurship. Moreover, in the more developed economies of the EU-15, when controlling for entrepreneurial motives, we even fail to see entrepreneurship's impact on growth, for the time period of 2005-2015. Thus, we can assume that the trajectory of economic growth in the developed countries can be better defined by other parameters. Perhaps, growth in that period was more affected by the rule-changing implications of the economic crisis. However, employment seems to somewhat be still affected by entrepreneurship, in the developed members of the EU-15.

In light of the above, this essay partly agrees with the prior scholarly findings. Similar results have been reported by Wong et al. (2005), where they stated that according to the models they developed, the rates of necessity and opportunity driven entrepreneurship are not significant for economic growth. Additionally, Stam et al. (2011), correlate GDP growth with the rate of entrepreneurship and ambitious firms. In their findings, despite entrepreneurship's clear positive causality to growth, when controlling for the share of ambitious entrepreneurs, they explore that the effect of entrepreneurship is insignificant for economic growth in high income countries. When their study examines entrepreneurship in low-income countries, they observe that entrepreneurship is still significant for growth. Those findings can be comparable to the similar results of our empirical study.

The findings above are, of course, bound by the availability of data. Longer time series would provide a clearer view of the phenomenon. Moreover, improved data collecting techniques as well as the inclusion of more reliable proxies to measure entrepreneurship could provide more reliable results. However, such an effort is inherently complex. As Storey (1991) mentions, operationalizing entrepreneurship for empirical measurement is difficult, especially when executing cross-country comparisons. To adhere to that issue, Braunerhjelm et al.(2010) mentions that self-employment is a great tool for scholars when executing cross-country comparisons, critisizing, however, how self-employment is often equated with entrepreneurship. According to them a vast number of firms, managed by the self-employed, are not in fact innovational and do not bring forth change. Thus, some of the foundational principles on what is thought to be entrepreneurship are not in line with the vast number of firms which are founded by the self-employed. On a similar note, Carree & Thurik (2003) mention that the number of self-employed is a possible "yardstick" for entrepreneurship, which can prove to be misleading.

Business ownership should not be equated with entrepreneurship, according to Carree et al. (2002). However, they underline that the level of business ownership can reveal developments in the entrepreneurial economy. Bearing in mind that this study tried to focus on precisely this aspect, the projection of the entrepreneurial economy on growth, the inclusion of every nuance the term can include is crucial. It is exactly this "undefined" term that has been promoted as an economic recovery tool by government officials in despair for their country's troublesome-looking macro figures.

6 Conclusion

Entrepreneurship is "at the heart of national advantage" (Porter, 1990; p. 125). The increasing share of small firms boosts the national economy (van Stel et al., 2005) by increasing domestic demand of products, services as well as human capital, along with their refinement and variety improvement. Wennekers & Thurik (1999) stress that in a global competitive environment additional productive potential should be confident it can find its own demand leading to a chain of events which enables the growth of micro-actors to be reflected in the macro level.

Nevertheless, the importance of the constant emergence of new firms does not end here. Before the constant refinement of products and services, firms need to diffuse knowledge and adapt it to their own specific needs. The diffusion of knowledge bears positive externalities for the region as a whole. According to Audretsch, et al. (2006, p.44) "entrepreneurship is an endogenous response to the incomplete commercialization of new knowledge". The public funds that go into education and R&D produce knowledge which is not always used. After realizing the market dynamics behind this knowledge, entrepreneurs successfully exploit the knowledge to push forward economic growth. However, if their applications prove to not be commercially viable, the commercial diffusion of knowledge they achieved can stand as an inspiration for their employees or other individuals in the entrepreneurs' social circle. Thus, the entrepreneurial act of forming new firms is a phenomenon which utilizes the unexploited outputs of public and private funds, through innovative applications and also pushes knowledge diffusion.

Audretsch (1995) described the concept above as the Knowledge Spillover Theory of Entrepreneurship. A phenomenon that has a strong spatial aspect to it (Audretsch & Feldman, 1996; Audretsch & Stephan, 1996). In other words, entrepreneurs are the risk-takers who transform the complex and cost-intensive knowledge (Arrow, 1962) into economic knowledge, taking on the burden of uncertainty to deliver a profitable business idea (Audretsch & Keilbach, 2004). As one can presume, it is the innovative and high-growth entrepreneurship which is rather likely to decrease unemployment ratios and thus, public policy should primarily focus on it (Thurik et al., 2008).

From a similar standpoint, the study of Acs (2006) stressed that it is not every aspect of entrepreneurship which is benefitial for economic and employment growth. When entrepreneurship is motivated out of necessity, to avoid unemployment or poorly-paid jobs, the significance to growth is non-existent or, even worse negative. It is the opportunity-driven entrepreneurship that can be attributable for growth.

