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Human capital as predictor for entrepreneurial product innovation for countries in different development stages

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Preface

Finalizing my master thesis means the end of my Economics and Business Master program at the Erasmus University Rotterdam. When closing this chapter of my life as a Master student, the next chapter full of (work) opportunities will begin for me.

I especially want to thank my supervisor Dr. Jolanda Hessels for her useful guidance, feedback, ideas and time. Without her help I would not be able to graduate in May 2014. I would also want to thank my family, friends and boyfriend for their believe and support in me. Finally, I want to thank Ganesh for inspiring and motivating me.

Verushka Bhagwanbali,
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Abstract

This thesis investigates the relationship of high education, start-up skills and prior business experience with becoming an entrepreneurial product innovator. This relationship is tested for countries with factor-driven economies, efficiency-driven economies and innovation-driven economies.

The relationship is measured with the logit model, with product innovation as dependent variable. Findings from a sample of 14,057 observations of (TEA) entrepreneurs in the year 2009 and 11,564 observations of (TEA) entrepreneurs in the year 2008 from the GEM APS data show that formal high education is positively related to product innovation for countries in all development stages. Previous business ownership has also a positive effect for countries with factor-driven and innovation-driven economies, while start-up skills are insignificant in the overall models. The results show that the individuals and society gain with product innovations if entrepreneurs have higher formal education

Keywords: Human Capital, Product innovation, Development stages, education, Start-up skills, Prior business ownership experience, 2008, 2009

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1. Introduction

This paper is triggered by the famous words of C. Freeman and L. Soete: 'not to innovate is to die' (Freeman & Soete, 1997, p.266). These words become clear when analyzing the entrepreneurial activity for the years 2008 and 2009 (GEM executive report, 2008; GEM executive report, 2009). The entrepreneurial activity as mentioned before is defined as the new venture start-up rate by educated entrepreneurs while taking in account for the change in business closure (GEM executive report, 2008, p38). These entrepreneurs have a leading role in business creation, innovation and economic welfare (Schumpeter, 1942; Neck & Greene, 2011). Innovation, which can be explained by the creation and upgrading of new products, strategies and services, is important for entrepreneurs and the development of a country (Schumpeter, 1942; Covin & Miles, 1999; Porter, 1990; Keizer *et al*., 2002) and can be seen as the primary instrument for many firms to gain competitive advantages (Baumol, 2002). Schumpeter (1942) refers to the entrepreneur as the innovator. However, not everyone is capable to become an innovative entrepreneur. To become an innovative entrepreneur certain competences are needed (Shane, 2000). One of the basic requirements for innovative firms to contribute to the economic wealth of a country is the quantity and quality of education (Bates, 1990). An individual who has got little basic education is assumed to carry out only basic manual work and finds it harder to work with more advanced technology and processes, while individuals with low quality of education are expected to adapt slower to the changing economy opportunities (GEM executive report, 2009, pp9-11; World Economic Forum, 2008, p5). Several studies show that human capital is one of the most important determinants for entrepreneurial innovation (Davidsson & Honig, 2003; Becker, 1964; Marvel & Lumpkin, 2007; Dakhli & De Clercq, 2004). This thesis will focus on the relationship between human capital and product innovation of early stage entrepreneurs within countries in different stages of development during the turbulent years of 2008 and 2009. The year 2008 is chosen, as the financial crisis began in the fall of the year 2008. The year 2009 is also chosen as the effects of the crisis were visible during the whole year 2009. The years are used as a comparison for testing the relationship.

There is mixed evidence about the effect and contribution of innovative entrepreneurs during the recession. The Global Entrepreneurship Monitor (GEM) executive reports of the years 2008 and 2009 show that both years have a severe decline for individuals over the world who want to start a new business and a decline in entrepreneurial opportunities (GEM executive

report, 2008, p5; GEM executive report, 2009, pp5-7). Entrepreneurial opportunity declines because of the declining demands for products and the lower availability of entrepreneurial finances that are caused by the risk adversity of the banks (GEM executive report, 2008, p29; Shane & Venkataraman, 2000). On average, firms all over the world invested less in innovation (Archibugi, Filippetti & Frenz, 2013). The underinvestment is not uniformly during the recession. Some firms do increase their innovation investments during the crisis. As contrary on outcomes of the GEM executive reports, other researches show that the recession does not have an impact on the rate of entrepreneurship (Stangler, 2009; Figueroa-Armijos, Dabson & Johnson, 2012). Furthermore, Stangler (2009) has found that more than fifty percent of the Fortune 500 companies during the years of 2008 and 2009 are born during an economic recession. Some of these well know companies are Microsoft and Southwest Airlines.

Nowadays, during the year 2013, regional and national governments are still trying to recover from the years 2008 and 2009, by reconstructing their economy. The words of Hopkins (2004, p.1) paint the importance of entrepreneurship and innovation during such years of recession; "Entrepreneurs historically have led the nation out of hard times".

Human capital, as shown in the study of Becker (1964) and Davidsson & Honig, (2003), can be seen as the sum of education, experience and skills. Several studies show that human capital is an important determinant for innovation, as it stimulates growth and development (Becker, 1964; Davidsson & Honig, 2003; Marvel & Lumpkin, 2007; Dakhli & De Clercq, 2004). Individuals and society gain from the investments in human capital (Sweetland, 1996).
The current study makes use of formal education, business experience and skills as the main human capital determinants. Education, experience and skills are narrow related to each other (Davidsson & Honig, 2003; Becker, 1964). Education is not only the sum of years of education. Formal education is also connected with sense, common search skills, imagination, skills for specific industries and skills and knowledge to run the business (Parker, 2009). The employer can also gain new skills by (work-) experience and information (Becker, 1964; Shane, 2003). Shane (2003) states that experience, like business- or life-experience are important factors for innovation. Some skills can only be gained by experience. This suggests the circular argument that "firms learn how to be innovative by success in innovation" (Rogers, 2002). Education and experience are also related to each other. Each individual gains his own knowledge through life (experience), which makes each individual's knowledge

unique. Life experience also causes differences in the individual's opportunity outcomes (Marvel & Lumpkin, 2007).

There is mixed evidence about the relationship of human capital with innovation. The studies of Davidsson & Honig (2003) show a positive relationship of formal education and previous start-up experience with innovation. The researchers make use of a sample of 380 Swedish nascent entrepreneurs. The study of Bates (1990) and Gimeno et *al*. (1997) also shows that education and experience have a positive relation with the probability of becoming an innovative entrepreneur. Bates (1990) investigates the longevity of males who enter self-employment in small business between 1976 and 1982 and has found that especially high educated entrepreneurs are more likely to create continued firms. Becker (1964) also finds a positive relationship of human capital with innovation. Education and experience are the two main characters of human capital theory (Becker, 1964). The human capital theory of Becker (1964) assumes that 'schooling raises earnings and productivity mainly by providing knowledge, skills and a way of analyzing problems' (p19). On the other hand the study of Rogers (2002) shows a negative relationship of management training with innovation for the non-manufacturing firms when dividing the firms into non manufacturing- and manufacturing firms. The negative effect is only for the employees in small firms. His study shows a significant positive relationship for the 5-19 employees firm size category. Rogers (2002) states that at some point, small firms do have more advantages than big firms.

In the current study, it is expected that the relation of human capital with product innovation does not differ for countries. This argument is based on the overall studies that show a positive relation of human capital with product innovation. However, Lynskey (2004) and Van Stel, Carree & Thurik (2005) do state that the level of entrepreneurship differs between countries. Lynskey (2004) states that the level of innovation differs between countries, while Van Stel, Carree & Thurik (2005) state that role of entrepreneurship differs from one stage of economic development to another stage of economic development when countries go through different stages of economic development. For example, High start-up rates in developing countries could have different signs of economic strengths than in highly developed countries. Only a small percentage of the new entrepreneurs in the developing countries will develop into high growth firms compared to in rich countries. The current study takes in consideration that the level of entrepreneurship differs between countries, by dividing the countries in development stages.

To distinguish all the countries in this research, they are divided into different stages of development. The stages that are used in this research are the stages of competitive development introduced by Michael porter (Porter, 1990) who distinguishes the stages factor-driven, efficiency-driven and innovation-driven and two transitions between the first three stages. The three stages that are used entail a succeeding upgrading of countries' competitive advantages and are associated with gradually rising of economic wealth as their income grows. The countries may shift from one stage of development to another stage of economic development. While the developing countries are in the developing stage, other countries are in the second stage, and only some countries are innovation-driven economies. The different stages have diverse patterns of export competitiveness. Factor-driven economies have primarily extractive activities or have labour-intensive manufacturing while on the other hand efficiency- driven economies use economies of scale as an important driver of development. Innovation-driven economies make use of research and development and have high-tech manufactures which increases the countries' amount of new products and services.

This research focuses on product innovation of starting entrepreneurs and entrepreneurs who own or manage a business for up to 3.5 years. The current study takes in consideration that the entrepreneurial activity is divided into phases (GEM executive report, 2008, p4). The entrepreneurial activity begins with the development of a new firm, continues with the establishment of the firm and possibly ends with the discontinuation of the firm. New firms have to develop their resources and have to respond to the changing market conditions, while the established firms do not face these exceptional difficulties (Burns & Stalker, 1961). This study is innovative as there is probably no other research that investigates the relationship of human capital with product innovation for entrepreneurs within countries in different stages of development for a volatile period (the years 2008 and 2009). The current subject may be interesting for future studies, as globalization plays an important role for the competitiveness between countries. 'The process of globalization is characterized by a reduction in the barriers to the cross-border flow of factors, products, information, technology and values' (Kaplinsky, Morris & Readman, 2002, p1). As borders between countries are reduced while on the other hand countries do differ in their entrepreneurial activity, it is recommended to divide the countries in development stages. This empirical research tries to fill in this gap.

The research question is:

What is the relationship between education, business experience and entrepreneurial skills with product innovation for entrepreneurs within factor-driven, innovation-driven and efficiency-driven countries?

This paper is divided in sections. This paper begins with a short introduction that explains the main concepts and the purpose of this empirical research. The second section is the literature review. This section draws upon prior innovation research to investigate the human capital relationship with product innovation within and between countries. The following section contains data and methodology that is used for this research. The fourth section explains the results of the previous sections. The results are discusses and analyzed in the fifth section. This research is ended with a conclusion and the references.

2. Theory and hypotheses

In this section, the literature of prior studies about the relationship of product innovation with human capital within countries in different stages of development is discussed. The literature is divided into sections. Each section begins with the definitions of the characters that are used in the section. The first section introduces the literature and definitions of product innovations by entrepreneurs. The second section discusses the relationship of human capital with (product) innovation. Well known studies about human capital are discussed. The literature of human capital is divided into three parts. These subchapters describe the relationship of education, experience and skills with innovation. The third section discusses the effects of innovation during crisis. The fourth section presents the development of the hypotheses.

2.1 Product innovation in general

If an entrepreneur can be seen as an innovator (Schumpeter, 1934), the probability of being an innovator seems to have an uneven distribution (Parker, 2009).

Product innovation has a leading role in this research. Firms have to develop new products to grow and expand into new areas. Significant innovative products are even important for firms to keep ahead in the market (Danneels & Kleinschmidt, 2001). Innovation is an extensive concept with a large amount of indicators and can be understood in different ways. The definition of product innovation according the Oslo manuals is as follow: product innovation is the introduction of a good that is new or substantially improved (OECD, Eurostat, Oslo Manual, 2005, p. 149). Most researchers like Van Praag & Versloot (2007) and Mansfield (1972) measure the quantity of innovations by the expenditure of research and development or the amount of patents and patents citations (Griliches, 1990).

As mentioned in the introduction, the level of innovation, entrepreneurship and human capital may differ between countries (Van Stel, Carree & Thurik, 2005; Bates, 1990; Griffith et *al*., 2006). Griffith et *al*. (2006) investigates innovation between different countries. The researchers have found that the European countries are lacking behind in their productivity performance compared to the USA. Productivity performance in their research is associated with more or less innovation Between the European countries it also seems that there are differences in the level of innovation. The amounts of firms that report to have R&D expenses and the R&D intensity within the countries are greater in Germany and France compared to

the UK and Spain. R&D intensity is measures as 'the gross domestic expenditure on R&D as a percentage of GDP' and determents how much innovation are undertaken by the firms within a country. The firms within Germany, Spain and the UK are all more successful in commercializing their product innovations than the French firms. Another difference between the European countries is the level of support. Firms within Germany, UK and Spain make more use of universities as a source of information, while French firms more rely on the government. The previous study suggests that the level of innovation is different within a group of countries. The lower rate of entrepreneurial activity within Europe compared to the United Stated may be caused by the risk-averse behaviour of Europeans and their attitude for preferring a job over entrepreneurship (GEM executive report, 2008). The previous also suggests that individuals have good income opportunities, through social insurance or jobs. The difference in the level of entrepreneurship between European countries can have several causes, like the difference in economic and institutional environments. Furthermore, 60% of the innovators in Germany are within the manufacturing firms compared to the service firms, while 40% of the U.K. innovators are innovating in the manufacturing industry compared to the service industry (Harrison, Jaumandreu & Mairesse, 2008).

As mentioned in the introduction, being innovative has positive effects on economic development. Especially radical innovations can stimulate economic growth, form new markets and change existing markets (Marvel & Lumpkin, 2007). Carree & Thurik (2003) provided surveys about the relationship of innovation with economic development and have found a significant positive relationship. Most of the product innovations are developed by small firms (de Mel, McKenzie & Woodruff, 2009; Caree & Thurik, 1999). Small firms therefore have a significant role in the economic growth of a nation. Carree & Thurik (1999) take this to a more national level and divide nations into levels of development. The richest EU-countries with the highest GDP per capita benefit more in terms of economic growth from small firms in the manufacturing industry. This is not the case for Spain and Portugal for example, as they have a lower GDP per capita than the rest of the EU countries. These findings are also in line with Audretsch & Thurik (2001) who argue that high developed countries shift from the model of the 'managed economy' to a more 'entrepreneurial economy'. A managed economy stands for more large-scaled production with the production factors of (unskilled) labour and capital as the core of competitive advantage. On the other hand, the entrepreneurial economy reflects the economic importance of knowledge. An explanation for the existence of more product innovations within small firms compared to the

big firms could be due to their core strategies for new and customized products that are formed by their characteristics and strengths. Small firms are closer to their clients, have unique competences, have more craftsmanship and are more motivated than large firms. These characteristics for small firms could explain the high development of product innovation (Nootenboom, 1994). Another reason for higher innovation in young small firms can also be the knowledge spill-over effect (Lucas, 1988; Romer, 1990; Glaeser *et al*., 1992; Audretsch & Thurik, 2010). Knowledge can reduce the risk that the product will fail and increases the chance that the entrepreneur will be successful (Steward-Knox & Mitchell, 2003). Knowledge from the individual can for example spill over from universities, customers, knowledge institutes and suppliers to the firms, which increases the entrepreneur's ability to innovate (Hoffman et *al*., 1998; Romijn & Albaladejo, 2001). Entrepreneurs use these knowledge spill-overs to recognize and exploit opportunities.

Roper (1997) investigates the relationship of product innovation and economic growth in Western Germany, U.K and Ireland and has shown that there are more graduates employed in small businesses in the U.K. and Ireland. In Germany the level of graduates in low-innovating small businesses is higher compared to innovative small businesses. Most of the employees in innovating firms have a technician or Master degree. The output of the innovative small firms grows also more than the non-innovators. Malerba & Orsenigo (1999) do research on the exit, entry and survival of innovative firms and used the data of six European countries. Research found that these innovative activities are highly turbulent over time. The small amount of firms who get through the entry barrier and keep on being innovative after their first patent do significant improvement in technology performance over the years. Especially the large innovators stay large over time, even during turbulent years. Firms who have a large share of patents are usually large and innovative and stay this by their stable core. However, there is a large turbulent amount of firms that innovate occasional. At country level, Audretsch (1998) find that the location and agglomeration is important for the knowledge spillovers and comparative advantages of developed countries. 'Globalization and the telecommunications revolution have triggered a shift in the comparative advantage of the leading developed countries towards an increased importance of innovative activity'.

