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This dissertation investigates the commercialization efforts of immigrant-founded knowledge-intensive entrepreneurship (KIE) firms in Europe. Founders of KIE firms have a higher receptiveness to technological opportunities and the exploitation of such opportunities into commercialization than founders of other types of firms. It is well established that expansion in economically useful commercialization is associated with economic growth, where the entrepreneur is the key economic agent that successfully turns inventions into commercial products or processes. Some of the existing literature that studies immigrant entrepreneurship in the United States has found that immigrant-founded firms have a higher probability of commercialization in the high-technology sector than native-founded firms. However, there is not a sufficient evidence of this relationship in European countries. To examine this relationship, I use a dataset derived from the European Commission-funded framework project (FP7) advancing knowledge-intensive entrepreneurship and innovation for growth and social well-being in Europe (AEGIS). This project aimed to explore and observe knowledge-intensive entrepreneurship (KIE) recurrently in different sectors and regions. I find a negative association between immigrant-founded firms and commercialization in the high-technology sector. The resulting negative association suggests that high-tech immigrant-founded firms in European countries are at a commercialization disadvantage than high-tech immigrant-founded firms in the United States. This disadvantage could be due to differences in the unobserved entrepreneurship abilities among immigrant founders

between the United States and some European countries. Also, in the analysis of sub-sample of countries, immigrant-founded firms are less innovative than native-founded firms in the group of (Croatia, Czech Republic, Greece, Italy, and Portugal) in the AEGIS database. This result might indicate that this group of countries differs from other European countries in size and socioeconomic model. Also, less innovative countries might have other attributes that might not attract more talented immigrant entrepreneurs compared to natives.

IMMIGRANT INNOVATIVE ACTIVITY AMONG ENTREPRENEURIAL FIRMS: A STUDY OF EUROPEAN FIRMS

by

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CHAPTER I

INTRODUCTION

For decades, developed nations have attracted an increasing inflow of immigrants searching for better opportunities. Recently, an increase in waves of immigrants and refugees from less developed countries has led to a so-called immigration crisis. One aspect of the immigration crisis is the pattern of this inflow to some European countries that are not accustomed to receiving immigrants. The resulting immigrant crisis has thus created negative anti-immigration views fueled by concerns about the apparent pressure on the host country's limited resources and the displacement of natives' jobs.

It is well established that ultimately immigrants can diversify the host country's economy because they are more likely to be more entrepreneurial than similarly skilled natives bringing new ideas and unique perspective in the process (Beaujot et al., 1994; Blume-Kohout, 2016; Borjas, 1986; Clark and Drinkwater, 2000; Constant and Zimmermann, 2006; Fairlie, 2008, 2012; Fairlie and Meyer, 1996; Hormiga and Bolívar-Cruz, 2014; Kanas et al., 2009; Mestres, 2010; Yuengert, 1995). Host countries benefit from such immigration trends because entrepreneurship is associated with economic growth and quality of life in a country; it generates new knowledge and innovation and helps create new jobs. Therefore, developed countries need to assume an active role by identifying obstacles and opportunities faced by immigrants and adopting policies that aim at deriving the full potential from immigrant entrepreneurs.

Governments recently have realized the importance of enacting an entrepreneurship policy to promote innovation for the eventual association between economic growth and innovation that is mostly generated by new innovative businesses (Audretsch, 2004; Edquist, 2001; Stevenson and Lundström, 2007). Many OECD countries have developed policies to attract successful foreign entrepreneurs and wealthy investors (Kerr and Kerr, 2020). However, these policies might not materialize to the desired results because foreign investors might lack the local knowledge and social capital, which are qualities that existing immigrants possess. Also, environmental factors in the host country could create a dissimilar experience for targeted immigrant entrepreneurs and prevent them from transferring the same success in the host country's market (Clydesdale, 2008).

Government policies need to be purposeful and justifiable by the existence of market failure (Edquist, 2001; Stevenson and Lundström, 2007). Any obstacles faced specifically by immigrant entrepreneurs, such as difficulties in access to finance or information, could be considered a market failure that necessitate the need for intervention by the government. Having a specific policy tailored to immigrants could help with their economic assimilation and upward mobility and could help increase the supply of entrepreneurs because immigrants are more likely to be entrepreneurs than natives (Barth and Zalkat, 2020; Desiderio, 2014; Fairlie and Lofstrom, 2015; Saxenian, 2002; Vandor and Franke, 2018). However, such specific policies could be difficult to implement successfully to obtain the desired results.

Therefore, policy makers need to take into consideration many aspects surrounding immigrant entrepreneurship especially the type of entrepreneurship that generates successful commercialization.

There are many definitions of an immigrant and even more interpretations about whom an entrepreneur is and what he or she does (i.e., entrepreneurship). Entrepreneurship as a field has been developed over the years by scholars from many disciplines (e.g., sociology, management, and economics).

Scholars have debated the definition of entrepreneurship, the role that entrepreneurs have, and the qualities entrepreneurs might possess, but they have not reached a consensus. This lack of consensus causes ambiguities and makes it difficult not only to deduce the entrepreneur's role in the economy but also to synthesize studies and analyze their results. Historically, the economic theory developed without having a role for the entrepreneur, which made some scholars argue that entrepreneurship cannot be analyzed using the existing economic theory of the firm (Casson, 2003; Hébert and Link, 1989).