This essay tried to focus on the EU-15 countries and explore the validity of view that entrepreneurship can be a useful tool for economic growth. For this, we utilized Eurostat and GEM data for 15 European countries between 2004 and 2015. We indeed found positive results

about entrepreneurship's significance on economic and employment growth for that period and study objects. Projecting Acs (2006) statements about the significance of motives, we divided our study objects into two separate groups, based on their GDP and employment growth performance. We found out that neither necessity nor opportunity driven entrepreneurship had an impact on economic and employment growth, regardless of the study groups. More specifically, when focusing on the motives behind entrepreneurship, we found out that entrepreneurship did not have an impact on the trajectory of GDP growth for the more developed economies. Nevertheless, it still retained its significance on the growth of the employment rate in developed countries and both economic and employment growth in the less developed member states.

Despite sharing some points with previous research (Wong et al., 2005; Stam et al., 2011), our study contrasts the majority of literature statements on the significance of opportunity-driven entrepreneurship's impact on growth. It should be noted that the most notable studies on the impact of necessity and opportunity entrepreneurship on economic and employment growth have utilized data prior to the 2008 recession. The contrasting image of the results presented in this study can and should be reflected on the rule-changing effects of the recent recession. It is important to examine how the renewed economic models and social issues that emerged because of the recession, have helped shape a new entrepreneurial culture. Did the challenge of recession and the new needs it created, help foster a new entrepreneurial mindset and did it point aspiring entrepreneurs towards profitable opportunities?

In light of the above, future research can focus on how events which bring major economic and social change such as the 2008 recession, can shape entrepreneurial motives and the entrepreneurial culture as a whole. Moreover, the utilization of more accurate proxies for entrepreneurship as well as for proxies which approach the impact of knowledge spillovers in regions is required. The correlation of those variables with the achieved level of growth is expected to bring forth valuable knowledge as well as useful insight for policy making in post-crisis Europe.

References

Acs, Z., & Armington, C. (2004). Employment growth and entrepreneurial activity in cities. *Regional Studies, 38*(8), 911-927.

Acs, Z. J. (1992). Small business economics: A global perspective. *Challenge, 35*(6), 38-44.

Acs, Z. J. (2006). How is entrepreneurship good for economic growth? *Innovations, 1*(1), 97-107.

Acs, Z. J., & Audretsch, D. B. (1988). Innovation in large and small firms: an empirical analysis. *The American economic review*, 678-690.

Acs, Z. J., & Audretsch, D. B. (1990). *Innovation and small firms*: Mit Press.

Acs, Z., & Armington, C. (2004). Employment growth and entrepreneurial activity in cities. *Regional Studies*, 38(8), 911-927.

Asteriou, D., & Hall, S. G. (2011). *Applied econometrics*. 2nd edition, New York: Palgrave Macmillan.

Audretsch, D. B., & Feldman, M. P. (1996). R&D spillovers and the geography of innovation and production. *The American economic review*, 86(3), 630-640.

Audretsch, D. B., & Fritsch, M. (1996). Creative destruction: Turbulence and economic growth in Germany. *Behavioral Norms, Technological Progress, and Economic Dynamics*, 137-150.

Audretsch, D. B., & Keilbach, M. (2004). Entrepreneurship and regional growth: an evolutionary interpretation. *Journal of Evolutionary Economics, 14*(5), 605-616.

Audretsch, D. B., Keilbach, M. C., & Lehmann, E. E. (2006). *Entrepreneurship and economic growth*: Oxford University Press.

Audretsch, D. B., & Stephan, P. E. (1996). Company-scientist locational links: The case of biotechnology. *The American economic review, 86*(3), 641-652.

Audretsch, D. B., & Thurik, A. R. (1998). The Knowledge Society, Entrepreneurship, and Unemployment.

Baltagi, B. (2008). *Econometric analysis of panel data*: John Wiley & Sons.

Becker, G. S. (1975). Front matter, human capital: a theoretical and empirical analysis, with special reference to education *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition* (pp. -22-20): NBER.

Bhola, R., Verheul, I., Thurik, R., & Grilo, I. (2006). Explaining engagement levels of opportunity and necessity entrepreneurs.

Birch, D. (1999). Entrepreneurial Hot Spots, Cognetics. *Inc., Boston, US*.

Bögenhold, D., Bonnet, J., Dejardin, M., & de Lema, D. G. P. (2016). *Contemporary Entrepreneurship*: Springer.

Bosma, N., Van Praag, M., Thurik, R., & De Wit, G. (2004). The value of human and social capital investments for the business performance of startups. *Small Business Economics, 23*(3), 227-236.

Bos, J. W., & Stam, E. (2013). Gazelles and industry growth: a study of young high-growth firms in The Netherlands. *Industrial and Corporate Change*, dtt050.