The current study also uses data from young and new firms, as these firms show high development of product innovation (Nootenboom, 1994).

2.2 Human capital

In this section the relationship of human capital with innovation will be analyzed and discussed. This section is also divided into subsections. The first section describes the relationship of education with innovation. The second section describes the relation of skills with innovation. The third section describes the relation of experience with innovation.

Human capital is considered to be a crucial factor for entrepreneurs to be innovative. Human capital is generally seen as a set of knowledge, skills and abilities of the individuals used in the activities that stimulate growth and development (Marvel & Lumpkin, 2007). There are several types of human capital. Marvel & Lumpkin (2007) make a distinction in general- and specific human capital, while Dakhli & De Clercq (2004) makes distinction in industry-specific, firm-specific and individual-specific human capital.

Marvel & Lumpkin (2007) investigate the effect of human capital on innovation radicalness. Prior knowledge, education and experience of entrepreneurs are used as human capital factors, which is also in line with the human capital indicators in the current study. The researchers make a distinction in general- and specific human capital and find that both human capital factors are important determinants of innovation. Specific human capital refers to knowledge, skills and experience that can only be used in a single environment, like a specific firm, industry or technology. On the other hand, general human capital can be used in different environments. Experience can include work experience, other on-the-job practical learning and non-formal education like on-the-job training. 'Through work experience, people develop information and skills that facilitate the formulation of entrepreneurial strategy, the acquisition of resources, and the process of organizing'. Experience is important for entrepreneur as it increases the human capital and decreases uncertainty of opportunities. Education is also part of human capital and may be useful for opportunity discovery and exploitation. Those who have increased education are more likely to be an entrepreneur.

There are numerous types of human capital, like firm-specific human capital, industry specific human capital and individual specific human capital (Grant, 1996; Bianchi, 2001; Marvel & Lumpkin, 2007). These types of human capital are explained below for a better understanding of the definitions. The current study makes use of individual specific human capital

Firm-specific human capital refers to skills and knowledge that is only useful within a specific firm and can be gained by on-the-job training and education. Firm-specific skills can encourage the advantage for this firm and can keep the firm ahead in competition, as these skills are not transferable to other firms. However, the limited amounts of communications between firms that are linked to the specific skills have limited impact on innovation within a specific region or wider society (Grant, 1996).

Industry-specific human capital refers to knowledge that is gained by experience within a specific industry. Bianchi (2001) even suggest that the exchange of high quality knowledge between the main players of the same industry can be an important factor for innovation within an industry. An industry or region can be seen as a specific 'culture' where network-partners who exchange tacit knowledge have a high level of mutual understanding (Maskell & Malmberg, 1999). Knowledge within a specific industry is usually only understandable for specialist within the same industry, which decreases the need for patent protecting within the specific industry (David, 1975).

Individual-specific human capital is usable in a much broader way than the firm-specific and industry-specific human capital, as it is applicable to a wider range of industries and firms. This kind of human capital refers to knowledge gained by education. This specific human capital can be the completion of general schooling, as well as academic education and vocational training (Hinz & Jungbauer-Gans 1999). Secondly, it refers to managerial and entrepreneurial experience. Entrepreneurs with prior start-up skills, managerial experience and job experience in specific branches gain extra human capital which can be used in their future or current firm (Hinz & Jungbauer-Gans 1999; Pennings et *al*., 1998). Thirdly, age, gender and total household income of an individual can be seen as individual specific- human capital (Kilkenny et *al*., 1999; Hinz & Jungbauer-Gans 1999). As mentioned in the introduction, age can be seen as human capital, because each individual gain his knowledge through his own unique life experience (Marvel & Lumpkin, 2007). Hinz & Jungbauer-Gans (1999) show that the probability that an individual becomes self-employed, differs for men and women. Women have a significant lower probability in becoming self-employed.

Researchers like Dakhli & De Clerq (2004) investigate how human capital and social capital differs between countries, while using the cultural dimensions of Hofstede (1980). The cultural dimension like individualism and uncertainty explains why some countries are more

innovative than other countries. Dakhli & De Clerq (2004) argue that within countries the level of education leads to different variations of innovation. Some regions are more economically successful than other regions because of the availability of skills and knowledge (Maskell & Malmberg, 1999). Acs *et al. (*2005) even suggest that that the level of education is lower in poor countries and Gollin *et al*. (2002) state that poor countries are usually not innovative as they do not construct new ideas. The differences in innovation between countries, sectors and firms are important to acknowledge. Studies who focus on only one country are not complete (Cefis & Orsenigo, 2001). Dakhli & De Clerq (2004) make use of sample sizes between the 600 and 3000 for each country. In total, their sample includes 59 countries. The sample consists of countries from five continents, i.e. 13 countries in Australia, 13 countries in Asia, 30 countries in Europe, 3 countries in Africa and 12 countries in America. They argue that 'economic development and output at the national level is the result of aggregate economic activity of individual regions within a country'. The effect on national growth happens without affecting the growth rate of the neighbour countries. For their data they construct several human capital factors and several dependent innovation variables. The individual's human capital variables are measured with the highest level of education, management or industry experience, age and the amount of vocational training. The country's human capital is measured with the average years of schooling and literacy rate, life expectancy and average income. The researchers have made the distinction between human capital on country level and individual level, because they had no access to country level data including vocational training or industry experience. The dependent variables that explain innovation are R&D expenditures, number of patents and high technology export. The researchers find strong evidence that human capital is positive related to (all three kinds of) innovation. This is also the case for all individuals within a country. The level of individual human capital has a positive effect on the innovative activity of a country.

The revolution of the human capital theory began with some founding fathers that were associated with the University of Chicago. Some of these innovators were Ted Schultz, Sherwin Rosen and Milton Friedman. Becker (1964) uses the theory of the previous founding fathers and extends this to the well known human capital theory. Becker (1964) finds that the productivity of the worker rises through training and education, this holds for formal as informal training and education. Education and experience are one of the most important investments of the human capital theory. Investments in schooling and training improve skills and knowledge and raise the individual earnings. This holds also for training and schooling

that are followed outside school, especially on-the-job. Some individuals who leave school are being prepared for their new jobs by formal and informal training programs. For the developed countries holds that especially highly educated and skilled individuals earn more than others. Furthermore, within a country, inequality in the distribution of earnings has a positive relationship to inequality in education and trainings.

Many researchers have used the human capital theory as a foundation for their own research. Davidsson & Honig (2003) and Marvel & Lumpkin (2007) are one of the many researchers that use education, experience and skills as their main characters of human capital, which originates from the human capital theory of Becker (1964). The human capital theory illustrates that individuals with more or higher quality of human capital will achieve more desirable outcomes and will therefore improve their variety of opportunities. The relationship of the human capital indicators, education, skills and experience, with innovation is discussed in chapter 2.2.1, 2.2.2 and 2.2.3. This thesis uses human theory to investigate the relationship of the human capital variables education, experience and skills with being an entrepreneurial product innovator.

2.2.1 The relationship of education with innovation

Education can be divided into levels and can also be seen as part of human capital. Education can increase a person's stock of information, abilities and skills which can improve the entrepreneurial judgments (Casson, 1995). Education enriches a person's knowledge and influences the ability of the entrepreneur to interpret, to understand, to apply new information and make conclusions or predictions outside the range of observation (Roberts, 1991). Ronstadt (1988) refers to this possession of prior knowledge as a 'knowledge corridor', in which a person can indentify certain opportunities while other opportunities are not indentified. The knowledge corridor is also in line with the research of Venkataraman (1997), who finds that the entrepreneurs will only notice the opportunities that are directly associated to their knowledge. On the long run, the level of education seems also significant for the survival of the innovative firms (Bates, 1990; Evans & Leighton, 1989). Hoffman et *al.* (1998) take this even further and state that the education and skills of employees can be seen as a pre-condition for the performance of high innovative firms.

There can be a negative or positive relationship between formal education and being an innovative entrepreneur (Parker, 2009). The positive relationship can be seen in the study of

Casson (1995), Romijn & Albaladejo (2001) and Mel, McKenzie & Woodruff (2009). Romijn & Albaladejo (2001) investigate the determinants of innovation for 33 small firms in the software and electronic industry in the United Kingdom. They make use of commonly used product innovation indicators as well as an experimental indicator for product innovation. The focus of the research is product innovation, because this is the dominant form of innovation (Hoffmann et *al.,* 1998). The innovation performance of these firms is correlated with the variables education, R&D effort, prior work experience and network relationships. The researchers have found that high education plays an important role in the development of product innovations. Especially prior work experience seems to be important for firms to innovate. Specialized knowledge and experience in this investigated industry seems more important for firms to be innovative than general managerial abilities and practical, intermediate-level technical skills. However, some of the firms in this research would not have succeeded without help of the university or science laboratory. The Industries in this research differ from each and cannot be generalized. De Mel, McKenzie & Woodruff (2009) conclude the same when researching a sample of entrepreneurs in Sri Lanka; (high) educated individuals are more likely to innovate. Entrepreneurs who are educated are more likely to conduct product innovation. The variable education is measured in the entrepreneurs years spend on education. Entrepreneurs who have more years of education are also more likely to conduct product innovation. During their research, the authors make a distinction in firm size. Educated individuals who are working in large firms are less acknowledged compared to the individuals who are working in young small firms. This is due the fact that communication within early staged firms is easier because of the better communication between the different layers in the organization. The likelihood of making innovation realty is larger because of the dynamic environment (Bodewes & de Jong, 2003).

Schumpeter (1934) refers to the entrepreneur as an innovator. Davidsson & Honig (2003) investigate, for a time period of eighteen months, the role of human capital amongst nascent entrepreneurs in Sweden. They use a sample of 380 nascent entrepreneurs and a control group of 608 general individuals. They especially want to investigate if the individuals who attempt to start a business have different levels of human capital and if this level affects their rate of success. They use the exploitation and discovery component of human capital that is suggested by Shane & Venkataraman (2000). Entrepreneurial discovery can also be seen as opportunity recognition. An individual who start his own business should have 'superior ability in successfully exploiting opportunities'. Davidsson & Honig (2003) use the variable

nascent entrepreneur as the first independent variable for discovery. Exploitation is researched by following the entrepreneurs over time while examining different human capital factors. The independent variables that are used for exploitation are several steps for obtaining patents/copyrights and profits. Both groups that are examined are tested for four aspects: years of education, years experience as a manager, years of work experience and whether or not the individual has previous start-up experience. The sample of nascent entrepreneurs has one independent variable more: whether or not the individual has taken business classes. These dependent variables and measurements of human capital measure tacit knowledge that is gained through explicit knowledge and experience and also tacit knowledge that is gained through formal education. Tacit knowledge refers to the know-how. In sum, Individuals can increase their knowledge by formal education (i.e. university education), informal education (i.e. work experience) and non-formal education (i.e. adult education). The researchers find a positive relationship of formal education and previous start-up experience in getting a nascent entrepreneur. The study took in consideration that over-investment in human capital can discourage risk-taking, while on the other hand under-investment can encourage risk-taking. Entrepreneurship can be seen as a risk-taking job. However, business education and previous start-up experience have a significant positive effect on entrepreneurs to be innovative. A common factor between business education and previous start-up skills is that they are specific.

The study of Rogers (2002) shows for the non- manufacturing firms that the individuals that have management training are less likely to innovate. The negative effect can only be seen for the small firms. Results for firms within the non-manufacturing industry with five till nineteen employees show a positive effect of management training with innovation. The researcher makes use of a sample of 3400 Australian firms for the years 1993 till 1995 and has divided the sample into manufacturing and non- manufacturing businesses. The negative relationship of management training with innovation for small firms compared to the larger firms can be caused by the accessibility of knowledge and human capital by larger firms. Larger firms have more and easier access to knowledge and human capital than small firms, which allows larger firms to innovate more. However this finding is in contrast with many numbers of researches that are stated in the introduction. The studies of de Mel, McKenzie & Woodruff (2009), Caree & Thurik (1999), Lucas (1988), Romer (1990), Glaeser *et al*. (1992) and Audretsch & Thurik (2001) state that most of the innovations come from small firms.

There is also mixed evidence for the relation of education with innovation for different industries. De Jong & Vermeulen (2004) did research in the Netherlands on the determinants of product innovation across different industries. The research is based on a survey of 1250 small businesses with a maximum age of five years. The quantity of innovation is higher for the financial service- and knowledge intensive firms compared to the hotel-, wholesale and transport-, construction-, catering- and retail industry. However, taking in account for the different industries, training and education are not significant with product innovation. According to De Jong & Vermeulen (2004), the insignificant effect of the education and training variable may be due to the single data that is used instead of multiple data sources. There are also only seven industries investigated, while financial service, engineering and architectural industries tend to have a link with innovations (Bangma & Peeters, 2003). Most studies, like Parker (2009) include the industry in the investigation between education and innovation. Shane (2003) finds a higher level of education in the industry sector compared to other industries. As most studies do acknowledge the use of different industries within their research, the current study will also make a distinction in different industries (Rogers, 2002; De Jong & Vermeulen, 2004; Bangma & Peeters, 2003; Shane, 2003)

Although the relation between education and product innovation could be positive as well as negative, as discussed above, in this thesis the expectation will be that the relationship will be positive. The reason for this is that this thesis makes use of formal education instead of business education. Business education may have a negative effect with innovation (Rogers, 20002).

2.2.2 The relationship of skills with innovation

Marvel & Lumpkin (2007) state that education increases skills and Shane (2003) states that business experience increases skills. Both researchers formulate that skills increase the exploitation and discovery of opportunities, which may lead to product innovations. As mentioned before, Marvel & Lumpkin (2007) state that ‘education is another aspect of a person’s human capital that may be valuable in the discovery and exploitation of opportunities. Education increases the entrepreneur’s skills, which in turns increases the success for an entrepreneur. Shane (2003) states that skills come from experience like business experience and industry experience. ‘Through work experience, people develop information and skills that facilitate the formulation of entrepreneurial strategy, the acquisition of resources, and the process of organizing’.

According to Freel (2005), skills are important for firms to innovate. These skills vary by sector, because product- and technological innovations are different for each sector. Resources that are used within each sector may be specific for product innovations (Oerlemans et *al*., 1998). Freel (2005) makes use of a sample with 1345 North British Small and medium entrepreneurs. The researcher investigates the relationship of a diversity of skills and training with product- and process innovations. The researcher makes also a distinction in incremental and novel innovations and between service- and manufacturing firms. Incremental innovations are based on previous innovations, while novel innovations are completely new. Freel (2005) makes use of different labour skills as independent variables. Some of the skills are finance skills, managerial skills, marketing skills and technological skills. The research shows only few statistical numbers. Only training intensity has a significant effect on both sorts of innovation within service- and manufacturing firms. Training intensity is measured as an index of training that is related to the number of training the staff has had. This means that entrepreneurs who had more training are more likely to conduct product innovations.

The current study will focus on business skills as one of the human capital indicator. The same indicator is also used in the study of Shane (2003). The GEM executive report (2008) also acknowledge that business skills, like perceived skills and knowledge to start a business, are important skills for individuals who want to become entrepreneurs. In this research the expectation will be that the relationship between business experience and product innovation is positive. The reason for this is that skills increase the exploitation and discovery of opportunities, which may lead to product innovations (Shane, 2003; Marvel & Lumpkin, 2007).

2.2.3 The relationship of experience with innovation

The relationship of experience with innovation may differ between studies. Studies about the relationship of experience with human capital make use of different kind of experiences. Davidsson & Honig (2003) (see chapter 2.2.1) use panel data and find a positive relationship of previous start-up experience with innovation. To examine the level of experience for individuals, they investigate the years of full time paid work-experience in any field, managerial experience and supervisory experience. However, when examining these human capital factors for non linear effects, these variables are insignificant and are left out of the research. The researchers use the relationship of previous start-up skills with innovation in

their empirical study. Previous start-up experience can be seen as experience and as a part of human capital and could be a positive skill when starting a new business (Politis & Gabrielsson, 2009).