It was not until the French economist Richard Cantillon (1755) first introduced the word *entreprendre* in his *Essai* where *entreprendre* in French translates to "undertake" (Casson, 2003; Nevin, 2013). Cantillon defined the entrepreneur as a risk-taking self-employed individual who seeks profit under uncertainty. Subsequent economists recognized and elaborated this definition where they added other attributes to the entrepreneur. For instance, Jean-Baptiste Say (1840) undermined uncertainty faced by the entrepreneur, and instead, he concentrated on the entrepreneur's judgment in the

decision-making process (Hébert and Link, 2009). Frank Knight (1921) distinguished between insurable risk and uninsurable uncertainty (Hébert and Link, 2009). Israel Kirzner (2015) stressed alertness as a quality of the entrepreneur (Kirzner, 2015). Joseph Schumpeter is the economist who introduced innovation to the definition of the entrepreneur and had a clear view of what economic function the entrepreneur had. Schumpeter viewed the entrepreneur as an individual who does any of the following: introduces new or improve upon goods or services, opens new markets, conquers new sources of supply, or creates a new type of industrial organization (Casson, 2003). According to Schumpeter, the entrepreneur could have any role in the firm, such as an employee or a manager.

In this dissertation, an immigrant is defined as an individual who resides in the country in which he or she founded a business, but who was born in another country. This limited definition of immigrants does not take into account the possible heterogeneity among immigrants in terms of origin or length of stay in the host country. However, this definition aligns well with the dataset used in this dissertation. Entrepreneurship refers in a narrow sense to the process taken by an individual or group of individuals to form a new business (Hébert and Link, 2009). Based on this definition, an immigrant entrepreneur establishes immigrant-founded firms, while a native entrepreneur establishes native-founded firms. The firms in this dissertation are knowledge-intensive entrepreneurship (KIE) firms. KIE entrepreneurs differ from who might be referred to as generic entrepreneurs because of their greater receptiveness to

technological opportunities and the exploitation of such opportunities into commercialization (Malerba and McKelvey, 2015).

A review of the extant literature on immigrant-founded firms' innovative performance revealed the predominance of papers that concentrated on countries accustomed to immigrants, such as the United States. 14% of the population in the United States are immigrants (U.S. Census Bureau, 2018). Also, the United States attracts talented immigrants more so than other developed countries, which makes conclusions about immigrant entrepreneurs' innovative performance from the United States not generalizable (Wadhwa et al., 2007). Also, the limited studies that addressed the innovative performance of immigrant-founded firms used indirect measures of innovative performance (e.g., R&D intensity, number of patents).

This dissertation contributes to the existing literature by analyzing the factors affecting innovative performance of immigrant-founded firms and native-founded firms using a unique dataset. The dataset used in this dissertation is the Advancing knowledge-intensive entrepreneurship and innovation for growth and social well-being in Europe (AEGIS), which gathered information about 4,004 KIE firms in various industries in ten European countries that vary economically and demographically. This heterogeneity contributes to the extant literature on immigrant entrepreneurship with evidence from Europe which has a different immigration policy and attracts different types of migrants than the United States.

The uniqueness of the AEGIS dataset is that it is a unified dataset that has information about the firm's geographical location and the industry it operates in, which

helps to control, from a statistical perspective, for the possible heterogeneity among sectors and countries. The AEGIS survey also obtained information about the characteristics of the founder/s of the firm, which assists in distinguishing among founders by their individual characteristics (e.g., immigration status, gender, human capital), and information about the characteristics and performance of the firm. This information helps in linking the founder of the firm (the entrepreneur) to the innovative performance of his/her firm.

Another contribution of this dissertation is the use of a direct measure of innovative performance, which is the firm's introduction of new or improved goods or services (i.e., commercialization). Using a direct measure better approximates the innovative performance of firms than using indirect measures, such as the number of patents that might not materialize to finished goods or services.

The reminder of this dissertation is organized as follows. Chapter II reviews the literature on immigrant entrepreneurship and on the determinants of innovation, Chapter III describes the data, Chapter IV defines the variables considered in the statistical analysis and presents descriptive statistics, Chapter V contains the results from the empirical analysis, Chapter VI summarizes the empirical findings, and finally Chapter VII discusses the study's limitations as well as potential future research on the topic.

CHAPTER II

LITERATURE REVIEW

This chapter reviews the relevant literature since the 1970s that has addressed immigrant entrepreneurship. The literature reviewed in this chapter differs from the literature that studies entrepreneurship in general; it focuses specifically on the entrepreneurship experience of immigrants.

In this chapter, I provide an overview of the multidisciplinary literature on immigrant entrepreneurship, the occupational choice of immigrants, the economic impact on host countries from immigration, and determinants of innovation. Then, I conclude and address yet unanswered questions about immigrant entrepreneurs.