Bozoki, E., & Richter, M. (2016). Entrepreneurship, Institutions and Economic Growth: A quantitative study about the moderating effects of institutional dimensions on the relationship of necessity-and opportunity motivated entrepreneurship and economic growth, Master's thesis, Department of Business Administration, Jönköpping University, Available online: [http://www.diva-portal.org/smash/record.jsf?pid=diva2:932681]

Braunerhjelm, P., Acs, Z. J., Audretsch, D. B., & Carlsson, B. (2010). The missing link: knowledge diffusion and entrepreneurship in endogenous growth. *Small Business Economics*, *34*(2), 105-125.

Carlsson, B. (1992). 'The Rise of Small Business: Causes and Consequences', in W. J. Adams (ed.), Singular Europe, Economy and Policy of the European Community after 1992, Ann Arbor, MI: University of Michigan Press, pp. 145–169.

Carlsson, B. (1999). Small business, entrepreneurship, and industrial dynamics *Are Small Firms Important? Their Role and Impact* (pp. 99-110): Springer.

Carree, M., Van Stel, A., Thurik, R., & Wennekers, S. (2002). Economic development and business ownership: an analysis using data of 23 OECD countries in the period 1976–1996. *Small Business Economics*, *19*(3), 271-290.

Carree, M. A., & Thurik, A. R. (1998). Small firms and economic growth in Europe. *Atlantic Economic Journal*, *26*(2), 137-146.

Carree, M. A., & Thurik, A. R. (1999). *Industrial structure and economic growth*: Cambridge, UK: Cambridge University Press.

Carree, M. A., & Thurik, A. R. (2003). The impact of entrepreneurship on economic growth *Handbook of entrepreneurship research* (pp. 437-471): Springer.

Edquist, C. (1997). Systems of innovation approaches – Their emergence and characteristics. In Edquist, C. (Ed.), *Systems of innovation – Technologies, institutions and organizations*, London: Pinter Publishers/Cassel Academic, 1-35

Edquist, C., and Johnson, B. (1997). Institutions and Organizations in Systems of Innovation. in Edquist, C. (Ed.), *Systems of innovation – Technologies, institutions and organizations*, London: Pinter Publishers/Cassel Academic, 41-60

Edquist, C. (2005), Systems of Innovation: Perspectives and Challenges, In : Fagerberg, J., Mowery, D. & Nelson, R. (eds.) *The Oxford Hanbook of Innovation*. Oxford: Oxford University Press. 181-208

Eurostat database (2017). Eurostat database, Available online: http://ec.europa.eu/eurostat/data/database [Accessed 20th of March 2017]

Fernández-Serrano, J., Berbegal, V., Velasco, F., & Expósito, A. (2017). Efficient entrepreneurial culture: a cross-country analysis of developed countries. *International Entrepreneurship and Management Journal*, 1-23.

Fritsch, M. (1997). New firms and regional employment change. *Small Business Economics*, 9(5), 437-448.

Global Entrepreneurship Monitor (2017). GEM database. Available online: http://www.gemconsortium.org/data [Accessed 25th of March 2017]

Global Entrepreneurship Monitor. (2017). Global Report 2016/17. Retrieved from http://www.gemconsortium.org/report/49812 [Accessed 25th of March 2017]

Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative science quarterly*, 750-783.

Halkos, G. (2011). *Econometrics: Theory and practice: Instructions in using Eviews, Minitab, SPSS and excel*. Athens: Gutenberg.

Hacker, R. S., & Hatemi-J, A. (2006). Tests for causality between integrated variables using asymptotic and bootstrap distributions: theory and application. *Applied Economics*, 38(13), 1489-1500.

Hechavarria, D. M., & Reynolds, P. D. (2009). Cultural norms & business start-ups: the impact of national values on opportunity and necessity entrepreneurs. *International Entrepreneurship and Management Journal*, *5*(4), 417.

Hessels, J., Van Gelderen, M., & Thurik, R. (2008). Entrepreneurial aspirations, motivations, and their drivers. *Small Business Economics*, *31*(3), 323-339.