Marvel & Lumpkin (2007) take the relationship between human capital and innovation even further by investigating the innovation radicalness of technical entrepreneurs in the USA. For their research, they make use of a sample of 145 technical entrepreneurs who are operating within a university incubator. As mentioned before in chapter 2.2, the researchers make a distinction in general and specific human capital. General human capital is tested with the number of employers the entrepreneur had worked for, the number of years of professional work experience and the entrepreneur's highest education level. Specific human capital is tested for prior knowledge of markets, technology, ways to serve markets and customer problems. Their study shows that both general- and specific human capital are important for entrepreneurs to be innovative. The empirical study of Marvel & Lumpkin (2007) show that there is a positive relationship between general human capital measured in formal education and years of professional work experience with radical innovation. The researchers define radical innovations as: 'Degree of radicalness is often used to classify innovations according to how radical they are compared with existing products or services' (p814). Becker (1964) argues that experience and education are one of the most important factors of human capital. However, the number of employers the entrepreneur had worked for seems to be negligible for radical innovation for the study of Marvel (& Lumpkin (2007). The outcomes of the specific human capital variables are unusual. Prior technology knowledge may create radical innovations while knowledge of ways to serve markets shows a negative relationship with radical innovation. This is not in line with Becker (1964) who states that individuals with higher human capital have more desirable outcomes. The findings of Marvel & Lumpkin (2007) may even suggest the contrary. It is favourable to have less of a specific knowledge to make radical innovations. Technology knowledge and prior knowledge of ways to serve markets were the most significant variables of innovation. However, customer problems, markets and ways to serve markets are less likely to cause innovation radicalness. This is in line with Bhide (2000), who states that too much human capital can limit entrepreneurs to take more risk on their ventures. To sum the findings of Marvel & Lumpkin (2007), experience and education are important human capital factors for entrepreneurs to be innovative. Furthermore, entrepreneurs will make radical innovations if they have a rich

knowledge of technology and are not hindered by current customers and norms of existing products or services.

On the other hand, other researches like Avermaete *et al*. (2004) claim that age, firm experience and scientific qualifications do not have a significant relationship with innovation. Avermaete et *al*. (2004) examine the determinants of product and process innovation of 147 small food manufacturing firms in Europe. The distinction of these firms is made in four levels of innovation: non- innovators, traditionals, followers and leaders. According to the researchers, the innovative firms are the ones who have a higher quantity of professional and managerial staff, which makes them more likely to innovate. Innovative firms have a higher proportion of qualified and technical employees compared to non-innovative firms. This finding is in contrast with Freel (2004) who claims the opposite. On the other hand, the study of Hitt & Barr (1989) shows a negative relationship between greater experience and innovation. The increase in experience limits strategic flexibility and can therefore reduce radical innovations. Bhide (2000) takes this a level higher and states that the increase in education and experience makes entrepreneurs less risk taking on starting a new firm. An explanation could be that the greater knowledge or experience of market practice and development standards leads to rigid ideas, what can limit the development of new opportunities (Marvel & Lumpkin, 2007).

The current study will focus on prior business ownership experience as one of the human capital indicator. Although the relationship between experience and product innovation could be positive as well as negative, as discussed above, in this thesis the expectation will be that the relation will be positive. The reason for this is that the entrepreneurs who have previous start-up experience could have a better approach to failure business (Politis & Gabrielsson, 2009). In simple words, you learn of your own mistakes. Minniti & Bygrave (2001) and McGrath (1999) even state that previous start-up experience can help entrepreneurs to make their existing business successful.

2.3 Innovation during recession

There is mixed evidence concerning the relationship of entrepreneurs and innovation during a recession (Figueroa-Armijos et *al*., 2012). Some researchers conclude that during hard times the main goal of entrepreneurs is to gain from opportunities (they are pulled into entrepreneurship), while other researchers conclude that individuals become entrepreneurs because of their current or future sight of unemployment or underemployment (they are

pushed into entrepreneurship). Opportunity based entrepreneurship represents the nature of voluntary entrepreneurship. These entrepreneurs have greater skills, are better prepared and earn more than necessity entrepreneurs (Bhola et *al.*, 2006).This is also in line with Fairlie (2009), who states that the opportunity-driven entrepreneurs have high income firms. Baron (2006) even suggests that these entrepreneurs make use of their prior knowledge and experience for seeking entrepreneurial opportunities. On the other hand individuals in countries with necessity-based entrepreneurial activity start their businesses because they do not have other job options to earn enough to survive (Frese & De Kruif, 2000). Necessity entrepreneurship in a country increases with the quantity of poverty (Reynolds et *al*., 2001). However, the last finding is in contrast with the main stream economic theories, who claim a direct relationship of entrepreneurship and economic development (Shane, 2009).

While most entrepreneurs are less willing to invest in innovations during the financial crisis of 2008, there are still minorities of entrepreneurs who increase their expenditures for making innovations (Archibugi & Filippetti, 2011). The same decrease in investments in innovation can be seen in the study of Paunov (2012), who investigates the firm's innovations for eight Latin American countries for the years 2008 and 2009. Archibugi, Filippetti & Frenz (2013) show two possibilities why these firms increase their expenditures on innovations. First, these firms can be seen as dynamic firms. These firms need to innovate to survive. The firms can keep ahead in competition by upgrading their knowledge. Second, these firms did not innovate before the crisis and can be seen as new innovators. These firms might be new on the market or may be small firms who keep ahead on the market. Archibugi, Filippetti & Frenz (2013) investigates the innovation drivers before and during the financial recession of 2008. The researchers make use of the UK Community Innovation Survey. The researchers examine the drivers of innovation investments, like skills and availability of finance before and after the crisis. The independent variable skills is measured as the 'log of the proportion of employees that hold a degree at BA/BSc level or above'. They have found that that the crisis has increased the innovation among new firms. These firms were also highly innovative before the crisis. Entrepreneurs who adapt their strategies for new product and market developments are the ones who will handle the crisis best.

On average, firms all over the world invested less in innovation during the financial crisis of 2009 (Archibugi, Filippetti & Frenz, 2013). The period 2009 represents a volatile year for entrepreneurs. However, new firms have to respond to the changing market conditions during

the crisis and before the crisis (Burns & Stalker, 1961). In this thesis the expectation will be that the relation between human capital and product innovation will be positive during the years 2008 and 2009. The reason for this is that the entrepreneurs in this study (TEA) need to innovate to survive. This holds for volatile and non-volatile years. It is therefore expected in this research that the relationship between human capital and product innovation stays the same for both years.

2.4 Developing the hypotheses

Previous literature often shows a positive relationship between human capital and product innovation. Human capital has various indicators which causes variations in prior research. However, usually human capital is seen as a set of knowledge, skills and abilities of the individuals used in the activities that stimulate growth and development (Marvel & Lumpkin). There are papers that show a positive relationship between human capital and product innovation or there are also papers that show no relationship. Some industries need more or less education to innovate. The financial industry for example is more likely to innovate if the employees are more educated. There are also studies that show a negative relationship between experience and innovation. Marvel & Lumpkin (2007) state that the source of the negative relationship between greater experience and innovation is not clear. It is unclear if the negative relationship comes from a lack of data or not. The articles from Davidsson & Honig (2003) and Politis & Gabrielsson (2009) are more convincing in stating this positive relation. Davidsson & Honig (2003) use panel data and make use of a control group containing 608 individuals of the 30.427 observed individuals. Politis & Gabrielsson (2009) use previous start-up skills as a measurement for experience, which is a good indicator for this research.

The majority of the entrepreneurs invest less in product innovations during the financial crisis (Paunov, 2012). According to Bhola et *al*. (2006), especially opportunity entrepreneurs are better prepared for the crisis and have greater skills compared to the necessity entrepreneurs. It seems that the expenditures on the drivers of innovation have a significant effect on the amount of innovation during and before the financial crisis of 2008/2009 (Archibugi, Filippetti & Frenz, 2013). However it is not expected that the dynamics in innovations within firms has a different effect of the relationship of human capital with product innovation.

Based on logic and empirical evidence, it is sensible to suspect that human capital has a positive relationship with entrepreneurial product innovation. It is also expected that the relationship of human capital with entrepreneurial product innovation is the same during and before the financial crisis of 2008/2009.

Based on the arguments above the following hypotheses are formulated:

Hypothesis 1: *Highly educated entrepreneurs as compared to low educated entrepreneurs are more likely to conduct product innovation.*

Hypothesis 2: *Entrepreneurs with start-up skills as compared to entrepreneurs without start-up skills are more likely to conduct product innovation.*

Hypothesis 3: *Entrepreneurs with prior business experience as compared to entrepreneurs without prior business experience are more likely to conduct product innovation.*

Hypothesis 4: *The relationship between education, start-up skills and prior business experience with the entrepreneur's product innovation is positive for the years 2008 and 2009.*

3. Data and methodology

As previously explained, the aim of this study is to research the influence of education, experience and skills with product innovation within countries in different stages of development during the turbulent years of 2008 and 2009.

3.1 Data

The dataset is obtained from the Global Entrepreneurship Monitor (GEM) from the years 2008 and 2009. The year 2008 is used as a base year. The year 2009 is used as a comparison and to see if the results are similar. The GEM 2008 surveys are taken before the start of the financial crisis. The GEM 2009 surveys are taken during the financial crisis. The full dataset contains data from the early stage entrepreneurial activity (TEA) of the Adult Population Survey on individual level (APS). The GEM APS is a questionnaire, which collects information about the individual's attitude and involvement towards entrepreneurship. This means that the full dataset contains observations of entrepreneurs, employed individuals and unemployed individuals. The interviews are conducted in 53 countries in the year 2009 and in 43 countries in the year 2008. Total entrepreneurial activity consists of nascent entrepreneurs who are involved in setting up a business and entrepreneurs who own or manage a business for up to 3.5 years plus the sum of the number of starting entrepreneurs. The information in the data set is obtained by telephone interviews and through door to door interviews. The age of the respondents varies between 18 and 64 years.

The model with product innovation as the dependent variable includes a sample of 14,057 observations of entrepreneurs in the year 2009 and 11,564 observations of entrepreneurs in the year 2008 (see Appendix A1). The full dataset of the year 2009 consists of 181,067observations. The full dataset of the year 2008 consists of 134,990 observations.

3.2 Variables

This research makes use of 1 dependent variable, 4 independent variables and 3 control variables which are described below.

3.2.1 The dependent variable: Product innovation

The variable that is used for measuring product innovation is: *the product is new to all or some customers.* This variable is used as dependent variable for both years. Newness of product or services is binary variable. This means that the value can have two values. Value 1

means that the entrepreneur offers a product that is new to all or some customers. If the variable has value 0, the product is new to none of the customers.

The dependent variable is product innovation. As mentioned in the literature review, researchers use different variables for measuring product innovation. Some researchers use patent counts as the measurement for product innovation (Griliches, 1990), while others use R&D development or new products as measurement for product innovation (Van Praag & Versloot, 2007). This research examines product innovation by measuring if the products or services are new to all or some customers. This measurement is chosen, because the measurements by patents count and R&D are weak. R&D expenses only measure inputs while the amount of patents measure outputs and capture only some kinds of innovations (Griliches, 1979, 1994; Griliches & Mairesse, 1998). Furthermore, the maturity of R&D can differ for firms. This means that there is a possibility that new firms have not immediately invested in R&D while they have innovative products. The same holds also for measuring product innovations by the count of patents. It is not necessarily that new firms, who just began, make use of patents while they do produce innovative products.

3.2.2 The independent variables: Education, start-up skills, previous business ownership and country

The independent variables that are used in this research are education, start-up skills, previous business owner experience and country. These variables are the main indicators of human capital in earlier performed studies.

Education

The variable *education* is a binary variable and measures the educational attainment of the entrepreneur. The variable can have the value 1 or 0. If the variable takes the value 1, the entrepreneur is high educated. If the variable takes the value 0, the entrepreneur is low educated. The entrepreneur is high educated when having attained post-secondary education or/and has graduate experience. On the other hand, the entrepreneur is low educated when having attained some secondary education or/and has a secondary degree.

Education is chosen as independent variable, as is one of the most important human capital factors (Becker, 1964; Marvel & Lumpkin, 2007). Education raises the productivity of the individual. Individuals with higher levels of education will improve their variety of

opportunities (Becker, 1964). Bates (1990) even states that education and skills of the employees can be seen as a pre-condition to be highly innovative at their jobs. Education enriches a person's knowledge and influences the ability of the entrepreneur to interpret, to understand, to apply new information and make conclusions or predictions outside the range of observation (Roberts, 1991).

For this research, it is expected that education is positive related to product-innovation, as previous studies have found a positive relationship with innovation. Some of these previous studies are the studies of Becker (1964), Marvel & Lumpkin (2007), Davidsson & Honig (2003), Roberts (1991) and Hoffmann et *al.* (1998).

Start-up skills

The variable *start-up skills* is a binary variable and measures whether the entrepreneur has indicated to have the knowledge, skills and experience required to start a new business. If the value of the variable is 1, the entrepreneur has the knowledge, skills and experience to start a new business. If the variable is 0, the entrepreneur has no knowledge, skills and experience to start a new business.

The variable start-up skills is a human capital variable and can be seen as entrepreneurial experience, skills and knowledge. For example Politis and Gabrielsson (2009) did research on a group of Swedish entrepreneurs in the year 2004 and claim that entrepreneurs with previous start-up experience have a better attitude towards failure. Entrepreneurs with a better attitude to failure could have a positive effect on their business. It is therefore expected that start-up skills have a positive relationship with product innovation.

Previous business ownership experience

The variable *previous business owner experience* is a binary variable and measures whether the entrepreneur in the past twelve months has sold, shut down, discontinued or quit a business they owned and managed, any form of self-employment, or selling goods or services to anyone. The variable is coded 1 if the variable holds true. The variable is coded 0 if the entrepreneur has no business experience.

The variable previous business ownership experience measures whether the entrepreneur has shut down and owned a business in the past year. This variable is chosen as independent

variable, because entrepreneurs with previous business experience could use their experience from the past to their current business for making it a success (McGrath, 1999; Minniti & Bygrave, 2001). An entrepreneur who has shut down his business is enriched with new knowledge and skills. The entrepreneurs have different reasons for closing down their business. They can close their business because of exit planning in advance, failure, having other outside attractive opportunities or personal reasons. According to Becker (1964) and Marvel &Lumpkin (2007), individuals that have more experience are also more likely to notice new market opportunities. For this research, it is therefore expected that previous business experience has a positive relationship with product innovation

Countries within and between different economic development stages

The countries that are tested are situated in three stages. The stages are divided into three levels: factor-driven, efficiency-driven and innovation-driven. Table 1 shows for the years 2008 and 2009 which country is situated in which stage. Countries may shift from one stage of development to another stage of economic development. The countries within these stages are binary variables and are used as independent variables. This means that the variable can have two values. Value 1 for a country variable means that the entrepreneur lives/works in this country. If the variable takes the value 0, the entrepreneur lives/works in one of the other countries that are used in the research.

Table 1: Countries in development stage for the years 2008 and 2009

Development stage	2008	2009
Factor-driven economies	Angola, Bolivia, Bosnia and Herzegovina*, Colombia*, Ecuador*, Egypt, India, Iran*	Algeria*, Guatemala*, Jamaica*, Lebanon*, Morocco, Saudi Arabia*, Syria*, Kingdom of Tonga, Uganda, Venezuela*, West Bank and Gaza Strip, Yemen
Efficiency-driven economies	Argentina, Brazil, Chile, Croatia*, Dominican Republic, Hungary*, Jamaica, Latvia, Macedonia, Mexico, Peru, Romania, Russia, Serbia, South Africa, Turkey, Uruguay	Argentina, Bosnia and Herzegovina, Brazil, Chile*, China, Colombia, Croatia*, Ecuador, Hungary*, Iran, Jordan, Latvia*, Malaysia, Panama, Peru, Romania*, Russia*, Serbia, South Africa, Tunisia, Uruguay*
Innovation-driven economies	Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Republic of Korea, Netherlands, Norway, Slovenia, Spain, United Kingdom, United States	Belgium, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Israel, Italy, Japan, Republic of Korea, Netherlands, Norway, Slovenia, Spain, Switzerland, United Kingdom, United Arab Emirates, United States

Source: GEM 2008/2009 Global Report
*denotes country in transition to a more advanced stage

3.2.3 The control variables: Age, Gender and Industry

The control variables that are used in this research are age, gender and industry.