Overview

The research focus of the studies on immigrant entrepreneurship reviewed in this chapter varies depending on the discipline of the researcher. While sociologists were among the first group of scholars to investigate immigrant entrepreneurship, they were generally concerned with differences among ethnic minorities in the intensity of entrepreneurial activity, regardless of their citizenship status (Light, 1972). Also, sociologists emphasized the impact of cultural factors, such as religion and the entrepreneurial values of the ethnic group, on the differences among ethnic groups' entrepreneurial activity.

Sociologists also emphasized whether entrepreneurial activity was the only way for ethnic minorities to reach social assimilation in the face of labor market disadvantages.

Borjas (1986) was among the first economists to study immigrant entrepreneurs, although these entrepreneurs are a sizeable part of the immigrant labor market. Economists who subsequently researched immigrant entrepreneurship mostly perceived immigration in the light of the neoclassical human capital theory, as a self-selected group that chose to immigrate to maximize earnings as risk-taking individuals (Constant and Zimmermann, 2006). Therefore, immigrants would choose entrepreneurship as the best alternative to unemployment or lower wages in the host country.

Economic literature has exhibited a shift in perspective over the last few decades. Much of the early research on immigrant entrepreneurs focused on individual factors to explain entrepreneurial differences among different immigrant groups (e.g., Bates, 1999; Fairlie and Meyer, 1996). Also, some immigrant entrepreneurship research viewed immigrants as if they were part of a homogeneous group, often viewed geographically (e.g., Europeans, Asians, or Middle Easterners), and often assumed to be of the same entrepreneurial activity (Borjas, 1986; Lofstrom, 2000; Yuengert, 1995). More recently, researchers started to focus on environmental factors in the host economy as an explanation for observed differences in entrepreneurial activity among similar immigrant groups in different regions (Clark and Drinkwater, 2000).

Variations among opportunities offered by regions that might pull immigrants toward entrepreneurial behavior include differences in immigration policies or market

conditions, or the existence of an ethnic enclave (i.e., co-ethnics living in a geographical cluster).

Rath and Kloosterman (2000) proposed the mixed embeddedness theory of immigrant entrepreneurship that tries to consider the interaction among individual, institutional, and social factors. Since their work was published, researchers also accounted for talent as a pull factor for some skilled entrepreneurs, and how countries could benefit from easing entrance for this type of immigrant due to the positive impact of skilled entrepreneurs on the innovation process and economic advancement of the host economies (Saxenian, 2002).

Studies on immigrant entrepreneurship have increased over time. A few studies were dedicated to reviewing the literature on immigrant entrepreneurship such as (Aliaga-Isla and Rialp, 2013; Basu and Pruthi, 2021; Becheikh et al., 2006; Dheer, 2018; Fairlie and Lofstrom, 2015). Examining these reviews would help discern the key gaps and observe what the immigrant entrepreneurship literature concentrated on. For instance, Aliaga-Isla and Rialp (2013) concluded that there is a lack of sufficient evidence on the role of external factors or environment on the experience of immigrant entrepreneurs. Basu and Pruthi (2021) found a shift in the studies from focusing on domestic or ethnic entrepreneurship to global or transnational immigrant entrepreneurs. Transnational entrepreneurs are entrepreneurs who cater to both the host and the home country utilizing resources from their established business in the host country (Basu and Pruthi, 2021; Dheer, 2018). Most of the immigrant entrepreneurship studies focuses on immigration experiences in the United States (Aliaga-Isla and Rialp, 2013; Basu and

Pruthi, 2021; Dheer, 2018). Much less has been written about the experiences of immigrants in other countries, making this study a timely contribution to the economics literature, in particular, and to the multidisciplinary literature.

The Occupational Choice of Immigrants

Occupational choices can be attributed to the interaction among individual factors, market conditions, and institutional policies each immigrant faces. Consequently, each immigrant will take part in a unique decision-making process that will be affected by all factors combined. Therefore, Jansen et al. (2003) and Wang and Warn (2018) argue that any host country's government policy aiming to increase the entrepreneurial activity of immigrants should take these interactions into account and try to be more specific, rather than general, in its policy initiatives. Differentiating among different immigrant groups is essential because it can alter conclusions about the effect of some determinants on the probability of, for example, entrepreneurship (Fairlie and Meyer, 1996). For instance, Jansen et al. (2003) reported differences among immigrant groups in the effect of socioeconomic factors such as gender, marital status, number of children, and education level on the odds of becoming an entrepreneur.

The theoretical model that is popular in the immigrant entrepreneurship literature depicts the choice the immigrant faces between wage-employment or entrepreneurship and unemployment. The immigrant chooses to become an entrepreneur if the potential earnings are higher than wage-employment or any unemployment benefits (Krichevskiy

et al., 2016). Earnings in both sectors are affected by many factors that need to be accounted for, which include individual factors and environmental factors.

Individual Factors

Individual factors including human capital, socioeconomic status, and social capital could affect the occupational choice of immigrants. Studies that focused on individual-level factors are more common in research on immigrant entrepreneurs (Aliaga-Isle and Rialp, 2013).