Kirzner, I. M. (1997). Entrepreneurial discovery and the competitive market process: An Austrian approach. *Journal of economic Literature*, *35*(1), 60-85.
Komisar, R. (2017). Necessity-Driven entrepreneurship, Youtube, [video online], Available online: https://www.youtube.com/watch?v=_2AUD6acjpc [Accessed 25th of March 2017]
Liñán, F., Fernández-Serrano, J., & Romero, I. (2013). Necessity and opportunity entrepreneurship: The mediating effect of culture. *reviSta de economía mundial, 33*.
Lundstrom, A., & Stevenson, L. (2005). Entrepreneurial Policy—Theory and Practice: Boston: Springer.
Lundvall, B.-Å. (2008), "National Innovation Systems - Analytical Concept and Development Tool", *Industry & Innovation*, 14 (1), 95-119.
Parker, S. C. (2004). *The economics of self-employment and entrepreneurship*: Cambridge University Press.
Parker, S. C., Congregado, E., & Golpe, A. A. (2012). Is entrepreneurship a leading or lagging indicator of the business cycle? Evidence from UK self-employment data. *International Small Business Journal*, *30*(7), 736-753.
Pfeiffer, F., & Reize, F. (2000). Business start-ups by the unemployed—an econometric analysis based on firm data. *Labour Economics*, *7*(5), 629-663.
Picot, G., Manser, M., & Lin, Z. (1998). *The role of self-employment in job creation in Canada and the United States.* Paper presented at the Canadian Employment Research Forum (CERF)-LEED International Conference on Self-Employment, Burlington, Ontario.
Porter, M. E. (1990). The competitive advantage of nations: New York: Free Press.
Rocha, H. O. (2004). Entrepreneurship and development: The role of clusters. *Small Business Economics*, *23*(5), 363-400.
Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle* (Vol. 55): Transaction publishers.
Solomon, G., Dickson, P. H., Solomon, G. T., & Weaver, K. M. (2008). Entrepreneurial selection and success: does education matter? *Journal of small business and enterprise development*, *15*(2), 239-258.
Solow, R. M. (1970). *Growth theory. An exposition.* Paper presented at the Growth theory. An exposition.
Stam, E., Hartog, C., Van Stel, A., & Thurik, R. (2011). Ambitious entrepreneurship, high-growth firms and macroeconomic growth. *The Dynamics of Entrepreneurship: Evidence from Global Entrepreneurship Monitor Data*, 231-249.
Sternberg, R., & Wennekers, S. (2005). Determinants and effects of new business creation using global entrepreneurship monitor data. *Small Business Economics*, *24*(3), 193-203.
Storey, D. J. (1991). The birth of new firms—does unemployment matter? A review of the evidence. *Small Business Economics*, *3*(3), 167-178.
Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics*, 66(1), 225-250.
Thurik, A. R., Carree, M. A., Van Stel, A., & Audretsch, D. B. (2008). Does self-employment reduce unemployment*? Journal of Business Venturing*, 23(6), 673-686.
Van der Sluis, J., van Praag, M., & Vijverberg, W. P. (2004). *Education and entrepreneurship in industrialized countries: A meta-analysis.*
Van Stel, A. (2005). COMPENDIA: Harmonizing business ownership data across countries and over time. *International Entrepreneurship and Management Journal*, 1(1), 105-123.
Van Stel, A., Carree, M., & Thurik, R. (2005). The effect of entrepreneurial activity on national economic growth. *Small Business Economics*, *24*(3), 311-321.

Van Stel, A., & Storey, D. (2004). The link between firm births and job creation: Is there a Upas tree effect? *Regional Studies, 38*(8), 893-909.

Wennekers, S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics, 13*(1), 27-56.

Wennekers, S., Van Stel, A., Carree, M., & Thurik, R. (2010). The relationship between entrepreneurship and economic development: is it U-shaped? *Foundations and Trends® in Entrepreneurship*, 6(3), 167-237.

Wennekers, S., Van Wennekers, A., Thurik, R., & Reynolds, P. (2005). Nascent entrepreneurship and the level of economic development. *Small Business Economics*, 24(3), 293-309.

Wong, P. K., Ho, Y. P., & Autio, E. (2005). Entrepreneurship, innovation and economic growth: Evidence from GEM data. *Small Business Economics, 24*(3), 335-350.

7 Appendix A - First part of the empirical study

In this appendix the reader can view the estimation outcomes for the Panel VAR system of equations, as displayed by Eviews. Lastly, the outcome of the Pairwise Dumitrescu Hurlin Panel Causality Tests is displayed.

Table 7 Panel VAR, Fixed effects, DLGDP as "depended"

Dependent Variable: DLGDP
Method: Panel Least Squares

Sample (adjusted): 2006 2015
Periods included: 10
Cross-sections included: 15
Total panel (balanced) observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0,001457	0,001134	1,285298	0,2010
DLGDP lag 1	0,436795	0,130378	3,350223	0,0011
DLGDP lag 2	-0,335247	0,133002	-2,520620	0,0129
DLNASE lag 1	0,257382	0,071690	3,590189	0,0005
DLNASE lag 2	0,069631	0,074242	0,937898	0,3500
EMPGR lag 1	-0,000657	0,001143	-0,575005	0,5663
EMPGR lag 2	0,001236	0,000950	1,301291	0,1955