Age

The control variable *age* is a continuous variable and measures the age of the entrepreneur in years.

Age is chosen as a control variable, as individuals gain experience also through time and by getting older and getting life experience. Their life experience can be used for making a success for their current business (Marvel & Lumpkin, 2007). For this research, it is taken in account that there could be a negative relationship between age and product innovation. According to Avermaete et *al*. (2004), statistically, the age of the entrepreneur is not different between the innovators and non-innovator

Gender

The control variable *gender* is a binary variable with the value 1 or 0. If the variable is coded 1, the entrepreneur is male. If the variable is coded 0, the entrepreneur is female.

The variable gender is used as a control variable. Human capital between males and females may be different. The study of Kilkenny et *al*. (1999) and Hinz & Jungbauer-Gans (1999) do also incorporate the effect of gender in their study. Hinz & Jungbauer-Gans (1999) show that the probability that an individual becomes self-employed, differs for men and women. Women have a significant lower probability in becoming self-employed.

Industry

This research makes use of different industries as control variable. The industries that are investigated are industries with extractive firm, transforming firms, business services and consumer oriented firms. The variable *industry* is a binary variable with the value 1 or 0. The variable is coded 1 for transforming firms. The variable is coded 0 for extractive firms, business service firms and consumer orientated firms. The transforming industry contains manufacturing and constructing firms. The Extractive industry contains the following firms: mining, farming, fishing and forestry. The consumer orientated firms need usually low resources and the business service firms are focused on process innovations.

The transforming industry is chosen to investigate, because this thesis investigated the relationship of product innovation with human capital. Product innovations are the highest in manufacturing firms as product innovations are 'centred around technical strengths' of the firms (Utterback & Suarez, 1993, p3).

Previous studies like Marvel & Lumpkin (2007) and Dakhli & De Clercq (2004) make a distinction in product innovation between different industries. Some specific knowledge, skills and experience can only be used in a single environment or industry. Knowledge within a specific industry is usually only understandable for specialist within the same industry, which decreases the need for patent protecting within the specific industry (David, 1975).
Romijn and Albaladejo (2002) did research on the influence of education on innovation and took in account that the results of their study cannot be generalized for every industry. The industry dummy is therefore needed for research about the association between innovation and education. Other research studies done about the influence of education on innovation

(De Jong and Vermeulen, 2004) and the influence of experience on innovation, show that the industry dummy is decisive in their research (Audretsch, 1991; Shane, 2003). Differences in industry characters, such as innovative capabilities show differences in the impact of this relationship (Audretsch, 1991). Parker (2009) also concluded that the relation between education and innovation depends i.e. on the industry. All these studies show the importance of the industry dummy for their research.

3.3 Descriptive analysis for the years 2008 and 2009

This section is divided into two parts or two years. The first section contains the descriptive analysis for the different independent-, dependent and control variables for the year 2008. The second section contains the descriptive analyses for the different independent-, dependent and control variables for the year 2009. The variables are the same for both years. The cross tabulations of the dependent and control variables with product innovation for both years can be seen in table 2. The total frequency column of table 2 shows the total entrepreneurs who consider their product to be new to all or some customers including the entrepreneurs who do not consider their product to be new to all or some customers.

Table 2: Cross tabulations for dependent and independent variables in the different development stage for the years 2008 and 2009.

		2008		2009	
		Product innovation	**Tot. frequency**	**Product innovation**	**Tot. frequency**
Factor- driven economies	High education	246 *(34.75%)*	708 *(100.00%)*	250 *(42.74%)*	585 *(100.00%)*
	Low education	626 *(35.03%)*	1,787 *(100.00%)*	813 *(39.14%)*	2,077 *(100.00%)*
	Has start-up skills	816 *(35.51%)*	2,298 *(100.00%)*	972 *(34.70%)*	2,801 *(100.00%)*
	Has no start-up skills	133 *(31.59%)*	421 *(100.00%)*	238 *(44.57%)*	534 *(100.00%)*
	Business ownership experience	186 *(39.91%)*	466 *(100.00%)*	136 *(26.98%)*	504 *(100.00%)*
	Otherwise	793 *(33.63%)*	2,358 *(100.00%)*	1,136 *(37.63%)*	3,019 *(100.00%)*
efficiency- driven economies	High education	779 *(58.48%)*	1,332 *(100.00%)*	920 *(57.93%)*	1,588 *(100.00%)*
	Low education	877 *(40.25%)*	2,179 *(100.00%)*	1,583 *(51.75%)*	3,059 *(100.00%)*
	Has start-up skills	1.568 *(49.09%)*	3.194 *(100.00%)*	2,284 *(54.76%)*	4,171 *(100.00%)*
	Has no start-up skills	241 *(49.69%)*	485 *(100.00%)*	383 *(48.73%)*	786 *(100.00%)*
	Business ownership experience	330 *(56.03%)*	589 *(100.00%)*	371 *(58.70%)*	632 *(100.00%)*
	Otherwise	1.534 *(47.67%)*	3,218 *(100.00%)*	2,445 *(51.84%)*	4,716 *(100.00%)*
Innovation- driven economies	High education	1,058 *(51.28%)*	2,063 *(100.00%)*	1,208 *(45.45%)*	2,658 *(100.00%)*
	Low education	852 *(47.07%)*	1,810 *(100.00%)*	806 *(39.03%)*	2,065 *(100.00%)*
	Has start-up skills	1,662 (*49.88%)*	3,332 *(100.00%)*	1,777 (*42.07%)*	4,224 *(100.00%)*
	Has no start-up skills	260 (48.06%)	541 *(100.00%)*	231 (39.55%)	548 *(100.00%)*
	Business ownership experience	116 *(50.00%)*	232 *(100.00%)*	201 *(48.55%)*	414 *(100.00%)*
	Otherwise	1,875 *(49.42%)*	3,794 *(100.00%)*	1,878 *(41.54%)*	4,521 *(100.00%)*

Source: APS Global Entrepreneurship Monitor 2001-2008 and 2009.

3.3.1 Descriptive analysis of the year 2008

This section describes the dependent-, independent- and control variables of the year 2008. The independent variables are measured in the first part and the control variables are measured in the last part. The relationship or cross tabulations of the control variables and independent variables with the dependent variable are shown in table 2.

3.3.1.1 Education

Table 2 shows the cross tabulations of all independent variables with product innovation. The numbers are shown for each development stage. Each development stage has different quantities of educated entrepreneurs who consider their product new to all or some customers. For the countries with factor-driven economies, 34.75% (i.e. 246 entrepreneurs) of the 708 high educated entrepreneurs consider their product new to some or all customers, while for countries with efficiency-driven economies 58.48 % (i.e. 779 entrepreneurs) of the 1,332 high educated entrepreneurs consider their product new to some or all customers. For the countries with innovation-driven economies 51.28% (i.e. 1.058 entrepreneurs) of the 2,063 high educated entrepreneurs consider their product new to some or all customers. The majority of the entrepreneurs in the innovation-driven economies are high educated compared to being low educated, while the majority of the entrepreneurs in the efficiency-driven and factor-driven economies are low educated compared to being high educated.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. The Chi-square test in this case determines whether education is dependent or independent from product innovation. The hypothesis for the test is as follow:

H_0: Education and Product innovation are independent.

H_a: Education and Product innovation are not independent

For the countries within the three development stages together, the Pearson Chi-square test shows that education and product innovation are not independent of each other on a significance level of 1% (X^2=94.2317, p=0.000). This means that education has a relationship with product innovation. Furthermore Cramer's V is used to show the strength of this relationship. Cramer's V indicates a strong association when having the value 1 and 0 for having no association. For the countries within the three development stages together,

Cramer's V shows that education and product innovation have a value of 0.0938. This means that the associations between the variables are very weak.

For the countries within each development stage separately, the results are not the same as previous. The Pearson Chi-square test for the countries with factor-driven economies show that education and product innovation are independent of each other on a significance level of 10% (X^2=0.0181 p=0.893). The Pearson Chi-square test for the countries with efficiency-driven economies show that education and product innovation are not independent of each other on a significance level of 1% (X^2=110.314 p=0.000). The Pearson Chi-square test for the countries with innovation- driven economies show that education and product innovation are not independent of each other on a significance level of 1% (X^2=6.845, p=0.009).

3.3.1.2 Start-up skills

In table 2 can be seen that each development stage has different quantities of entrepreneurs who have the knowledge, skills and experience required starting a new business and considering their product new to all or some customers compared to having no start-up skills. For the countries with factor-driven economies, 35.51% (i.e. 816 entrepreneurs) of the 2,298 entrepreneurs who have start-up skills consider their product new to some or all customers, while for the countries with efficiency-driven economies 49.09% (i.e. 1.568 entrepreneurs) of the 3,194 entrepreneurs who have start-up skills consider their product new to some or all customers. For the countries with innovation-driven economies 49.88% (i.e. 1,662 entrepreneurs) of the 3,332 entrepreneurs who have start-up skills consider their product new to some or all customers. The majority of the entrepreneurs in the countries with innovation-driven economies, efficiency-driven economies and innovation-driven economies have start-up skills compared to having no start-up skills.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. For the countries within the three development stages together, the Pearson Chi-square test shows that start-up skills and product innovation are not independent of each other on a significance level of 10% (X^2= 3.7698 p=0.052). This means that start-up skills have a relationship with product innovation. Furthermore Cramer's V is used to show the strength of this relationship. Cramer's V indicates measures between the 0 and 1. For all the countries, Cramer's V shows that start-up

skills and product innovation has a value of 0.018. This means that the association between the variables is very weak.

The results are not the same as previous when looking at the results of the countries with each specific development stage. The Pearson Chi-square test for the countries with factor-driven economies show that start-up skills and product innovation are independent of each other on a significance level of 10% (X^2= 2.404, p=0.121). The Pearson Chi-square test for the countries with efficiency- driven economies show that start-up skills and product innovation are independent of each other on a significance level of 10%
(X^2= 0.0604, p=0.806). The Pearson Chi-square test for the countries with innovation- driven economies show that start-up skills and product innovation are independent of each other on a significance level of 10% (X^2= 0.6173, p=0.432).

3.3.1.3 Previous business ownership experience

Table 2 shows that each development stage has different quantities of entrepreneurs with business ownership experience and considering their product new to all or some customers compared to having no business ownership experience. For the countries with factor-driven economies, 39.39% (i.e. 186 entrepreneurs) of the 466 entrepreneurs who have business ownership experience consider their product new to some or all customers, while for the countries with efficiency-driven economies 56.03% (i.e. 330 entrepreneurs) of the 589 entrepreneurs who have business ownership experience consider their product new to some or all customers. For the countries with innovation-driven economies 50.00% (i.e. 116 entrepreneurs) of the 232 entrepreneurs with business ownership experience consider their product new to some or all customers. The majority of the entrepreneurs in the innovation-driven economies, efficiency-driven economies and innovation-driven economies have no business ownership experience compared to having no business ownership experience.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. All the countries together, the Pearson Chi-square test shows that business ownership experience and product innovation are not independent of each other on a significance level of 10% (X^2= 11.1081 p=0.001). This means that business ownership experience have a relationship with product innovation. Furthermore Cramer's V is used to show the strength of this relationship. Cramer's V indicates measures between the 0 and 1. For all the countries together, Cramer's V shows that business

ownership experience and product innovation has a value of 0.031. This means that the associations between the variables are very weak.

For the countries with factor-driven, efficiency-driven and innovation-driven economies are the results not the same as all the countries together. The Pearson Chi-square test for the countries with factor-driven economies show that business ownership experience and product innovation are not independent of each other on a significance level of 1% (X^2=6.7840, p=0.009). The Pearson Chi-square test for the countries with efficiency- driven economies shows that business ownership experience and product innovation are not independent of each other on a significance level of 1% (X^2= 13.9171, p=0.000). The Pearson Chi-square test for the countries with innovation- driven economies show that business ownership experience and product innovation are independent of each other on a significance level of 10% (X^2= 0.0294, p= 0.864).

3.3.1.4 Control variables

Age

The control variable *age* is a continuous variable and measures the age of the entrepreneur in years. The entrepreneurs in this research are between the 18 and 64 years. There are some entrepreneurs above the 64 years and below 18 years. 0.24% of the individuals are under the age of 18 and 6.52% of the individuals are older than 64. The minimum age in the dataset is 9 and maximum age is 100. However, the majority of the working age lies between the age of 18 and 64. Table A1 shows that the age of the entrepreneurs who live in factor-driven economies is 38 years on average. The age of the entrepreneurs who live in the efficiency-driven economies is 41 years on average. The age of the entrepreneurs who live in the innovation-driven economies is 43 years on average.

Gender

The control variable *gender* is a binary variable with the value 1 or 0. If the variable is coded 1, the entrepreneur is male. If the variable is coded 0, the entrepreneur is female. From the full dataset of 134,990 observations, 119,640 individuals have filled in their gender for the research. 56,874 individuals are male and 62,766 are female.

Industry

This research makes use of different industries as a control variable. The industries that are investigated are industries with extractive firm, transforming firms, business services and consumer oriented firms. The variable *industry* is a binary variable with the value 1 or 0. The variable is coded 1 for transforming firms. The variable is coded 0 for extractive firms, business service firms and consumer orientated firms. In total, 1,161 of the 2,475 transforming firms consider their product to be new to all or some consumers compared to not being new to all or some consumers. 3,394 of the 7,285 extractive-, business service- and consumer oriented firms consider their product to be new to all or some consumers.

3.3.2 Descriptive analysis of the year 2009

This section describes the dependent-, independent- and control variables of the year 2009. The independent variables are measured in the first part and the control variables are measured in the last part. The relationship or cross tabulations of the control variables and independent variables with the dependent variable are shown in table 2.

3.3.2.1 Education

Table 2 shows the cross tabulations of all independent variables with product innovation. The numbers are shown for each development stage. Each development stage has different quantities of educated entrepreneurs who consider their product new to all or some customers. For the countries with factor-driven economies, 42.74% (i.e. 250 entrepreneurs) of the 585 high educated individuals consider their product new to some or all customers, while for the countries with efficiency-driven economies 57.93% (i.e. 920 entrepreneurs) of the 1,588 high educated individuals consider their product new to some or all customers. For the countries with innovation-driven economies 45.04% (i.e. 1,235 entrepreneurs) of the 2,742 high educated individuals consider their product new to some or all customers. The majority of the entrepreneurs in the innovation-driven economies are high educated compared to being low educated, while the majority of the entrepreneurs in the efficiency-driven and factor-driven economies are low educated compared to being high educated.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. The Chi-square test in this case determines

whether education is dependent or independent from product innovation. The hypothesis for the test is as follow:

H_0: Education and Product innovation are independent.

H_a: Education and Product innovation are not independent

For all the countries together, the Pearson Chi-square test shows that education and product innovation are not independent of each other on a significance level of 1% (X^2=23.099, p=0.000). This means that education has a relationship with product innovation. Furthermore Cramer's V is used to show the strength of this relationship. Cramer's V indicates a strong association when having the value 1 and 0 for having no association. For all the countries together, Cramer's V shows that education and product innovation have a value of 0.0435. This means that the associations between the variables are very weak.