Becker (2009) has distinguished between specific and generic human capital where specific human capital is the accumulation of knowledge and/or experience that is in the same field or sector as the current firm, which can be benefited from directly (Protogerou et al., 2017). Generic human capital can be measured using age to approximate experience and years of schooling. Human capital stock could accumulate both in the birth and host countries. Therefore, an increasing number of studies have made the distinction between the measurement of human capital stock based on the source of accumulated human capital because foreign education and experience are often valued less than the education and experience obtained in the host country, and this potential bias could affect labor decisions differently. Moreover, some researchers, such as Sanders and Nee (1996), included the host country's language proficiency as part of the definition of human capital.

Several studies agree that higher education obtained from birth countries leads to a higher chance of choosing entrepreneurship among immigrants (Blume-Kohout, 2016;

Iranzo Sancho, 2017; Li, 2001; Neupert and Baughn, 2013; Peroni et al., 2016; Sanders and Nee, 1996; Szarucki et al., 2016; Vinogradov and Kolvereid, 2007). Immigrants encountering less employer appreciation for higher education and ability not acquired in the host country could be motivated by expectations that entrepreneurship will bring higher earnings. Conversely, Akee et al. (2007) found that higher education obtained in the host country led to a higher immigrant entrepreneurship propensity in the host country than education obtained abroad. The same conclusion about education in the Akee et al. (2007) paper is also found in terms of work experience (Blume-Kohout, 2016; Evans, 1989; Iranzo Sancho, 2017; Kanas et al., 2009; Krichevskiy et al., 2016; Le, 2000; Neville et al., 2014). However, some researchers argue that immigrants with lower education levels are more likely to be entrepreneurs because they are facing more obstacles than more highly educated immigrants in the job market (Evans, 1989; Hammarstedt, 2004, 2006; Kanas et al., 2009; Le, 2000). Some scholars have thus concluded that there is evidence of a U-shape relationship between education and the propensity of entrepreneurship (Fairlie, 2012). Also, Kahn et al. (2017) accounted for unobserved ability by using wages in previous jobs as an indicator of productivity and ability showed evidence of a U-shape relationship between ability and entrepreneurship propensity.

In general, being fluent in the host country's language increases the propensity of entrepreneurship, at least among some groups of immigrants (Clark and Drinkwater, 2000; Le, 2000; Mora and Dávila, 2005). However, Evans (1989) and Krichevskiy et al. (2016) have established that having limited knowledge of the host country's language,

while it lowers communication ability with the locals, increases the odds of the entrepreneurship attracting similar immigrants to his or her firm.

Researchers predominantly agree that the older the immigrants are, up to their late 50s or 60s, more likely to engage in entrepreneurial activity (Blume-Kohout, 2016; Ohlsson et al., 2010). These findings suggest that older immigrants might also have accumulated more human capital in the form of experience or knowledge, and thus might have been in the host country for a longer time. This increased human capital gives older immigrants better access to social and financial capital, which is essential to starting a new business. Akee et al. (2007) found that retirement-aged individuals are 21% more likely to engage in entrepreneurial activity than younger immigrants. However, retirement-age immigrants, while having more access to recourses that increase the probability of starting a new business after retirement, are more likely to have less energy and poorer health and are more likely to be risk-averse, which are all deterrents to choosing entrepreneurship. Other researchers, such as Krichevskiy et al. (2016) and Vandor and Franke (2018), noted that younger immigrants are more likely to be entrepreneurs than older ones. Therefore, there might be other factors that cause different conclusions, such as different dataset characteristics, as some would distinguish between permanent and temporary residents, and some even distinguish by age at the beginning of immigration (Blume-Kohout, 2016; Li, 2001).

Researchers of immigrant entrepreneurship have found that men are more likely than women to choose entrepreneurship as a career path (Kanas et al., 2009; Martín-Montaner et al., 2018; Mestres, 2010; Neville et al., 2014; Szarucki et al., 2016;

Tavassoli and Trippl, 2019). The reasoning behind this finding is based on gender differences in time allocation for childcare or marital responsibilities.

Also, women are more risk-averse and prefer a steady job, or they face discrimination from financial institutions that might grant loans more frequently to men (Blume-Kohout, 2016; Hammarstedt, 2004; Li, 2001; Mestres, 2010; Peroni et al., 2016; Szarucki et al., 2016). Previous studies concluded that female immigrants are less likely than male immigrants to be entrepreneurs (Beaujot et al., 1994; Clark and Drinkwater, 2000; Kanas et al., 2009; Martín-Montaner et al., 2018; Mestres, 2010; Neville et al., 2014; Szarucki et al., 2016; Tavassoli and Trippl, 2019). As well, some scholars omit females from their studies because including them could complicate the analysis due to gender differences in labor force participation (Beaujot et al., 1994; Borjas, 1986; Evans, 1989; Le, 2000; Lofstrom, 2000; Yuengert, 1995).

There is consensus that length of stay in the host country is associated with higher entrepreneurial activity, as it is plausible to assume that immigrants need time to adjust to the unfamiliar environment of the host country, particularly if they originated from less-developed countries (Akee et al., 2007; Clark and Drinkwater, 2000). This adjustment period is needed to understand laws and regulations in the new host country, to make a better assessment of market conditions, and to have a better knowledge of possible financial resources and institutions. Several studies estimated this adjustment period to be between 5 and 10 years, with each additional year increasing the propensity of entrepreneurship (Constant and Zimmermann, 2006). However, Levie (2007) found that recent immigrants are more likely to be entrepreneurs, but this action could be due to the

difference in the mean age between recent and tenured immigrants. Also, the longer immigrants stay in the host country, the more likely they are to accumulate wealth.