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,316417	Mean dependent var	0,001434
Adjusted R-squared	0,210435	S.D. dependent var	0,014972
S.E. of regression	0,013304	Akaike info criterion	-5,672306
Sum squared resid	0,022833	Schwarz criterion	-5,250817
Log likelihood	446,4230	Hannan-Quinn criter.	-5,501069
F-statistic	2,985572	Durbin-Watson stat	1,839558
Prob(F-statistic)	0,000101		

Table 8 Panel VAR, Fixed effects, EMPGR as "depended"

Dependent Variable: EMPGR
Method: Panel Least Squares

Sample (adjusted): 2006 2015
Periods included: 10
Cross-sections included: 15
Total panel (balanced) observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0,107861	0,132134	-0,816302	0,4158
EMPGR lag 1	0,308659	0,133227	2,316793	0,0221
EMPGR lag 2	-0,245818	0,110751	-2,219564	0,0282
DLNASE lag 1	9,842394	8,355939	1,177892	0,2410
DLNASE lag 2	11,35990	8,653339	1,312777	0,1916
DLGDP lag 1	43,33432	15,19632	2,851633	0,0051
DLGDP lag 2	3,210763	15,50218	0,207117	0,8362

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,398489	Mean dependent var	-0,044342
Adjusted R-squared	0,305232	S.D. dependent var	1,860380
S.E. of regression	1,550678	Akaike info criterion	3,844438
Sum squared resid	310,1936	Schwarz criterion	4,265927
Log likelihood	-267,3329	Hannan-Quinn criter.	4,015676
F-statistic	4,273000	Durbin-Watson stat	2,203928
Prob(F-statistic)	0,000000		

Table 9 Panel VAR, Fixed effects, DLNASE as "depended"

Dependent Variable: DLNASE
Method: Panel Least Squares

Sample (adjusted): 2006 2015
Periods included: 10
Cross-sections included: 15
Total panel (balanced) observations: 150

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0,000806	0,001631	0,494067	0,6221
DLGDP lag 1	-0,289563	0,187632	-1,543249	0,1252
DLGDP lag 2	0,028342	0,191409	0,148071	0,8825
DLNASE lag 1	-0,289198	0,103172	-2,803053	0,0058
DLNASE lag 2	-0,065630	0,106845	-0,614260	0,5401
EMPGR lag 1	0,003983	0,001645	2,421446	0,0168
EMPGR lag 2	-0,000596	0,001367	-0,435887	0,6636

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,220267	Mean dependent var	0,000310
Adjusted R-squared	0,099378	S.D. dependent var	0,020175
S.E. of regression	0,019147	Akaike info criterion	-4,944213
Sum squared resid	0,047290	Schwarz criterion	-4,522724
Log likelihood	391,8160	Hannan-Quinn criter.	-4,772976
F-statistic	1,822063	Durbin-Watson stat	2,127631
Prob(F-statistic)	0,024427		

Pairwise Dumitrescu Hurlin Panel Causality Tests

Sample: 2004 2015
Lags: 2

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
DLNASE does not homogeneously cause DLGDP	2.81595	-0.26884	0.7881
DLGDP does not homogeneously cause DLNASE	5.16747	0.95305	0.3406
EMPGR does not homogeneously cause DLGDP	2.96887	-0.18938	0.8498
DLGDP does not homogeneously cause EMPGR	6.85512	1.82997	0.0673
EMPGR does not homogeneously cause DLNASE	2.04335	-0.67029	0.5027
DLNASE does not homogeneously cause EMPGR	4.74055	0.73121	0.4647

Table 10 Dumitrescu-Hurlin Panel Causality test for System of Equations 1#. DLGDP might cause EMPGR

8 Appendix B - Second Part of the empirical study

In this appendix the reader can view the estimation outcomes for the Panel VAR system of equations, as displayed by Eviews. First-off we begin with the second system of equations which reports the results of the Panel VAR model for the "Less developed" country group. A dummy variable (DUMDL) is utilized to separate between the two study samples. The group of "less developed countries" has a dummy figure of 0 whereas the "developed" ones have a figure of 1.

8.1 System of equations 2# – "Less Developed countries"

Table 11 Panel VAR, Fixed effects, DLGDP as "depended", "Less Developed" country group

Dependent Variable: DLGDP
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=0
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.007075	0.007269	0.973286	0.3355
DLGDP lag 1	0.884792	0.240429	3.680052	0.0006
DLGDP lag 2	-0.723875	0.255464	-2.833570	0.0068
DLNASE lag 1	0.312427	0.141614	2.206181	0.0324
DLNASE lag 2	0.184807	0.172203	1.073191	0.2888
EMPGR lag 1	-0.002039	0.001552	-1.313776	0.1954
EMPGR lag 2	0.002960	0.001711	1.730292	0.0903
NERA lag 1	0.002710	0.004304	0.629695	0.5320
NERA lag 2	-0.000522	0.004543	-0.114926	0.9090
OPRA lag 1	-0.001090	0.002286	-0.476900	0.6357
OPRA lag 2	-0.001504	0.001965	-0.765397	0.4479