When looking at the results for the countries with the same development stages are the results not the same as previous. The Pearson Chi-square test for the countries with factor-driven economies show that education and product innovation are independent of each other on a significance level of 10% (X^2= 2.455, p= 0.117). The Pearson Chi-square test for the countries with efficiency- driven economies show that education and product innovation are not independent of each other on a significance level of 1% (X^2= 16.095, p=0.000). The Pearson Chi-square test for the countries with innovation- driven economies show that education and product innovation are not independent of each other on a significance level of 1% (X^2= 19.561, p=0.000).

3.3.2.2 Start-up skills

In table 2 can be seen that each development stage has different quantities of individuals who have the knowledge, skills and experience required starting a new business and considering their product new to all or some customers compared to having no start-up skills. For the countries with factor-driven economies, 34.70% (i.e. 972 entrepreneurs) of the 2,801 entrepreneurs who have start-up skills consider their product new to some or all customers, while for the countries with efficiency-driven economies 54.76% (i.e. 2,284 entrepreneurs) of the 4,171 entrepreneurs who have start-up skills consider their product new to some or all customers. For the countries with innovation-driven economies 42.07% (i.e. 1,777 entrepreneurs) of the 4,224 entrepreneurs who have start-up skills consider their product new to some or all customers. The majority of the entrepreneurs in the innovation-driven

economies, efficiency-driven economies and innovation-driven economies have start-up skills compared to having no start-up skills.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. For all the countries together, the Pearson Chi-square test shows that start-up skills and product innovation are independent of each other on a significance level of 10% (X^2=0,001 p=0.982). This means that start-up skills have no relationship with product innovation.

When looking at the results for the countries with the same development stages are the results not the same as previous. The Pearson Chi-square test for the countries with factor-driven economies show that start-up skills and product innovation are not independent of each other on a significance level of 1% (X^2=18.889, p=0.00). The Pearson Chi-square test for the countries with efficiency- driven economies show that start-up skills and product innovation are not independent of each other on a significance level of 1%
(X^2=9.679, p=0.002). The Pearson Chi-square test for the countries with innovation- driven economies show that start-up skills and product innovation are independent of each other on a significance level of 10% (X^2=1.334, p=0.248).

3.3.2.3 Previous business ownership experience

In table 2 can be seen that each development stage has different quantities of individuals who have business ownership experience and considering their product new to all or some customers compared to having no business ownership experience. For the countries with factor-driven economies, 26.98% (i.e. 136 entrepreneurs) of the 504 entrepreneurs who have business ownership experience consider their product new to some or all customers, while for the countries with efficiency-driven economies 58.70% (i.e. 371 entrepreneurs) of the 632 entrepreneurs who have business ownership experience consider their product new to some or all customers. For the countries with innovation-driven economies 48.55% (i.e. 201 entrepreneurs) of the 414 entrepreneurs who have business ownership experience consider their product new to some or all customers. The majority of the entrepreneurs in the innovation-driven economies, efficiency-driven economies and innovation-driven economies have no business ownership experience compared to having no business ownership experience.

The Pearson Chi-square test of independence is also used to see if there is a significant association between the variables that are tested. For all the countries together, the Pearson Chi-square test shows that business ownership experience and product innovation are independent of each other on a significance level of 10% (X^2=0,924 p=0.336). This means that business ownership experience has no relationship with product innovation.

When looking at the results for the countries with the same development stages are the results not the same as previous. The Pearson Chi-square test for the countries with factor-driven economies show that business ownership experience and product innovation are not independent of each other on a significance level of 1% (X^2=21.212, p=0.00). The Pearson Chi-square test for the countries with efficiency- driven economies show that business ownership experience and product innovation are not independent of each other on a significance level of 1% (X^2=10.514, p=0.001). The Pearson Chi-square test for the countries with innovation- driven economies show that business ownership experience and product innovation are not independent of each other on a significance level of 1% (X^2=7.647, p=0.006).

3.3.2.4 Control variables

Age

Table A1 shows that the age of the entrepreneurs who live in the factor-driven economies is 35 years on average. The age of the entrepreneurs who live in the efficiency-driven economies is 40 years on average. The age of the entrepreneurs who live in the innovation-driven economies is 46 years on average.

Gender

The control variable *gender* is a binary variable with the value 1 or 0. If the variable is coded 1, the entrepreneur is male. If the variable is coded 0, the entrepreneur is female. From the full dataset of 181,067 observations, 179873 individuals have filled in their gender for the research. 85,249 individuals are male and 94,624 are female.

Industry

In total, 1,173 of the 2,579 transforming firms consider their product to be new to all or some consumers. 4,407 of the 9,701 extractive-, business service- and consumer oriented firms consider their product to be new to all or some consumers.

3.4 Methodology

This section discusses the methodology that is used to test if the human capital indicators influence entrepreneurial product innovation within countries in different development stages. The section that discusses the methodology and models that are used in this research are divided into sub-sections. The subsection discusses the models that are used for each hypothesis.

3.4.1 Methods

This research analyzes the APS GEM data for two years. All the models that are used in this research include country dummies. Hypotheses 1, 2 and 3 are answered by dividing the countries in development stages. The countries with factor- driven economies, efficiency-driven economies and innovation-driven economies are different for the years 2008 and 2009 and can be seen in table 1. Hypotheses 4 is answered by testing hypotheses 1, 2 and 3 for the years 2008and 2009.

Based on the reference of Schumpeter (1934) to the entrepreneur as an innovator, this study makes use of entrepreneurial product innovation as the dependent variable for the years 2008 and 2009. The relationship of human capital with entrepreneurial product innovation is tested in this research by the logit model. The results of the logit models show only the significance and sign of the variables. In order to calculate the magnitude of the variables, the marginal effects are also calculated for the same models as the logit models.

Both years will be tested by the logit model to see if there is a difference in the relationship of human capital with entrepreneurial product innovation. The first step of the research is the descriptive analysis. The descriptive analysis is discussed and tested in chapter 3.3. For the analyses, the crosstabs of the variables are performed and the Pearson's chi² test is performed to see if the variable entrepreneurial product innovation is dependent or independent with the human capital variables and the control variables. The second step for the analyses is the correlation performance of the variables that are used in this research. Table A2-A4 in the appendix shows the correlation matrix of the previous variables within each development stage for the year 2008. Table A5-A7 in the appendix shows the correlation matrix of the previous variables within each development stage for the year 2009. Table A8 in the appendix shows the correlation matrix of the dependent variable, human capital variables and control variables, when using all the country dummies for the year 2008. The same holds for table A9

in the appendix, which holds for the year 2009. The next step in the analyses is the logit performance, which will be further explained below. In order to see how the independent variables influence the dependent variables by using advanced empirical analysis, the logit model and the marginal effects are used.

Robustness check

Each logit model is checked for robustness by adding control variables to each model. The control variables that are used in this research are age, gender and transforming industry. If these variables contribute in a positive way to the logit models, the control variables are added to the logit models. The robustness of each logit model is tested with the Wald test on a 10% significance level. The Wald test in this research measures if parameters Age=0, Gender=0 and Industry=0. If the variables are equal to zero on a significance level of 10%, the variables are used in the logit models. Including the variables in the logit models creates a better fit of the logit models.

Logit model

Based on the previous data, the logit regression is suitable to use in a model with binary dependent variables, where the dependent variable takes the value 1 or 0. The logit model will show the best relationship between the variables. As the observations of the samples are large, the logit model is therefore also a good model for this research. The basic logit model for multiple explanatory variables is formulated as follow:

Equation 1: Source: Lecture slides QMA, Teresa Bago dÚva (2012)

$$\Pr(y=1|x) = F(\beta 0 + \beta 1\chi 1 + \beta 2\chi 2 + \ldots \beta k\chi k) = \Lambda(F(\beta 0 + \beta 1\chi 1 + \beta 2\chi 2 + \ldots \beta k\chi k)$$

$$= \frac{\exp\ (\beta 0 + \beta 1\chi 1 + \beta 2\chi 2 + \ldots \beta k\,\chi k)}{1 + \exp\ (\beta 0 + \beta 1\chi 1 + \beta 2\chi 2 + \ldots \beta k\,\chi k)}$$

Equation 1 tests the probability if the dependent y variable is 1, while using the independent variables x1, x2, xk. β0 indicates the constant term of the model.

3.4.1.1 Hypothesis 1, 2, and 3 for the year 2008

For a good comparison between the years 2008 and 2009 it is necessary to do identical tests between the years. The control variables are added to see if the relation of the human capital variables with entrepreneurial product innovation changes and to see if the model is a better fit. If the model is a better fit without the control variables, they will be left out of the model.

Equation 2 is used to test the dependent variable product innovation for countries with factor-driven economies. Equation 3 is used to test the dependent variable product innovation for countries with efficiency-driven economies. Equation 4 is used to test the dependent variable product innovation for countries with innovation-driven economies. Equation 2, 3 and 4 below are also used to test the logit models and to calculate the marginal effects of the variables.

The dependent variable is entrepreneurial product innovation. Educhigh stands in every equation for the binary variable high education. Suskill stands for the variable start-up skills and discent stands for the variable previous business ownership experience. Age, gender and the transforming industry are the added control variables. Each country is situated in one of the three development stages. β0 stands for the constant in the logit model.

Equation 2:

Pr (Product innovation = 1 |educhigh, suskill, discent, Angola, Bolivia, Bosnia and Herz., Colombia, Ecuador, Egypt, India, Iran, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Angola + β5 x Bolivia + β6 x Bosnia and Herz. + β7 x Colombia + β8 x Ecuador + β9 x Egypt + β10 x India + β11 x Iran + β12 x age + β13 x gender + β14 x industry)

Equation 3:

Pr (Product innovation = 1 |educhigh, suskill, discent, Argentina, Brazil, Chile, Croatia, Dominican Rep., Hungary*, Jamaica, Latvia, Macedonia, Mexico, Peru, Romania, Russia, Serbia, South Africa, Turkey, Uruguay, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Argentina + β5 x Brazil + β6 x Chile + β7 x Croatia + β8 x Dominican Rep + β9 x Hungary + β10 x Jamaica + β11 x Latvia + β12 x Macedonia + β13 x Mexico + β14 x dcountry17 + β15 x dcountry12 + β16 x dcountry2 + β17 x dcountry33 + β18 x dcountry4 + β19 x Peru + β20 x Romania + β21 x Russia + β22 x Serbia + β23 x South Africa + β24 x Turkey + β25 x Uruguay + β26 x age + β27 x gender + β28 x industry)*

Equation 4:

Pr (Product innovation = 1 |educhigh, suskill, discent, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Netherlands , Norway, Slovenia, Spain, UK, US, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Belgium + β5 x Denmark + β6 x Finland + β7 x France + β8 x Germany + β9 x Greece + β10 x Iceland + β11 x Ireland + β12 x Israel + β13 x Italy + β14 x Japan + β15 x Korea + β16 x Netherlands + β17 x Norway + β18 x Slovenia + β19 x Spain + β20 x UK + β21 x US + β22 x age + β23 x gender + β24 x industry)

3.4.1.2 Hypothesis 1, 2, and 3 for the year 2009

The control variables are added to see if the relation of the human capital variables with entrepreneurial product innovation changes and to see if the model is a better fit. If the model is a better fit without the control variables, they will be left out of the model.

Equation 5 is used to test the dependent variable product innovation for countries with factor-driven economies. Equation 6 is used to test the dependent variable product innovation for countries with efficiency-driven economies. Equation 7 is used to test the dependent variable product innovation for countries with innovation-driven economies. Equation 5, 6 and 7 below are also used to test the logit models and to calculate the marginal effects of the variables.

The dependent variable is entrepreneurial product innovation. Educhigh stands in every equation for the binary variable high education. Suskill stands for the variable start-up skills and discent stands for the variable previous business ownership experience. Age, gender and the transforming industry are the added control variables. Each country is situated in one of the three development stages. β0 stands for the constant in the logit model.

Equation 5:

Pr (Product innovation = 1 |educhigh, suskill, discent, Algeria, Guatemala, Jamaica, Lebanon, Morocco, Saudi Arabia, Syria, Tonga, Uganda, Venezuela, Gaza strip, Yemen, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Algeria + β5 x Guatemala + β6 x Jamaica + β7 x Lebanon + β8 x Morocco + β9 x Saudi Arabia + β10 x Syria + β11 x Tonga + β12 x Uganda + β13 x Venezuela + β14 x Gaza strip + β15 x Yemen + β16 x age + β17 x gender + β3 x industry)

Equation 6:

Pr (Product innovation = 1 |educhigh, suskill, discent, Argentina, Bosnia, Brazil, Chile, China, Shenzhen, Colombia, Croatia, Ecuador, Hungary, Iran, Jordan , Latvia, Malaysia, Panama, Peru, Romania, Russia, Serbia, South Africa, Tunisia, Uruguay, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Argentina + β5 x Bosnia + β6 x Brazil + β7 x Chile + β8 x China + β9 x Shenzhen + β10 x Colombia + β11 x Croatia + β12 x Ecuador + β13 x Hungary + β14 x Iran + β15 x Jordan + β16 x Latvia + β17 x Malaysia + β18 x Panama + β19 x Peru + β20 x Romania + β21 x Russia + β22 x Serbia + β23 x South Africa + β24 x Tunisia + β25 x Uruguay + β26 x age + β27 x gender + β27 x industry)

Equation 7:

Pr (Product innovation = 1 |educhigh, suskill, discent, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Netherlands, Norway, Slovenia, Spain, UK, US, Hong Kong, Switzerland, UAE, age, gender, industry) = F (β0 + β1 x educhigh + β2 x suskill + β3 x discent + β4 x Belgium + β5 x Denmark + β6 x Finland + β7 x France + β8 x Germany + β9 x Greece + β10 x Iceland + β11 x Ireland + β12 x Israel + β13 x Italy + β14 x Japan + β15 x Korea + β16 x Netherlands + β17 x Norway + β18 x Slovenia + β19 x Spain + β20 x UK + β21 x US + β22 x Switzerland + β23 x Hong Kong + β24 x UAE + β25 x age + β26 x gender + β27 x industry)

4. Results

The results of the models that are tested in chapter 3 are described in this chapter. The results in this chapter are divided into sections. The first section describes the results which include the equations for answering hypothesis 1, 2, 3 and 4 for the countries with factor-driven economies. The second section describes the results describes the results which include the equations for answering hypothesis 1, 2, 3 and 4 for the countries with efficiency-driven economies. The third section describes the results which include the equations for answering hypothesis 1, 2, 3 and 4 for the countries with innovation-driven economies. Each section shows the results for the years 2008 and 2009. The last part is ended with a summery, which contains the answers of the hypotheses.

The dependent variable of the logit model and the marginal effects is entrepreneurial product innovation. Some countries are dropped out of the models as it causes multicollinearity.

Factor-driven economies

Table 3 shows the relationship of human capital with entrepreneurial product innovation for countries with factor-driven economies. The coefficients in the tables below show only the signs of the values for the logit models, while the average marginal effects show the magnitude of the variables. Table 3 for the year 2008 shows the results for equation 2 and for the year 2009 the results of equation 5.

The Wald tests for the factor-driven economies have a probability of 0.0821 in the year 2008 and a probability of 0.0000 for the year 2009. On a significance level of 10%, adding the control variables makes both models a better fit.