It is uncontroversial to assume that more access to funds increases the propensity of entrepreneurship. Most studies measure wealth in terms of homeownership because immigrants who own a home can use it as collateral when applying for a loan (Fairlie, 2012). However, immigrants are less likely to own a home, which suppresses their chance to be entrepreneurs (Fairlie, 2012).

Social capital refers to the stock of social ties that the immigrant has, which could be with co-ethnics or natives (Kanas et al., 2009). Szarucki et al. (2016) found no evidence of the effect of having social ties on immigrant entrepreneurship, and Kanas et al. (2009) found that co-ethnic relationships had no positive effect on entrepreneurship, while bonding with natives increased the probability of entrepreneurship. However, De Noni et al. (2013) found that social ties within the ethnic enclave are a major factor in acquiring not only financial capital but also in acquiring employees, as well as consumers. Therefore, acquiring social capital increases the likelihood that an immigrant will be entrepreneur. Also, Martín-Montaner et al. (2018) found that co-ethnic ties with individuals who were entrepreneurs in their home country had a positive effect on the immigrant's decision to switch from wage-employment to entrepreneurship.

Having strong family ties can potentially provide labor resources as well as financial resources. Sanders and Nee (1996) found that having more adult relatives in proximity to the immigrant had a positive effect on the odds of starting a business. Moreover, family composition, which is measured by marital status and the number of

children, had either different effects on immigrant entrepreneurial activity by gender, or no effect (Akee et al., 2007; Krichevskiy et al., 2016; Mestres, 2010; Szarucki et al., 2016) or similar effects (Ohlsson et al., 2010; Sanders and Nee, 1996). For instance, a group of researchers has established that married immigrant men are more likely to be entrepreneurs than single immigrant men (Akee et al., 2007; Blume-Kohout, 2016; Borjas, 1986; Constan and Zimmermann, 2006; Le, 2000; Lofstrom, 2000).

One of the many definitions is that an entrepreneur is an individual who bears the risk in facing uncertainty (Hébert and Link, 2009), which is why individuals who are less risk-averse are more likely to be entrepreneurs. As observed by Constant and Zimmermann (2006), immigrants are a self-selected group who are prepared to assume risk to have a better living. Also, Szarucki et al. (2016) and Hormiga and Bolívar-Cruz (2014) concluded that risk perception is an important determinant of immigrant entrepreneurship but also emphasized that immigrants are, in general, less likely to consider starting a new business or a risky endeavor.

Environmental Factors

Environmental factors refer to factors that immigrants as a group face in a specific host country or coming from the same home country. These factors differ from individual factors in their effect on groups of immigrants compared to the individual immigrant. Studying the effects of environmental factors on entrepreneurship propensity can help policy makers target specific initiatives to increase entrepreneurship among certain groups of immigrants. Targeted policies would help with immigrant's economic

assimilation in the host country and would lessen any market failure barriers that impede an individual reaching the desired entrepreneurship and innovation levels (Barth and Zalkat, 2020; Stevenson and Lundström, 2007).

Many early studies on immigrant entrepreneurship asserted that immigrants came to the host country looking for wage-employment but faced discrimination in the job market. This discrimination can be in terms of offering the immigrants lower wages than similarly skilled natives, or that employers fail to acknowledge immigrants' foreign credentials. This discrimination leads to a difference in the predicted earnings between entrepreneurship and wage-employment for immigrants, which pushes immigrants toward entrepreneurship (Beaujot et al., 1994; Clark and Drinkwater, 2000; Constant and Zimmermann, 2006; Hammarstedt, 2006; Li, 2000). Since discrimination is subjective, it is seldom asked about on data collection surveys, which caused some researchers to try to measure discrimination indirectly.

Hammarstedt (2006), for example, measured the difference in predicted earnings from entrepreneurship and wage-employment and examined the effect that this difference had on entrepreneurial decisions among immigrants. Hammarstedt (2006) found evidence of a strong effect, which is an indicator of labor market discrimination against immigrants in the host country. Similarly, Beaujot et al. (1994) used the interaction between credentials and the type of business as an indicator of discrimination, and found that immigrants, especially ones with foreign high education, were more likely to be entrepreneurs in a non-professional occupation, which is an indication of obstacles faced in wage-employment.

Certain immigrant groups face labor market discrimination more than others, which would increase their likelihood of entrepreneurship; yet, they could also face financial institution discrimination, which would deter business start-ups (Clark et al., 2017). Nevertheless, Fairlie and Meyer (1996) concluded that entrepreneurial activity was more pervasive among comparatively advantaged immigrant groups that do not usually face labor market discrimination in the host country. Therefore, while there is some evidence of discrimination among immigrants, there is also a set of opportunities that influence certain groups of immigrants to be entrepreneurs without being forced by financial reasons.