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.581793	Mean dependent var	-0.001231
Adjusted R-squared	0.436329	S.D. dependent var	0.018014
S.E. of regression	0.013525	Akaike info criterion	-5.543411
Sum squared resid	0.008414	Schwarz criterion	-4.965104
Log likelihood	191.6174	Hannan-Quinn criter.	-5.315960
F-statistic	3.999581	Durbin-Watson stat	1.909293
Prob(F-statistic)	0.000113		

Table 12 Panel VAR, Fixed effects, EMPGR as "depended", "Less Developed" country group

Dependent Variable: EMPGR
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=0
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0,217522	0,996473	-0,218292	0,8282
DLGDP lag 1	60,38665	32,95787	1,832238	0,0734
DLGDP lag 2	-1,299534	35,01878	-0,037110	0,9706
DLNASE lag 1	23,80769	19,41240	1,226417	0,2263
DLNASE lag 2	32,79250	23,60545	1,389192	0,1715
EMPGR lag 1	0,317610	0,212780	1,492665	0,1424
EMPGR lag 2	-0,397961	0,234538	-1,696787	0,0965
NERA lag 1	-0,052765	0,590001	-0,089432	0,9291
NERA lag 2	0,382569	0,622715	0,614356	0,5420
OPRA lag 1	0,172124	0,313409	0,549200	0,5855
OPRA lag 2	-0,307204	0,269310	-1,140708	0,2599

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.556811	Mean dependent var	-0.623576
Adjusted R-squared	0.402658	S.D. dependent var	2.398763
S.E. of regression	1.853954	Akaike info criterion	4.297707
Sum squared resid	158.1086	Schwarz criterion	4.876013
Log likelihood	-118.3778	Hannan-Quinn criter.	4.525158
F-statistic	3.612071	Durbin-Watson stat	2.314572
Prob(F-statistic)	0.000323		

Table 13 Panel VAR, Fixed effects, DLNASE as "depended", "Less Developed" country group

Dependent Variable: DLNASE
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=0
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.009566	0.008551	-1.118658	0.2691
DLGDP lag 1	0.141673	0.282829	0.500915	0.6188
DLGDP lag 2	-0.339805	0.300515	-1.130742	0.2640
DLNASE lag 1	-0.204554	0.166588	-1.227901	0.2257
DLNASE lag 2	-0.228896	0.202571	-1.129956	0.2644
EMPGR lag 1	0.002317	0.001826	1.268732	0.2109
EMPGR lag 2	0.002053	0.002013	1.019947	0.3131
NERA lag 1	0.005213	0.005063	1.029525	0.3086
NERA lag 2	0.005075	0.005344	0.949676	0.3472
OPRA lag 1	0.000809	0.002690	0.300645	0.7650
OPRA lag 2	-0.003339	0.002311	-1.444570	0.1554

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.344229	Mean dependent var	-0.005476
Adjusted R-squared	0.116135	S.D. dependent var	0.016923
S.E. of regression	0.015910	Akaike info criterion	-5.218580
Sum squared resid	0.011644	Schwarz criterion	-4.640274
Log likelihood	181.3853	Hannan-Quinn criter.	-4.991129
F-statistic	1.509154	Durbin-Watson stat	2.096773
Prob(F-statistic)	0.137618		

Table 14 Panel VAR, Fixed effects, NERA as "depended", "Less Developed" country group

Dependent Variable: NERA
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=0
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0,687744	0,298996	2,300175	0,0260
DLGDP lag 1	-9,395969	9,889160	-0,950128	0,3470
DLGDP lag 2	4,266835	10,50755	0,406073	0,6866
DLNASE lag 1	0,256810	5,824780	0,044089	0,9650
DLNASE lag 2	5,536379	7,082924	0,781652	0,4384
EMPGR lag 1	0,021538	0,063846	0,337343	0,7374
EMPGR lag 2	-0,100915	0,070374	-1,433982	0,1583
NERA lag 1	0,306023	0,177032	1,728629	0,0906
NERA lag 2	0,028078	0,186848	0,150269	0,8812
OPRA lag 1	0,067929	0,094040	0,722339	0,4737
OPRA lag 2	-0,033276	0,080808	-0,411793	0,6824

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,537412	Mean dependent var	1,195882
Adjusted R-squared	0,376512	S.D. dependent var	0,704507
S.E. of regression	0,556287	Akaike info criterion	1,890126
Sum squared resid	14,23496	Schwarz criterion	2,468432
Log likelihood	-42,53896	Hannan-Quinn criter.	2,117576
F-statistic	3,340040	Durbin-Watson stat	2,021222
Prob(F-statistic)	0,000689		