Table 3: Human capital effects on entrepreneurial product innovation with country dummies included for factor-driven economies for the years 2008 and 2009

2008 (n=8889)				2009 (n=9817)			
Variables	**Coef.**	**P-value**	**Average marginal effects**	**Variables**	**Coef.**	**P-value**	**Average marginal effects**
High education	0.3548	0.0000	0.0880	**High education**	0.1617	0.0000	0.0403
Start-up skills	0.0495	0.4380	0.0123	**Start-up skills**	0.0377	0.5330	0.0094
Business ownership experience	0.2442	0.0010	0.0609	**Business ownership experience**	0.2297	0.0010	0.0574
Angola	-0.5009	0.0000	-0.1202	**Algeria**	0.0271	0.8310	0.0068
Bosnia	-1.4792	0.0000	-0.2998	**Guatemala**	0.0796	0.6380	0.0199
Colombia	0.2198	0.0260	0.0548	**Jamaica**	-1.3170	0.0000	-0.2832
Ecuador	-0.0134	0.9110	-0.0033	**Lebanon**	-0.5093	0.0000	-0.1229
Egypt	-1.0091	0.0000	-0.2254	**Morocco**	-1.5020	0.0000	-0.3090
India	-1.1509	0.0000	-0.2496	**Saudi Arabia**	0.8507	0.0000	0.2048
Age	-0.0047	0.0110	-0.0012	**Syria**	-0.1636	0.3530	-0.0405
Gender	-0.0130	0.7700	-0.0032	**Tonga**	0.2678	0.1050	0.0668
Industry	0.0210	0.6740	0.0052	**Uganda**	-1.1772	0.0000	-0.2585
_cons	-0.0899	0.4370	0.0000	**Venezuela**	-0.8543	0.0000	-0.1972
				Gaza Strip	-1.1939	0.0000	-0.2608
				Yemen	0.6367	0.0000	0.1566
				Age	-0.0090	0.0000	-0.0022
				Gender	0.1420	0.0010	0.0354
				Industry	-0.0317	0.5300	-0.0079
				_cons	0.0179	0.8710	0.0000

Iran and Bolivia are dropped out of the model for 2008, as these countries cause multicollinearity. The table for the year 2008 shows that high education, previous business ownership experience and age have a significant relation with product innovation. Five of the six country dummies have a significant relation with product innovation. Ecuador is not significant on a 10% significance level. Working/living in Bolivia, Bosnia, Egypt and India has a significant negative relation with product innovation compared to working/living in the other countries, while working/living in Columbia has a positive significant relation with product innovation compared to the other countries in the model. The marginal effect shows that on average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 8.80 percentage points compared to being

low educated, ceteris paribus. Previous business ownership experience has a positive sign and is significant, as the p value is smaller than 0.01. The probability of having closed down a business in the past twelve months increases the probability with 6.09 percentage points on average to being an entrepreneurial product innovator compared to having not closed down a business in the last year, ceteris paribus.

For the year 2009 it is found that education and previous business ownership experience have a significant positive relation with product innovation. In specific, on average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 4.03 percentage points compared to being low educated, ceteris paribus. On average, on a significance level of 1%, having closed down a business in the past year increases the probability of being an entrepreneurial product innovator with 5.75 percentage points compared to having not closed down a business in the past year, ceteris paribus.

Efficiency-driven economies

Table 4 shows the relationship of human capital with entrepreneurial product innovation for countries with efficiency-driven economies. The coefficients in the tables below show only the signs of the values for the logit models, while the average marginal effects show the magnitude of the variables. Table 4 for the year 2008 shows the results for equation 3 and for the year 2009 the results of equation 6.

The Wald tests for the efficiency-driven economies have a probability of 0.6295 in the year 2008 and a probability of 0.0002 for the year 2009. On a significance level of 10%, adding the control variables makes the models a better fit for the year 2009. The control variables are also added to the model of 2008, as the significance of the human capital variables do not change.

Table 4: Human capital effects on entrepreneurial product innovation with country dummies included for efficiency-driven economies for the years 2008 and 2009.

2008 (n=8889)				2009 (n=9817)			
Variables	**Coef.**	**P-value**	**Average marginal effects**	**Variables**	**Coef.**	**P-value**	**Average marginal effects**
High education	0.2255	0.0000	0.0560	**High education**	0.2368	0.0000	0.0591
Start-up skills	0.0504	0.4480	0.0125	**Start-up skills**	-0.1373	0.0260	-0.0343
Business ownership experience	0.0514	0.4810	0.0128	**Business ownership experience**	0.0635	0.3620	0.0159
Brazil	-1.4200	0.0000	-0.2933	**Argentina**	1.5821	0.0000	0.3394
Chile	1.4080	0.0000	0.3193	**Bosnia**	-0.7705	0.0050	-0.1816
Croatia	-1.1726	0.0000	-0.2527	**Brazil**	-1.1882	0.0000	-0.2637
Hungary	-1.5851	0.0000	-0.3145	**Chile**	2.6476	0.0000	0.4744
Jamaica	-1.0570	0.0000	-0.2347	**China**	0.8655	0.0000	0.2078
Latvia	0.5551	0.0050	0.1375	**Shenzhen**	1.3007	0.0000	0.2915
Macedonia	-0.7402	0.0000	-0.1720	**Colombia**	0.5896	0.0000	0.1448
Mexico	0.4093	0.0010	0.1020	**Croatia**	-0.7698	0.0010	-0.1815
Peru	1.4690	0.0000	0.3336	**Ecuador**	-1.0896	0.0000	-0.2462
Romania	-0.4786	0.0990	-0.1146	**Hungary**	-0.4872	0.0050	-0.1186
Russia	-0.4927	0.1400	-0.1178	**Jordan**	0.1373	0.3750	0.0343
Serbia	-0.8628	0.0000	-0.1963	**Latvia**	-0.1963	0.1940	-0.0487
South Africa	0.6359	0.0000	0.1569	**Malaysia**	-0.4820	0.1000	-0.1173
Turkey	2.0687	0.0000	0.4146	**Peru**	1.4564	0.0000	0.3204
Uruguay	0.8780	0.0000	0.2125	**Romania**	0.2409	0.3720	0.0601
Age	-0.0020	0.2970	-0.0005	**Russia**	-0.0251	0.9290	-0.0063
Gender	0.0195	0.6700	0.0048	**Serbia**	0.0977	0.6750	0.0244
Industry	-0.0326	0.5310	-0.0081	**South Africa**	0.5772	0.0010	0.1417
_cons	-0.2982	0.0130	0.0000	**Uruguay**	0.9564	0.0000	0.2260
				Age	-0.0070	0.0000	-0.0017
				Gender	0.0770	0.0840	0.0192
				Industry	-0.0588	0.2650	-0.0147
				_cons	-0.1440	0.1950	0.0000

The significance of the human capital variables are the main important variables in this model. The model with the year 2008 shows that only the human capital variable education is significant on a 1% significance level and has a positive relation with product innovation. Only one of the fifteen countries is insignificant. On average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 5.60 percentage points compared to being low educated, ceteris paribus.

The model with the year 2009 shows that only the human capital variable education and start-up skills are significant on a 5% significance level. Five of the nineteen countries are insignificant. On average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 5.91 percentage points compared to being low educated, ceteris paribus. On average, on a significance level of 5%, having start-up skills decreases the probability of being an entrepreneurial product innovator with 3.43 percentage points compared to having no start-up skills, ceteris paribus.

Innovation-driven economies

Table 5 shows the relationship of human capital with entrepreneurial product innovation for countries with innovation-driven economies. Table 3 for the year 2008 shows the results for equation 4 and for the year 2009 the results of equation 7.

The Wald tests for the efficiency-driven economies have a probability of 0.3834 in the year 2008 and a probability of 0.0032 for the year 2009. On a significance level of 10%, adding the control variables makes the models a better fit for the year 2009. The control variables are also added to the model of 2008, as the significance of the human capital variables do not change.

Table 5: Human capital effects on entrepreneurial product innovation with country dummies included for innovation-driven economies for the years 2008 and 2009.

2008 (n=8889)				2009 (n=9817)			
Variables	**Coef.**	**P-value**	**Average marginal effects**	**Variables**	**Coef.**	**P-value**	**Average marginal effects**
High education	0.3272	0.0000	0.0813	**High education**	0.3062	0.0000	0.0763
Start-up skills	0.0168	0.7920	0.0042	**Start-up skills**	-0.0329	0.5800	-0.0082
Business ownership experience	0.2298	0.0010	0.0573	**Business ownership experience**	0.1248	0.0610	0.0312
Belgium	-0.1626	0.5590	-0.0401	**Denmark**	0.1625	0.5070	0.0406
Denmark	-0.1073	0.6410	-0.0265	**Finland**	0.0952	0.5550	0.0238
Finland	0.0125	0.9420	0.0031	**France**	-0.7429	0.0000	-0.1770
Germany	-0.3409	0.0530	-0.0829	**Germany**	-0.5231	0.0000	-0.1263
Greece	0.3544	0.0210	0.0884	**Greece**	-1.5780	0.1500	-0.3176
Iceland	0.2859	0.0720	0.0713	**Iceland**	-1.1655	0.0000	-0.2570
Ireland	0.0293	0.8770	0.0073	**Israel**	0.1994	0.2260	0.0498
Israel	-0.2608	0.2140	-0.0639	**Italy**	-0.1642	0.5430	-0.0407
Italy	-0.0867	0.6620	-0.0215	**Japan**	-0.0417	0.8880	-0.0104
Japan	0.7168	0.2550	0.1755	**Korea**	-0.0036	0.9850	-0.0009
Korea	0.3863	0.0130	0.0963	**Netherlands**	-0.3358	0.0690	-0.0823
Netherlands	-0.0410	0.8080	-0.0102	**Norway**	-0.1714	0.3510	-0.0424
Norway	-0.0733	0.7240	-0.0182	**Slovenia**	-1.1982	0.0000	-0.2613
Slovenia	0.1529	0.3490	0.0382	**Spain**	-0.8906	0.0000	-0.2049
Spain	0.2845	0.0000	0.0709	**U.K.**	-0.6273	0.0000	-0.1498
U.S.	-0.1623	0.1610	-0.0400	**U.S.**	-0.7194	0.0000	-0.1697
Age	-0.0030	0.1080	-0.0007	**Hong Kong**	1.2058	0.0340	0.2766
Gender	0.0270	0.5390	0.0067	**Switzerland**	-0.3412	0.0720	-0.0836
Industry	0.0237	0.6310	0.0059	**UAE**	0.3846	0.0080	0.0957
_cons	-.3.2074	0.0004		**Age**	-0.0035	0.0560	-0.0009
				Gender	0.1338	0.0020	0.0334
				Industry	-0.0131	0.7960	0.0000
				_cons	-0.0761	0.4710	0.0000

The significance of the human capital variables are the main important variables in this model. The model with the year 2008 shows that only the human capital variables education and discent are significant on a 1% significance level. Only seven of the sixteen countries are significant. On average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 8.13 percentage points compared to being low educated, ceteris paribus. Having closed down a business in the past twelve months has a positive and significant relation with being an entrepreneurial product innovator. The probability of having closed down a business in the past year increases the

probability with 0.42 percentage points on average of being an entrepreneurial product innovator compared to having not closed down a business in the past year, ceteris paribus.

The model with the year 2009 shows that only the human capital variables education and previous business ownership experience are significant on a 10% significance level. The significance of the human capital variables are the main important variables in this model. Eleven of the nineteen countries are significant. On average, on a significance level of 1%, being high educated increases the probability of being an entrepreneurial product innovator with 7.63 percentage points compared to being low educated, ceteris paribus. Having closed down a business in the past twelve months has a positive and significant relation with being an entrepreneurial product innovator. On a significance level of 10%, the probability of having closed down a business in the past year increases the probability with 3.12 percentage points on average of being an entrepreneurial product innovator compared to having not closed down a business in the past year, ceteris paribus.

In sum, the results above are different for answering the hypotheses that are described in chapter 2.4. Hypothesis 1 is accepted for the years 2008 and 2009. The variable high education has a positive significant relation with being an entrepreneurial product innovator. Highly educated entrepreneurs as compared to low educated entrepreneurs are more likely to conduct product innovation. This holds for entrepreneurs who live in factor-driven economies, efficiency-driven economies and innovation-driven economies. Hypothesis 2 is rejected for both years. There cannot be made a conclusion for the variable start-up skills, as the variable is insignificant for five of the six models. Only one model for countries with efficiency-driven economies for the year 2009 show that start-up skills is negative significant. Hypothesis 3 is partly accepted for the years 2008 and 2009. Entrepreneurs who live/work in factor-driven economies and innovation-driven economies with prior business experience as compared to entrepreneurs without prior business experience are more likely to conduct product innovation. There cannot be made a conclusion for the variable prior business experience for the countries with efficiency-driven economies, as the variable is insignificant for both years. Hypothesis 4 is partly accepted. Countries with factor-driven economies and innovation-driven economies show no difference in the results between the years 2008 and 2009. Countries with efficiency-driven economies have different results between the years 2008 and 2009.

5. Discussion

This section discusses and analyses the results from chapter four. The results are discussed with the comparison of previous literature studies and with new insights.

The previous results show that there is a positive relationship of high education with being an entrepreneurial product innovator for countries of all three development stages. The results show similarities with previous studies. Entrepreneurs with post-secondary degrees/ graduate experience are more likely to conduct product innovation in their company compared to entrepreneurs who have only some secondary experience/ a secondary degree. The results hold for the efficiency-driven, factor-driven and innovation-driven economies. The positive relation of having high education and being an entrepreneurial product innovator can also be seen in previous literature studies. Parker (2009) states that education symbolizes more than only the sum of years education. Formal education is also connected with sense, common search skills, imagination, skills for specific industries and skills and knowledge to run the business (Parker, 2009). Education makes individuals smarter and makes it more easier for them to interpret, to understand, to apply new information and make conclusions or predictions outside the range of observation (Roberts, 1991).When dividing innovation into higher levels and lower levels of innovation, Bates (1990) even states that education is a pre-condition for the performance of highly innovative firms. It is therefore expected that individuals with higher education should have higher/more skills and knowledge to run the business.

Interesting are the differences in the average marginal effects of education between the different development stages. Van Stel, Carree & Thurik (2005) acknowledge the difference in innovation between the different development stages that the countries go through. Bates (1990) states that the quantity and quality of the educational systems is linked to the wealth of a country. Countries with innovation-driven economies are therefore expected to have higher levels of education compared to countries with efficiency-driven and factor-driven economies. Individuals with higher education are more likely to contribute to the economic wealth of a country. This is also in line with the results of the current research. The magnitude of the relationship of education with product innovation is one of the highest in countries with innovation-driven economies. This does not hold for countries with factor-driven economies for the year 2008, which shows an unusual high average marginal effect. This unusual effect can be caused by the limited country observations of factor-driven economies. There are

observations of only six countries with factor-driven economies. Table A1 in the appendix shows that there are 4,001 observations of entrepreneurs who are high educated compared to being low educated and there are only 246 observations of highly educated entrepreneurs who conduct product innovation for factor-driven economies, compared to the 779 observations for countries with efficiency-driven economies and 1,058 observations for innovation-driven economies. There may be also another explanation for this unusual effect. Factor-driven economies have usually high agriculture sectors. As these sectors develop and the quality and quantity of formal education rises, it is expected that the agriculture sectors will improve the economic wealth of the country. The GEM executive report 2008 shows that the quality and quantity of training is linked with higher levels of entrepreneurial activity for countries with factor-driven economies. For example, a product innovation that comes from one entrepreneur or farmer who had high education may also make other famers innovate as the other farmers want to keep ahead in competition. The high magnitude of the relationship of education with product innovation is low for the year 2009 compared to the year 2008 and other development stages. This can be caused by the recession. During the recession, entrepreneurs are less willing to invest in innovations and therefore less willing to invest in education (Archibugi & Filippetti, 2011).

The results of the current study show that the relationship of the human capital variables start-up skills and previous business ownership experience in relation to entrepreneurial product innovation is not in line with most previous studies. Marvel & Lumpkin (2007) investigates the relation of general human capital with innovation. Prior knowledge, education and (work) experience of entrepreneurs are used as human capital factors. Individuals with work experience are more likely to discover opportunities and are more likely to conduct product innovation. The human capital theory of Becker (1964) and the study of Davidsson & Honig (2003) are more in line with this research. Becker (1964) uses education and experience as the two main characters of human capital theory. Davidsson & Honig (2003) use the same human capital indicators and find a positive effect with innovation. Start-up skills are in almost every model insignificant. The explanations of the relationship of previous business ownership experience with entrepreneurial product innovation are explained below.