Some studies assumed that immigrants were pulled toward entrepreneurship by opportunities created by the existence of ethnic enclaves (i.e., co-ethnics living in a geographical cluster). Ethnic enclaves often offer access to relatively cheap labor, access to financial and social resources, and access to markets with higher demand for ethnic goods and services. While some immigrants choose to live in a proximity to an ethnic enclave to reunite with family or friends, others chose to move there as they sought an economic opportunity from living in an ethnic enclave (Toussaint-Comeau, 2005). The studies were divided in their conclusions about the ethnic enclave effect on entrepreneurial behavior. For instance, Evans (1989) and Lofstrom (2000) found that only immigrants who belonged to a large ethnic group are more likely to become entrepreneurs, while Borjas (1986) and Andersson and Hammarstedt (2015) found that the mere presence of ethnic enclaves increased the propensities for entrepreneurship among some groups of immigrants. Conversely, Clark and Drinkwater (2000) and

Martín-Montaner et al. (2018) found a negative enclave effect on the propensity of entrepreneurship, while Yuengert (1995), Mora and Dávila (2005), and Tavassoli and Trippl (2019) found no effect of the existence of ethnic enclaves on entrepreneurship likelihood. Notably, when scholars differentiated data by the type of ethnic enclave, they reached different conclusions. For example, Le (2000) found that being part of a language-based ethnic enclave had a positive effect on the probability of starting a business, while being part of a birthplace-based ethnic enclave did not affect the probability of starting a business. Also, Tavassoli and Trippl (2019) found a significant positive effect on the decision to transition from employment to entrepreneurship when the immigrant is surrounded by an ethnic community that had high shares of entrepreneurs with the same industry as the immigrant. Therefore, while the existence of an ethnic enclave can create entrepreneurial opportunities for immigrants, it can also be the cause of obstacles such as increasing the competition within the enclave.

The home country's positive entrepreneurship culture and prevalence are predicted to increase the likelihood of entrepreneurship for the immigrant in the host country (Clark and Drinkwater, 2000; Krichevskiy et al., 2016; Vinogradov and Kolvereid, 2007; Yuengert, 1995). Some studies examined the effect of the degree of similarity between host and home cultures and found that entrepreneurship is more frequent among immigrants originating from countries with a different culture than the destination country's culture (Blume-Kohout, 2016; Jansen et al., 2003; Andersson and Wadensjo, 2004; Yuengert, 1995). For instance, Blume-Kohout (2016) found that immigrants from countries giving lower value and support for entrepreneurship as a

career option compared to the destination country are more likely to be entrepreneurs in their host country. Also, some researchers used religion as an indicator of culture and argue that immigrants who belonged to a religion whose members have a high regard for entrepreneurship are more likely to be involved in entrepreneurship activity than other immigrants (Clark and Drinkwater, 2000).

Economic conditions in the host country, which in the literature are different from cultural conditions, can play a significant factor in determining opportunities available for the immigrant. The enforcement of property laws and the existence of economic freedom, along with a booming economy, enhances the opportunity structure in the host country (Hermes and Leicht, 2010; Vandor and Franke, 2018). Such conditions provide a rich environment for immigrants to start a business in which they are found to assimilate and reach entrepreneurship rates comparable to natives (Van Tubergen, 2005). Conversely, if immigrants arrived in the host country while its unemployment rate is relatively high, priority in filling available jobs would be given to the natives, which would cause immigrants to reluctantly turn to entrepreneurship (Van Tubergen, 2005).

To better assess the role of economic conditions and institutions on immigrant entrepreneurship propensity, Schuetze and Antecol (2006) compared the effect of different immigration policies and market conditions among Australia, Canada, and the United States. These researchers found that Australia and Canada had similar immigration policies that target talented immigrants, similar tax policies, and similar market sizes, all of which are different from the United States. Schuetze and Antecol (2006) found that the United States attracted more talented entrepreneurs than Canada

and Australia, even though the United States did not implement targeted immigration policies. Immigrants preferred the United States over Canada and Australia because of its broader market and its more favorable tax policies. At the community level, Kwon et al. (2013) concluded that immigrants who belonged to a community with high social trust increased their likelihood of starting a business. The host country's immigration policy at the time of immigration and the main reason to immigrate could affect later entrepreneurial decisions and earnings. For instance, immigrants who came to a host country to reunite with relatives in that country or with refugees are mostly less educated than individuals who came for educational or economic reasons as the second group might have higher entrepreneurial tendencies than the first group and subsequently better earnings. Wang and Warn (2018) investigated Chinese immigrants who entered Australia under three different immigration policy schemes. The researchers found that the economic and political circumstances under which the immigrants arrived in a country, along with the specific cause of immigration, profoundly affected labor market decisions and entrepreneurial activity and earnings. For example, they found that Chinese who were granted admission to Australia based on a humanitarian crisis had a challenging time finding wage-employment and turned to starting a firm in low-barrier industries serving co-ethnics with low profitability. This is different from the entrepreneurial success of skilled Chinese who had education in Australia and, as a result, were fluent in English, had knowledge of local markets, and came at a time when their expertise was needed. Also, the earlier business Chinese immigrants had substantial financial capital. However, they were not fluent in the English language and had little

experience in the local market, which resulted in having slightly better options for establishing new firms than refugees, but still catered to co-ethnic markets. In conclusion, even though favorable economic conditions in the host country can create an opportunity structure and therefore help spur immigrant entrepreneurship, there is also evidence of the effect that adverse economic conditions have on pushing immigrants to entrepreneurship.