Table 15 Panel VAR, Fixed effects, OPRA as "depended", "Less Developed" country group

Dependent Variable: OPRA
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=0
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1,821495	0,524859	3,470445	0,0011
DLGDP lag 1	9,171892	17,35947	0,528351	0,5998
DLGDP lag 2	-22,40214	18,44500	-1,214537	0,2307
DLNASE lag 1	-11,22506	10,22484	-1,097822	0,2780
DLNASE lag 2	0,290322	12,43339	0,023350	0,9815
EMPGR lag 1	0,112526	0,112075	1,004022	0,3206
EMPGR lag 2	0,040305	0,123535	0,326266	0,7457
NERA lag 1	0,096203	0,310763	0,309571	0,7583
NERA lag 2	-0,195513	0,327994	-0,596087	0,5540
OPRA lag 1	0,454099	0,165078	2,750815	0,0085
OPRA lag 2	-0,094575	0,141850	-0,666727	0,5083

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,446257	Mean dependent var	2,680070
Adjusted R-squared	0,253651	S.D. dependent var	1,130330
S.E. of regression	0,976509	Akaike info criterion	3,015524
Sum squared resid	43,86423	Schwarz criterion	3,593830
Log likelihood	-77,98901	Hannan-Quinn criter.	3,242975
F-statistic	2,316942	Durbin-Watson stat	2,076731
Prob(F-statistic)	0,013435		

8.2 System of equations 3# – “Developed countries”

Table 16 Panel VAR, Fixed effects, DLGDP as "depended", "Developed" country group

Dependent Variable: DLGDP
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=1
Periods included: 7
Cross-sections included: 7
Total panel (balanced) observations: 49

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.019530	0.010204	-1.913888	0.0687
DLGDP lag 1	-0.865569	0.213463	-4.054895	0.0005
DLGDP lag 2	-1.094625	0.218498	-5.009778	0.0001
DLGDP lag 3	-0.702261	0.228291	-3.076164	0.0055
DLGDP lag 4	-0.360733	0.192295	-1.875936	0.0740
DLNASE lag 1	-0.059888	0.122613	-0.488434	0.6301
DLNASE lag 2	-0.018125	0.140329	-0.129162	0.8984
DLNASE lag 3	-0.183032	0.147538	-1.240573	0.2278
DLNASE lag 4	-0.243518	0.128520	-1.894792	0.0713
EMPGR lag 1	0.001710	0.002206	0.775330	0.4464
EMPGR lag 2	0.005415	0.002133	2.538603	0.0187
EMPGR lag 3	0.001809	0.002363	0.765611	0.4520
EMPGR lag 4	0.000741	0.001839	0.402681	0.6911
NERA lag 1	0.002661	0.006858	0.388022	0.7017
NERAlag 2	0.010144	0.006618	1.532648	0.1396
NERA lag 3	0.002774	0.006513	0.425856	0.6744
NERA lag 4	-0.004444	0.006773	-0.656153	0.5185
OPRA lag 1	0.005150	0.002338	2.202389	0.0384
OPRA lag 2	-0.001692	0.002245	-0.753899	0.4589
OPRA lag 3	0.000667	0.002176	0.306308	0.7623
OPRA lag 4	-0.000158	0.002113	-0.074568	0.9412

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.830471	Mean dependent var	1.06E-05
Adjusted R-squared	0.630118	S.D. dependent var	0.012084
S.E. of regression	0.007349	Akaike info criterion	-6.687206
Sum squared resid	0.001188	Schwarz criterion	-5.644775
Log likelihood	190.8366	Hannan-Quinn criter.	-6.291709
F-statistic	4.145043	Durbin-Watson stat	1.298485
Prob(F-statistic)	0.000602		

Table 17 Panel VAR, Fixed effects, EMPGR as "depended", "Developed" country group

Dependent Variable: EMPGR
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=1
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0,395248	0,665308	-0,594083	0,5554
DLGDP lag 1	58,34816	19,40357	3,007083	0,0043
DLGDP lag 2	-8,648588	18,59318	-0,465148	0,6440
DLNASE lag 1	1,171536	11,44209	0,102388	0,9189
DLNASE lag 2	14,98921	11,97163	1,252061	0,2169
EMPGR lag 1	-0,120482	0,218884	-0,550437	0,5847
EMPGR lag 2	0,083858	0,190882	0,439319	0,6625
NERA lag 1	0,318794	0,663295	0,480622	0,6331
NERA lag 2	0,817374	0,669283	1,221268	0,2282
OPRA lag 1	-0,080457	0,209851	-0,383399	0,7032
OPRA lag 2	-0,068642	0,202724	-0,338597	0,7365