The model of the year 2009 for the efficiency-driven economies shows a significant negative relationship of start-up skills with product innovation, while the other models show no significant effect. Models used by Grant (1996), Marvel & Lumpkin (2007), Davidsson &

Honig (2003) and Hinz & Jungbauer-Gans (1999) use skills as an indicator for human capital to test the relationship with innovation. The current research makes also use of education, business experience and start-up skills as the main indicators for human capital. However the variable start-up skills measures if the individual has the knowledge, skills and experience required to start a new business. Entrepreneurs with prior start-up skills, managerial experience and job experience in specific branches gain extra human capital which can be used in their future or current firm. For the current study, start-up skills can be insignificant in the overall models, as it may refer to the skills that may be useful when starting a firm. These skills can be seen as a barrier of starting a firm, while it does not have to mean that this individual is innovative.

This research can only make a conclusion for prior business ownership experience for countries with factor-driven economies and innovation-driven economies, as the variable is insignificant for countries with efficiency-driven economies. Prior business ownership experience has a significant positive effect for both years for the countries with factor-driven- and innovation-driven economies. Countries with efficiency-driven economies usually develop their wealth by firms who go after higher productivity by using economic of scale. This sector also supports industrialization. Countries with efficiency-driven economies have more product innovation in the industry sector. The insignificant relationship of prior business experience with product innovation can occur, because having specific prior business experience can be more relevant than general prior business ownership experience for countries with efficiency-driven economies. Industry-specific or firm specific human capital, or in this case business experience, may have a significant relationship with product innovation instead of general prior business ownership experience. There is also limited communication between firms with firm specific human capital (Grant, 1996). Product innovations are therefore expected to usually stay within the firm.

The average marginal effects show that the magnitude of the previous effects is higher for the year 2008 compared to the year 2009. These results are also in line with previous studies. Marvel & Lumpkin (2007) state that experience and education are important human capital factors for entrepreneurs to be innovative. The difference in the magnitude between the two years can also be explained by previous studies. The majority of the entrepreneurs decrease their investments in product innovation (Archibugi & Filippetti, 2011). This can also be the investments in human capital. If fewer entrepreneurs are more educated and have less skills

and experience during the crisis, the magnitude of the relationship of education, skills and prior business ownership experience may be lower in the year 2009 compared to the year 2008.

The difference for the human capital variables results of the average marginal effects between the different development stages can also be explained by necessity-based entrepreneurial activity. It is expected that entrepreneurs within factor-driven economies are more necessity driven, while entrepreneurs in the innovation-driven countries are more opportunity driven. Individuals in countries with necessity-based entrepreneurial activity start their businesses because they do not have other job options to earn enough to survive (Frese and De Kruif, 2000). Necessity entrepreneurship in a country increases with the quantity of poverty (Reynolds *et al*., 2001). The differences in human capital between the different development stages and countries could be explained by the studies of Dakhli & De Clerq (2004) and Maskell & Malmberg (1999). Dakhli & De Clerq (2004), who argue that within countries the level of education leads to different variations of innovation. Some regions are more economically successful than other regions because of the availability of skills and knowledge (Maskell & Malmberg, 1999). The difference in data between the years 2008 and 2009 is in line with the study of Malerba & Orsenigo (1999). The researchers have found that the innovative activities for entrepreneurs are highly turbulent over time. The small amount of firms who get through the entry barrier and keep on being innovative after their first patent do significant improvement in technology performance over the years. However, there is a large turbulent amount of firms that innovate occasional.

Limitations

This research has some limitations considering the way that the data is obtained, the variables that are measured and the data that is collected.

First of all, a limitation concerning the way that the data is obtained is the way of information that is collected by the individuals. This research makes use of cross-section data. Data is obtained at a single moment in time. The information in the dataset is obtained by telephone interviews and through door to door interviews. A limitation could be the observation bias, memory decay or rationalization after the fact, which increases the risk of gaining incorrect information (Davidsson & Honig, 2003).

Another limitation of the variables that are measured is the variable previous business ownership experience. Previous business experience holds only for individuals who have, in the past 12 months, sold, shut down, discontinued or quit a business owned and managed, any form of self-employment, or selling goods or services to anyone. The individuals who have closed down, sold, discontinued or quit a business longer than a year ago are not taken in account for in this research, while they could have a significant effect on being an entrepreneurial product innovator.

The second limitation of the variables that are measures is the subjectiveness of some results from the interviews. The entrepreneurs answer the interview from their point of view. The variable start-up skills and product innovation could be interpreted otherwise by consumers/employers. Entrepreneurs can lie and answer the questions in a better way than the reality. However, interviews that are answered by the consumers, if the product is new to them can also be interpreted subjective by them. The variable start-up skill is also a subjective variable. Entrepreneurs can think that they have a good knowledge of the business, while it is actually the opposite.

This research cannot make a conclusion for the relation of the variable start-up skilss, as a human capital variable, with product innovation. This limitation may be caused as the variable is subjective. Another reason can be that the question *do you have the knowledge, skills and experience required to start a new business* can be interpreted in different ways. The GEM executive report (2008) also acknowledge that business skills, like perceived skills and knowledge to start a business, are important skills for individuals who want to become entrepreneurs. Start-up skills can be a good measurement for individuals who want to become an entrepreneur. However, an individual with start-up skills does not have to be innovative.

A limitation of this research could be the lack of precision of registrations of new firms in some countries. For example, firms in the Netherlands have to register in the chamber of commerce, while firms in the UK do not have to register. Some businesses register their business for tax reasons while they do not have entrepreneurial activity, while some businesses in other countries do not register as they want to avoid tax costs. The rate of entrepreneurship may therefore be not accurate in some countries.

A possible limitation of this research could be the difference in data between countries. Van Stel, Carree & Thurik (2005) state that the role of entrepreneurship differs from one stage of economic development to another stage of economic development when countries go through different stages of economic development. Multiple countries with a specific development stage may also show differences in the level of innovation or education. However, the observations are large, which may fade this limitation

Catching up

This research makes use of a novel way of investigation. There are studies about the relationship of human capital with product innovation; however most of these studies focus on one or multiple country data. Most studies do not use multiple country data and divide the countries in development stages. Furthermore this research also looks at the effects of the financial crisis of 2008/2009. It is recommended for future studies to considerate using data for countries with different development stages. The current subject may be interesting for future studies, as globalization plays an important role for the competitiveness between countries. 'The process of globalization is characterized by a reduction in the barriers to the cross-border flow of factors, products, information, technology and values' (Kaplinsky, Morris & Readman, 2002, p1). As borders between countries are reduced while on the other hand countries do differ in their entrepreneurial activity, it is recommended to divide the countries in development stages.

6. Conclusion

Becker (1964) uses the theory of the previous founding fathers and extends this to the well known human capital theory. Becker (1964) finds that the productivity of the worker rises through training and education, this holds for formal as informal training and education. This research began with some expectation that were built on earlier literature studies. It is expected that there is a positive effect of human capital with entrepreneurial product innovation. The positive relationship is expected in the factor-driven economies, efficiency-driven economies and the innovation-driven economies. As many studies have their own human capital indicators, this research makes use of high education, start-up skills and previous business ownership experience as the main human capital variables. This study also expects that the effects are the same for the years 2008 and 2009.

The research question of this thesis is:
What is the relationship between education, business experience and entrepreneurial skills with product innovation for entrepreneurs within factor-driven, innovation-driven and efficiency-driven countries?

Higher levels of formal education have a positive effect for being an entrepreneurial product innovator for countries with factor-driven, innovation-driven and efficiency- driven economies. Education raises the productivity of the individual.

This study cannot make a conclusion about the relationship of the human capital variables start-up. Having start-up skills does not influence the entrepreneurs to innovate their products.

The relationship of previous business ownership experience with entrepreneurial product innovation is positive for countries with factor-driven economies and innovation-driven economies. The study cannot make a conclusion for this variable for countries with efficiency-driven economies, as the variable is insignificant.

Overall, this research shows that the human capital variables education and prior business ownership has a positive effect on product innovation for countries with factor- driven en innovation-driven economies. The human capital variable education has a positive effect on product innovation for countries with efficiency-driven economies.

References

Acs, Z. J., & Varga, A. (2005). Entrepreneurship, agglomeration and technological change. *Small Business Economics*, 24(3), 323–334.

Acs, Z. J., Arenius, P., Hay, M., & Minniti, M. (2005). *Global Entrepreneurship Monitor,* (2004 Executive Report). London: London Business School and Babson College. Retrieved from http://www.emekin.net/documentos/eu/GEM_2004_Exec_Report.pdf

Archibugi, D., Filippetti, A., (2011). *Innovation and Economic Crisis. Lessons and Prospects from the Economic Downturn*. London, England: Routledge.

Archibugi, D., Filippetti, A., & Frenz, M. (2013). Economic crisis and innovation: Is destruction prevailing over accumulation? *Research Policy, 42(2),* 303–314.

Audretsch, B. (1998). Agglomeration and the location of innovative activity. *Oxford Review of Economic Policy,* 14(2), 18–29.

Audretsch, D. B. & Thurik, A. R. (2001). What is New about the New Economy: Sources of Growth in the Managed and Entrepreneurial Economies. *Industrial and Corporate Change, 10,* 267–315. doi:10.1093/icc/10.1.267

Avermaete, T., Viane, J., Morgan, E.J., Pitts, E., Crawford, N. & Mahon, D. (2004). Determinants of product and process innovation in small food manufacturing firms. *Trends in Food Science & Technology*, 15, 474-483.

Bangma, K. L., & Peeters, H. H. M. (2003). *Kleinschalig ondernemen 2003: structuur en ontwikkeling van het Nederlandse MKB*. Zoetermeer, Netherlands: EIM, Onderzoek voor Bedrijf & Beleid.

Baron, R. A. (2006). Opportunity recognition as pattern recognition: How entrepreneurs "connect the dots" to identify new business opportunities. *The Academy of Management Perspectives Archive, 20*(1), 104-119.

Bates, T. (1990). Entrepreneur human capital inputs and small business longevity. *Review of Economics and Statistics*, *72*(4), 551.

Baumol, W. J. (2002). The free-market innovation machine. Princeton, NJ: Princeton University Press.

Becker, G. S. (1964). Human Capital. Chicago: *University of Chicago Press*.

Bhide, A. (2000). *The origin and evolution of new businesses*. New York: Oxford.

Bhola, R., Verheul, I., Thurik, A. R., & Grilo, I. (2006). *Explaining engagement levels of opportunity and necessity entrepreneurs*. Zoetermeer, Netherlands: EIM, Onderzoek voor Bedrijf & Beleid. Retrieved from http://hdl.handle.net/1765/9705

Bianchi, T. (2001). With and without co-operation: two alternative strategies in the food-processing industry in the Italian South. *Entrepreneurship & Regional Development 13*, 117-145.

Bodewes, W., & de Jong, J. P. J. (2003). Innovatie in het midden- en kleinbedrijf" (Innovation in small- and medium sized enterprises). In P. Risseeuw & R. Thurik. (Eds.), *Handboek ondernemers en adviseurs: management en economie van het midden- en kleinbedrijf* (pp. 323-338). Dordrecht, Netherlands: Kluwer Academic Publishers.

Borjas, G. J. (1986). The self-employment experience of immigrants. *The Journal of Human Resources, 21,* 485-506.

Borjas, G. J. & Bronars, S. G. (1989). Consumer discrimination and self-employment. *Journal of Political Economy, 97*, 581-605.

Bosma, N., Acs, J. Z., Autio, E., Coduras, A., & Levie, J. (2008). *Global entrepreneurship monitor*, (2008 Executive report). US*:* Babson College. Retrieved April 15, 2013 from http://www.gemconsortium.org/docs/264/gem-2008-global-report

Bosma, N., & Levie, J. (2009). *Global entrepreneurship monitor: 2009* (2009 Executive report). US*:* Babson College. Retrieved April 15, 2013 from http://www.gemconsortium.org/docs/search?doc_cat_id=1&sub_cat_id=5&team_id=0&q=

Burns, T. E., & Stalker, G. M. (1961). The *he Management of Innovation*. Tavistock, London:.

Carree, M. A. & Thurik, A. R. (1999). Industrial Structure and Economic Growth, In D. B. Audretsch & A. R. Thurik (eds.), *Innovation, Industry Evolution and Employment* (pp. 86–110).Cambridge, UK: Cambridge University Press.

Carree, M. A., & Thurik, A. R. (2003). The Impact of Entrepreneurship on Economic Growth'. In David B. Audretsch and Zoltan J. Acs (eds.), *Handbook of Entrepreneurship Research* (pp. 437–471). Boston/Dordrecht: Kluwer- Academic Publishers.

Cefis, E., & Orsenigo, L. (2001). The persistence of innovative activities: a cross-countries and cross- sectors comparative analysis. *Research Policy*, 30, 1139–1158.

Covin, J. O., & Miles, M. P. (1999). Corporate entrepreneurship and the pursuit of competitive advantage. *Entrepreneurship Theory and Practice*, *23*(3), 47–63.

Dakhli, M., & De Clercq, D. (2004). Human capital, social capital, and innovation: a multicountry study. *Entrepreneurship & Regional Development*, 16, 107-128

Danneels, E., & Kleinschmidt, E. J. (2001). Product innovativeness from the firm's perspective: its dimension and their relation with project selection and performance. *The Journal of Product Innovation*, 18, 357-373.

David, P. A. (1975). *Technical choice innovation and economic growth: essays on American and British experience in the nineteenth century*. Cambridge, UK: University Press.

Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing* 18(3), 301-33.1

De Jong, J. P., & Vermeulen, P. A. (2006). Determinants of Product Innovation in Small Firms A Comparison Across Industries. *International Small Business Journal*, *24*(6), 587-609.

De Mel, S., McKenzie, D., & Woodruff, C. (2009). *Innovative firms or innovative owners? Determinants of innovation in micro, small, and medium enterprises* (IZA Working Papers. No. 3962). Retrieved from http://hdl.handle.net/10419/35347

Evans, M. D. R. (1989) Immigrant entrepreneurship: effects of ethnic market size and isolated labor pool. *American Sociological Review*, 54, 950-962.

Evans, D.S. & Leighton, L.S. (1989). Some empirical aspects of entrepreneurship. *American Economic Review*, 79(3), 519.

Fairlie, R.W. (2009). *Kauffman Index of Entrepreneurial Activity: 1996-200*8. Kansas City, MO: Ewing Marion. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1395945

Figueroa-Armijos, M., Dabson, B. & Johnson, T.G. (2012). Rural Entrepreneurship in a Time of Recession. *Entrepreneurship Research Journal*, 2(1), Article 3. DOI:10.2202/2157-5665.1044

Freel, M. S. (2005). Patterns of innovation and skills in small firms. *Technovation*, 25(2), 123-134.

Freeman, C., & Soete, L. (Eds.). (1997). *The economics of industrial innovation*. Oxon, UK: Routledge.

Frese, M. & de Kruif, M. (2000). Psychological success factors of entrepreneurship in Africa, a selective literature review. In M. Frese, (ed.) *Success and Failure of Microbusiness Owners in Africa: A Psychological Approach*, London, UK: Quorum Books.

Geroski, P. A., Van Reenen, J., & Walters, C.F. (1997). How persistently do firms innovate? *Research Policy*, 26 (1), 33–48.

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*, 42(4), 750–783.

Glaeser, E., H. Kallal, J. Scheinkman, &. Shleifer, A. (1992). Growth of Cities. *Journal of Political Economy*, 100(6), 1126-1152.

Gollin, D., Parente, S., & Rogerson, R. (2002). The Role of Agriculture in Development. *The American Economic Review*, 92(2), 160-164.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17, 109-122.

Griffith, R., Huergo, E., Mairesse, J., & Peters, B. (2006). Innovation and productivity across four European countries. *Oxford Review of Economic Policy*, 22(4), 483-498.

Griliches, Z. (1979). Issues in Assessing the Contribution of Research and Development to Productivity Growth. *Bell Journal of Economics*, 10(1), 92–116.

Griliches, Z. (1990). Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature*, 28, 1661–1707.

Griliches, Z. (1994). Productivity, R&D, and the Data Constraint. *American Economic Review*, 84(1), 1–23.