Immigrant Entrepreneurs' Impact on the Host Economy

Immigrant entrepreneurs' contribution to the host economy mainly depends on their firm's success, which could be financial and non-financial (Fairlie and Lofstrom, 2015). Financial success can be measured by earnings, turnover generated from the firm, or the growth of the number of employees (Fairlie and Lofstrom, 2015). Dalziel (2008) found evidence that immigrant-founded firms outperformed native-founded firms in terms of revenues among the sample of top financially successful firms in Canada. Other researchers also found evidence of similar financial success of immigrant-founded firms (Chaganti et al. 2008; Kerr and Kerr, 2017; Neville et al., 2014). They attributed this success to the immigrants' aggressive competitive approach that could enhance performance (Chaganti et al., 2008), or having an export-oriented firm that would benefit from the international ties that immigrants have an advantage over natives (Saxenian, 2002). For instance, Neville et al. (2014) found evidence that immigrant-founded firms are more likely to be exporters. Being exporters caused them to outperform other non-exporting firms, where they measured performance by an index consisting of revenue and

profit growth, increases in employment, and increases in salary expenses from 2004 to 2008. Conversely, Joona (2011) found that immigrant-founded firms in Sweden generated less income to the founder compared to native-founded firms, which is ascribed to immigrants having a lower reservation wage than natives. Also, Lofstrom (2011) found that among the low-skilled, immigrant-founded firms have lower earnings than native-founded firms and wage-employed immigrants in the United States. Immigrant-founded firms can contribute to the economy of the host country by creating jobs for themselves and others. Fairlie and Lofstrom (2015) found that immigrant-founded firms met or even exceeded the average number of jobs created by native-founded firms.

Another example of the positive contribution that immigrant-founded firms can have on the host country is innovation. Innovation was considered synonymous with entrepreneurship, at least in accordance with Schumpeter's view on entrepreneurship (Hébert and Link, 2009). In the literature, innovation had multiple definitions and was approximated using different measures. Direct measures, such as innovation counts, innovation impact, or the introduction of new or improved goods or services (i.e., commercialization), and indirect measures, such as R&D intensity or number of patents (Becheikh et al., 2006; Souitaris, 1999). Nevertheless, innovation is a process that starts with an idea or inputs to end with an output or successful commercialization (Stevens and Burley, 1997). Having different measures in the literature that use one of the steps of the process of innovation to gauge the innovativeness of the firm, can be misleading and

could distort policy implications, thus making comparison of results across research difficult.

Studies on innovation performance and determinants of innovation that focus on immigrant-founded firms are scant. Mueller (2014) compared patenting activity—one measure of innovation—between immigrant-founded and native-founded firms and reported no significant difference. In comparison, Brown et al. (2019) and Hart et al. (2009) found that in the high-tech sector, immigrant-founded firms are more likely to be innovative compared to native-founded firms using multiple measures of innovation (e.g., patenting, R&D activity, commercialization, etc.).

The survival of firms is one measure of success. Many studies that compared the survival of immigrant-founded firms to native-founded firms reported that immigrant-founded firms had a shorter survival probability than native-founded firms (Bates, 1999; Irastorza, 2010; Joona, 2010; Kerr and Kerr, 2017; Mueller, 2014; Vinogradov and Isaksen, 2008). Bates (1999) found that Asian immigrants who invested more financial and human capital in their businesses and those working in a professional business are more likely to survive, while Asian immigrants who owned a traditional business that mainly served minority clientele are less likely to survive. This is not unusual, as studies found that immigrants are more likely to be in traditional businesses, which are industries with a low barrier of entry and thus have a higher probability of exiting. Also, by analyzing the transition from entrepreneurship, Joona (2010) found that natives are more likely to exit entrepreneurship to wage-employment, while immigrants are more likely to exit to unemployment, which is an indication of being forced out of business rather than

finding a better alternative. The authors attributed this low survival likelihood of immigrant-founded firms to the disadvantaged location of the business and the transient nature of immigrants (Bates, 1999; Irastorza, 2010; Joona, 2010; Kerr and Kerr, 2017; Mueller, 2014; Vinogradov and Isaksen, 2008).

A possible unwanted effect of the success of immigrant-founded firms is that they crowd out native-founded firms. Unel (2018) found evidence of crowding out native-founded firms among females but not among males, while Fairlie and Meyer (2003) found evidence that immigrant-founded firms might inhibit the entry of native-founded firms in the United States.

Determinants of Innovation

There have been theories about what factors affect firms' innovativeness or commercialization performance and how significant those factors are as covariates with innovation (Souitaris, 1999). Some of the factors identified by researchers pertain to the characteristics of the founder/s of the firm or (individual characteristics), while other factors concern the characteristics of the firm.

The main individual characteristic is the human capital accumulated by the founder/s of the firm. Higher human capital (either generic or specific human capital) of the founder/s is expected to be related positively with the firm innovativeness or commercialization activities (Alarcón et al., 2019; Audretsch et al., 2016; Farace and Mazzotta, 2015; Hadjimanolis, 2000; Protogerou et al., 2017).