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,491721	Mean dependent var	0,201516
Adjusted R-squared	0,314928	S,D, dependent var	1,177951
S,E, of regression	0,974979	Akaike info criterion	3,012387
Sum squared resid	43,72685	Schwarz criterion	3,590693
Log likelihood	-77,89019	Hannan-Quinn criter,	3,239838
F-statistic	2,781341	Durbin-Watson stat	2,121814
Prob(F-statistic)	0,003430		

Table 18 Panel VAR, Fixed effects, DLNASE as "depended", "Developed" country group

Dependent Variable: DLNASE
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=1
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0,002101	0,007677	0,273656	0,7856
DLGDP lag 1	-0,322182	0,223887	-1,439038	0,1569
DLGDP lag 2	-0,273338	0,214536	-1,274088	0,2090
DLNASE lag 1	-0,427252	0,132024	-3,236174	0,0022
DLNASE lag 2	-0,148390	0,138134	-1,074248	0,2883
EMPGR lag 1	0,006898	0,002526	2,731362	0,0089
EMPGR lag 2	0,002457	0,002202	1,115644	0,2704
NERA lag 1	-9,29E-06	0,007653	-0,001214	0,9990
NERA lag 2	0,004523	0,007722	0,585705	0,5609
OPRA lag 1	0,000421	0,002421	0,173671	0,8629
OPRA lag 2	-0,000913	0,002339	-0,390155	0,6982

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,391568	Mean dependent var	0,002655
Adjusted R-squared	0,179940	S.D. dependent var	0,012423
S.E. of regression	0,011250	Akaike info criterion	-5,911755
Sum squared resid	0,005822	Schwarz criterion	-5,333449
Log likelihood	203,2203	Hannan-Quinn criter.	-5,684305
F-statistic	1,850264	Durbin-Watson stat	2,226906
Prob(F-statistic)	0,052752		

Table 19 Panel VAR, Fixed effects, NERA as "depended", "Developed" country group

Dependent Variable: NERA
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=1
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.400622	0.168276	2.380737	0.0215
DLGDP lag 1	-0.005140	4.907748	-0.001047	0.9992
DLGDP lag 2	-2.722572	4.702776	-0.578929	0.5655
DLNASE lag 1	-0.518112	2.894049	-0.179027	0.8587
DLNASE lag 2	0.724198	3.027987	0.239168	0.8120
EMPGR lag 1	0.011731	0.055362	0.211896	0.8331
EMPGR lag 2	0.026104	0.048280	0.540671	0.5913
NERA lag 1	0.252333	0.167767	1.504063	0.1394
NERA lag 2	0.078246	0.169282	0.462223	0.6461
OPRA lag 1	0.059023	0.053078	1.112002	0.2719
OPRA lag 2	-0.009888	0.051275	-0.192846	0.8479

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.660901	Mean dependent var	0.842684
Adjusted R-squared	0.542954	S.D. dependent var	0.364767
S.E. of regression	0.246602	Akaike info criterion	0.263103
Sum squared resid	2.797366	Schwarz criterion	0.841409
Log likelihood	8.712249	Hannan-Quinn criter.	0.490554
F-statistic	5.603355	Durbin-Watson stat	2.319440
Prob(F-statistic)	0.000002		

Table 20 Panel VAR, Fixed effects, OPRA as "depended", "Developed" country group

Dependent Variable: OPRA
Method: Panel Least Squares

Sample: 2005 2015 IF DUMDL=1
Periods included: 9
Cross-sections included: 7
Total panel (balanced) observations: 63

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2,171805	0,525475	4,133032	0,0001
DLGDP lag 1	19,03528	15,32537	1,242077	0,2205
DLGDP lag 2	-5,010999	14,68530	-0,341225	0,7345
DLNASE lag 1	-15,66715	9,037212	-1,733627	0,0897
DLNASE lag 2	-13,06720	9,455460	-1,381974	0,1737
EMPGR lag 1	-0,162410	0,172879	-0,939439	0,3524
EMPGR lag 2	0,057523	0,150763	0,381549	0,7046
NERA lag 1	-0,256700	0,523885	-0,489994	0,6265
NERA lag 2	0,177365	0,528614	0,335528	0,7388
OPRA lag 1	0,425712	0,165745	2,568473	0,0135
OPRA lag 2	0,021346	0,160116	0,133319	0,8945

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0,629060	Mean dependent var	3,489509
Adjusted R-squared	0,500038	S.D. dependent var	1,089070
S.E. of regression	0,770060	Akaike info criterion	2,540492
Sum squared resid	27,27763	Schwarz criterion	3,118798
Log likelihood	-63,02549	Hannan-Quinn criter.	2,767943
F-statistic	4,875584	Durbin-Watson stat	2,080199
Prob(F-statistic)	0,000012		