Griliches, Z., & Mairesse, J. (1998). Production Functions: The Search for Identification. In S. Strom (ed.), *Econometrics and Economic Theory in the Twentieth Century: The Ragnar Frisch Centennial Symposium*, (169–203). Cambridge, UK: Cambridge University Press.

Harrison, R., Jaumandreu, J., Mairesse, J., & Peters, B. (2008). *Does innovation stimulate employment? A firm-level analysis using comparable micro-data from four European countries* (Working Paper No. 14216). Retrieved from http://www.nber.org/papers/w14216

Hinz, T., & Jungbauer-Gans, M. (1999). Starting a Business after Unemployment: Characteristics and Chances of Success (empirical evidence from a regional German labour market), *Entrepreneurship and Regional Development*, 11, 317-333.

Hitt, M., & Barr, S. (1989). Managerial selection decision models. *Journal of Applied Psychology*, 1, 53–62.

Hoffman, K., Parejo, M., Bessant, J., & Perren, L. (1998). Small firms, R&D, technology and innovation in the UK: a literature review. *Technovation*, 18(1), 39-55.

Hofstede, G. (1984).*Culture's consequences: International differences in work-related values*. Beverly Hills, CA: sage.

Hopkins, J. (2004, April). Entrepreneurs are born, but can they be taught? Educators try to sculpt what our economy craves. *USA Today, Special. Reprint Edition*, p1.

Kaplinsky, R., Morris, M., & Readman, J. (2002). The globalization of product markets and immiserizing growth: Lessons from the South African furniture industry. *World Development*, *30*(7), 1159-1177.

Keizer, J.A., Dijkstra, L., & Halman, J. (2002). Explaining innovative efforts of SMEs: an exploratory survey among SMEs in the mechanical and electrical engineering sector in The Netherlands. *Technovation*, 22, 1-13

Kidd, M. P. (1993). Immigrant wage differentials and the role of self-employment in Australia. *Australian Economic Papers*, 32, 92-115.

Kilkenny, M., Nalbarte, L., & Besser, T. (1999). Reciprocated Community Support and small Town-Small business success. *Entrepreneurship and Regional Development*, 11, 231-246.

Lucas, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3-42.

Lynskey, M. (2004). Knowledge, finance and human capital: the role of social institutional variables on entrepreneurship in Japan. *Industry & Innovation*, 11(4), 373-405.

Malerba, F., & Orsenigo, L. (1999). Technological entry, exit and survival. *Research Policy*, 28, 643–660.

Mansfield, E. (1972). Contribution of R&D to economic growth in the United States. *Science*, 175(4021), 477-486.

Marvel, M. R., & Lumpkin, G. T. (2007). Technology entrepreneurs' human capital and its effects on innovation radicalness. *Entrepreneurship Theory and Practice*, 31(6), 807-828.

Maskell, P. & Malmberg, A. (1999). Localised Learning and Industrial Competitiveness. *Cambridge Journal of Economics*, 23, 167-185.

McGrath, R.G. (1999). Falling forward: real options reasoning and entrepreneurial failure. *Academy of Management Review*, 24(1), 13-30.

Minniti, M., & Bygrave, W. (2001). A dynamic model of entrepreneurial learning. *Entrepreneurship Theory and Practice*, 25(3), 5-16.

Neck, H. M., & Greene, P. G. (2011), Entrepreneurship Education: Known Worlds and New Frontiers. *Journal of Small Business Management*, 49, pp55–70. doi:10.1111/j.1540-627X.2010.00314.x

Nooteboom, B, (1994). Innovation and diffusion in small firms: theory and evidence. *Small Business Economics*, 6(5), 327-347.

OECD, Eurostat (2005). *Oslo Manual- Guidelines for collecting and Interpreting Innovation Data*. Joint Publication. Retrieved from http://www.uis.unesco.org/Library/Documents/OECDOsloManual05_en.pdf

Oerlemans L., Meeus M., & Boekema F. (1998). Do networks matter for innovation? The usefulness of the economic network approach in analysing innovation. *Tijdschrift voor Economische en Sociale Geografie*, 89, 298–309.

Parker S. C (2009). *The economics of Entrepreneurship*, Cambridge, UK: University press.

Paunov C. (2012). The global crisis and firms' investments in innovation. *Research Policy*, 41(1), 24–35.

Pennings, J.M., Lee, K., & van Witteloostuijn, A. (1998). Human Capital, Social Capital, and Firm Dissolution. *Academy of Management Journal*, 41, 425-440.

Politis, D., & Gabrielsson, J. (2009). Entrepreneurs' attitudes towards failure: an experiential learning approach. *International Journal of Entrepreneurial Behaviour & Research*, 15(4), 364-383.

Porter, M. E. (1990). *The Competitive Advantage of Notions*. Retrieved from Harvard business review: http://cspug2s.units.it/sid/docenti/brusati/didattica/11%20Porter%20The%20Competitive%20Advantage%20of%20Nations.pdf

Reynolds, P. D., Hay, M., & Camp, S. M. (2001). *Global Entrepreneurship Monitor,* (2002 Executive Report). London: London Business School and Babson College. Retrieved from http://www.ucema.edu.ar/u/gcettolo/WebGlobalGEMReport11.12_1.pdf

Roberts, E. B. (1991). *Entrepreneurs in high technology: Lessons from MIT and beyond* (pp. 46-99). New York: Oxford University Press.

Rogers M. (2002). Network, firm size and Innovations. *Small Business Economics*, 22, 141–153.

Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98, S71–S102.

Romijn, H., & Albaladejo, M. (2002). Determinants of innovation capability in small electronics and software firms in southeast England. *Research policy*, 31(7), 1053-1067.

Ronstadt, R. (1988). The corridor principle. *Journal of Business Venturing*, 3, 31–40.

Roper, S. (1997). Product Innovation and Small Business Growth: A Comparison of the Strategies of German, U.K. and Irish Companies. *Small Business Economics*, 9, 523-537.

Schumpeter, J. A. (1942). *Capitalism, socialism, and democracy* (Harper Colophon ed., 1976). New York: Harper and Brothers.

Schumpeter, J. A. (1934). The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle. Cambridge, Mass: Harvard University.

Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11(4), 448–469.

Shane, S. A. (2003). *A general theory of entrepreneurship: The individual-opportunity nexus*. USA: Edward Elgar Publishing.

Shane, S. (2009). Why encouraging more people to become entrepreneurs is bad public policy. *Small Businesses Economics*, 33(2), 141-149.

Shane, S. & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), 217-226.

Stangler, D. (2009). *The economic future just happened*. Kansas City, USA: Ewing Marion Kauffman Foundation.

Steward-Knox, B., & Mitchell, P. (2003).What separates the winners from the losers in new product development. *Trends in Food Science and Technology*, 14, 58–64.

Sweetland, R.S. (1996). Human Capital Theory: Foundations of a Field of Inquiry. Review of Educational Research, 66(3), 341-3.

Utterback, J. M., & Suarez, F. F. (1993). Innovation, competition, and industry structure. *Research policy*, *22*(1), 1-21.

Van Praag, C. M., & Versloot, P. H. (2007). What is the value of entrepreneurship? A review of recent research. *Small Business Economics*, 29(4), 351-382.

Van Stel, A., Carree, M., & Thurik, R. (2005). The effect of entrepreneurial activity on national economic growth. *Small Business Economics*, 24(3), 311-321.

Venkataraman, S. (1997). The distinctive domain of entrepreneurship research: An editor's perspective. In J. Katz & R. Brockhaus (Eds.), *Advances in entrepreneurship, firm, emergence, and growth* (pp. 119–138). Greenwich, CT: JAI Press.

World Economic Forum. (2008). *The Global Competitiveness Report 2008-2009.* Retrieved from http://www.weforum.org/pdf/GCR08/GCR08.pdf

Appendix

Table A1: Summery statistics of each variable used for the years 2008 and 2009.

	2008 (n=134.990)			2009 (n=181,067)		
Dependent variables	**Factor-driven economies**	**efficiency-driven economies**	**Innovation-driven economies**	**Factor-driven economies**	**efficiency-driven economies**	**Innovation-driven economies**
Product innovation						
Product is new to some/all customers	989	1,869	1,994	1,286	2,826	2,081
Product is not new to some/all customers	1,876	1,952	2,038	2,257	2,540	2,860
Independent variables						
Education						
High education (post- secondary degree/ graduate experience)	4,001	11,286	29,384	3,466	13,621	44,709
Low education (some secondary experience/ secondary degree)	11,908	23,459	32,941	12,780	29,168	54,218
Start-up skills						
Has knowledge, skills and experience to start a new business	9,081	15,114	24,200	11,894	19,424	35,621
Otherwise	4,179	11,121	26,722	4,815	14,306	38,036
Previous business ownership experience						
Has owned and shut down a business in the past year	1,489	2,136	1,162	1,539	2,361	2,155
Otherwise	15,693	34,657	63,997	19,983	48,884	104,533
Control variable						
Gender: 1.Male	8,659	16,829	31,386	10,644	25,006	49,599
0.Female	8,821	20,054	33,891	10,993	26,461	57,170
Average age	38	41	43	35	40	46

Source: APS Global Entrepreneurship Monitor, 2001-2008 and 2009.

Table A2: Correlation matrix for all variables in the factor-driven economies for the year 2008.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	-0.0027 (0.8930)	1.0000				
3.Start-up skills	0.0297 (0.1211)	0.0570 (0.0000)	1.0000			
4. Business ownership experience	0.0490 (0.0092)	0.0219 (0.0060)	0.898 (0.0000)	1.0000		
5.Gender	0.0089 (0.6337)	-0.0913 (0.0000)	-0.1236 (0.0000)	-0.0321 (0.0000)	1.0000	
6.Age	-0.0186 (0.3207)	-0.1124 (0.0000)	-0.0349 (0.0001)	-0.0078 (0.6476)	-0.0229 (0.3036)	1.0000

Source: APS Global Entrepreneurship Monitor 2001-2008.

Table A3: Correlation matrix for all variables in the efficiency-driven economies for the year 2008.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	0.1773 (0.0000)	1.0000				
3.Start-up skills	-0.0041 (0.8060)	0.0938 (0.0000)	1.0000			
4. Business ownership experience	0.0605 (0.0002)	0.0020 (0.7123)	0.1387 (0.0000)	1.0000		
5.Gender	-0.0136 (0.4024)	-0.0254 (0.0000)	-0.1281 (0.0000)	-0.0249 (0.0000)	1.0000	
6.Age	-0.0403 (0.0131)	-0.0888 (0.0000)	-0.0969 (0.0000)	-0.0247 (0.0000)	0.0343 (0.0000)	1.0000

Source: APS Global Entrepreneurship Monitor 2001-2008.

Table A4: Correlation matrix for all variables in the innovation-driven economies for the year 2008.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	0.0420 (0.0089)	1.0000				
3.Start-up skills	0.0126 (0.4322)	0.0559 (0.0000)	1.000			
4. Business ownership experience	0.0027 (0.8639)	0.0012 (0.7613)	0.0933 (0.0000)	1.0000		
5.Gender	0.0083 (0.5990)	0.0074 (0.0660)	-0.1174 (0.0000)	-0.0280 (0.0000)	1.0000	
6.Age	-0.0036 (0.8192)	-0.0887 (0.0000)	-0.0037 (0.3985)	-0.0121 (0.0020)	0.02676 (0.0000)	1.000

Source: APS Global Entrepreneurship Monitor 2001-2008.

Table A5: Correlation matrix for all variables in the factor-driven economies for the year 2009.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	0.0304 (0.1172)	1.0000				
3.Start-up skills	-0.0753 (0.0000)	0. 0627 (0.0000)	1.0000			
4.Business ownership experience	-0.0776 (0.0000)	0.0089 (0.2570)	0.0993 (0.0000)	1.0000		
5.Gender	-0.0328 (0.0510)	-0.0262 (0.0008)	-0.1503 (0.0000)	-0.0424 (0.0000)	1.0000	
6.Age	-0.0436 (0.0102)	0.0473 (0.0000)	-0.0172 (0.0278)	0.0215 (0.0018)	-0.0229 (0.0009)	1.0000

Source: APS Global Entrepreneurship Monitor 2009.

Table A6: Correlation matrix for all variables in the efficiency-driven economies for the year 2009.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	0.0589 (0.0000)	1.0000				
3.Start-up skills	0.0442 (0.0019)	0.0610 (0.0000)	1.0000			
4. Business ownership experience	0.0443 (0.0012)	0.0030 (0.5348)	0.1268 (0.0000)	1.0000		
5.Gender	0.0445 (0.0011)	0.0006 (0.9087)	-0.1277 (0.0000)	-0.0385 (0.0000)	1.0000	
6.Age	-0.0322 (0.0187)	0.0041 (0.4011)	-0.0457 (0.0000)	-0.0190 (0.0000)	0.0222 (0.0000)	1.0000

Source: APS Global Entrepreneurship Monitor 2009.

Table A7: Correlation matrix for all variables in the innovation-driven economies for the year 2009.

	1.	2.	3.	4.	5.	6.
1.Product-innovation	1.0000					
2.Education	0.0644 (0.0000)	1.0000				
3.Start-up skills	0.0167 (0.2483)	0.1277 (0.0000)	1.0000			
4. Business ownership experience	0.0394 (0.0057)	0.0145 (0.0000)	0.1169 (0.0000)	1.0000		
5.Gender	-0.0123 (0.3888)	-0.0475 (0.0000)	-0.1782 (0.0000)	-0.0470 (0.0000)	1.0000	
6.Age	-0.0409 (0.0043)	-0.0820 (0.0000)	-0.0429 (0.0000)	-0.0024 (0.4321)	0.0267 (0.0000)	1.0000

Source: APS Global Entrepreneurship Monitor 2009.

Table A8: Correlation matrix for all variables for the year 2008.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Product innovation	1.0000									
2.Education	0.0938***	1.0000								
3.Start-up skills	0.0184*	0.0513***	1.0000							
4.Business ownership experience	0.0311**	-0.0119***	0.1247***	1.0000						
5. Stage 1	-0.1304***	-0.1191***	0.1243***	0.0972***	1.0000					
6. Stage 2	0.0545***	-0.0962***	0.0524***	0.0608***	-0.2764***	1.0000				
7. Stage 3	0.0653***	0.1726***	-0.1366***	-0.1250***	-0.4527***	-0.7318***	1.0000			
8. Age	-0.0052	-0.0509***	-0.0585***	-0.0261***	-0.1098***	-0.0349***	0.1103 ***	1.0000		
9. Gender	-0.0003	-0.0144***	-0.1290***	-0.0297***	-0.0166***	0.0255***	-0.0119 ***	0.0319***	1.0000	
10. Industry	0.0013	-0.0049	0.0109	0.0004	-0.0508***	0.0318***	0.0120	0.0215**	-0.1021***	1.0000

Source: APS Global Entrepreneurship Monitor 2001-2008.
*** denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.

Table A9: Correlation matrix for all variables for the year 2009.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Product innovation	1.0000									
2.Education	0.0429***	1.0000								
3.Start-up skills	-0.0002	0.0831***	1.0000							
4.Business ownership experience	0.0081	-0.0145	0.1275***	1.0000						
5. Stage 1	-0.0993***	-0.2093***	0.1364***	0.0772***	1.0000					
6. Stage 2	0.1272***	-0.0949***	0.0447***	0.0432***	-0.2341***	1.0000				
7. Stage 3	-0.0389***	0.2886***	-0.1353***	-0.0908***	-0.4468***	-0.7651***	1.0000			
8. Age	-0.0316***	0.1122***	-0.0785***	-0.0295***	-0.1967***	-0.1201***	0.2408***	1.0000		
9. Gender	0.0086	-0.0314***	-0.1607***	-0.0436***	-0.0133***	-0.0151***	0.0227***	0.0239***	1.0000	
10. Industry	0.0004	0.0350***	0.0401***	-0.0110	-0.0937***	0.0247***	0.0656***	0.0406***	-0.0925***	1.0000

Source: APS Global Entrepreneurship Monitor, 2009.
*** denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.