The studies of the effect on the commercialization performance of the firm from having a female founder in the founding team are limited. Nevertheless, some studies on the relationship between scientists in academia and commercialization performance have found that females, in general, are less likely than males to commercialize or pursue patenting for their inventions despite having the same or higher quality of innovations (Hunt et al., 2013; Whittington and Smith-Doerr, 2005). Hunt et al. (2013) have found evidence of lower patenting activity for females holding science and engineering degrees compared with similarly qualified males, and that only 5.5% of the patents granted to females commercialized. Also, while different from a female founder, Shane et al. (2015) have found evidence, in a randomized experiment, that technology licensing officers are more reluctant to support university spinoffs (as a step to commercialization of faculty members) of females regardless of the actual innovation characteristic.

Characteristics of the firm that have been hypothesized to affect innovation or commercialization performance are mainly the size of the firm, R&D intensity, age of the firm, the strategy of the firm (i.e., export orientation), and the strategic cooperation and/or agreements with external entities (e.g., universities, other firms, public agencies).

Firm size and R&D intensity are closely related to each other in the literature. Firm size can be measured by sales or by the number of employees. Many researchers tried to assess Schumpeter's influential theory that larger firms are more innovative, especially that larger firms might possess higher market power and higher revenues that can finance a formal internal R&D sector (Alarcón et al., 2019; Cohen, 2010; Hansen, 1992; Symeonidis,1996).

Proponents of Schumpeter's view cited the ability of large firms to diversify, therefore mitigate risk that is caused by the uncertainty of funding new projects, and to obtain higher return on R&D investment (Cohen, 2010). However, Schumpeter's theory does not account for variations generated from the specific industry or the sector that the firms belong to and only concentrated on the association between the size of the firm and R&D intensity as a measure of innovation (Alarcón et al., 2019; Bhattacharya and Bloch, 2004; Symeonidis,1996). Using R&D intensity (innovation input) as a measure of innovation is problematic as some small firms that do not have an internal R&D laboratory still are involved in R&D agreements or activity and have differences in calculating and reporting R&D intensity (Hansen.1992; Symeonidis,1996). Smaller firms might have advantage in the flexibility of management and the speed of decision-making process which might be helpful in sizing opportunities in technologically fast-moving industries, whereas larger firms are more rigid, and decisions might go through multiple channels due to the higher bureaucracy nature of large firms (Cohen, 2010; Hadjimanolis, 2000). The size of the firm might be positively related to higher R&D investment, but it does not directly lead to an increase in commercialization performance as more complex factors are involved in this process (Alarcón et al., 2019; Becheikh et al., 2006; Symeonidis,1996). Some researchers even found a negative association between firm size and innovation output (Hansen, 1992).

R&D intensity as an innovation input is expected to positively influence innovation output in terms of successfully commercialized goods or services. Another aspect of R&D intensity is indirect as increasing the firm's investment in R&D is

hypothesized to increase the firm's absorbing abilities (Cohen and Levinthal, 1989). This makes the firm have a better utilization of external knowledge, which could increase the firm's innovation output (Cohen and Levinthal, 1989). However, from a policy perspective, increasing R&D spending by itself is not enough to commercialize successfully or have economically useful goods or services (Braunerhjelm et al., 2010; Michelacci, 2003). Increases in economically useful commercialization is linked to economic growth where the entrepreneur plays an essential role in turning inventions into commercial products or processes.

Age of the firm is also proposed as a determinant of innovation and it can relate positively with the size of the firm, yet some types of firms might remain small in terms of the number of their employees. Some researcher stated that younger firms are more motivated to commercialize and be more innovative than older firms, while others view that older firms have accumulated more experience and might be more efficient in predicting the success of funded projects, and hence older firms have commercialization success more than younger firms (Becheikh et al., 2006).

Export oriented firms can compete in the international market and this ability comes from competitive advantage, and thus exporting is expected to increase innovativeness of the firm to maintain competitive advantage (Alarcón et al., 2019; Bhattacharya and Bloch, 2004; Hadjimanolis, 2000; Protogerou et al., 2017; Souitaris, 1999). The strategic cooperation and/or agreements with external entities, such as a university or other firms, is an indication of the firm's external knowledge source. The existence of such agreements is expected to have a positive effect on the firm's

commercialization, and this effect is more announced in smaller firms that might lack the financial sources needed to have a formal internal R&D sector (Hadjimanolis, 2000; Protogerou et al., 2017).

Conclusion and Unanswered Questions from the Literature

In this chapter, I reviewed the literature that addressed immigrant entrepreneurship. This literature is interdisciplinary, with contributions from scholars in economics, sociology, and management. Differences in discipline emphasis caused differences in points of emphasis and conclusions about immigrant entrepreneurship, yet many of the scholars regardless of discipline focused on determining the factors that were associated with immigrants choosing to be entrepreneurs.

The occupational choice of the immigrant depended on many factors combined where the immigrants are considered rational agents who choose to maximize their potential earnings in the future and therefore compare potential wage-employment earnings and entrepreneurship earnings. Those earnings are affected by individual factors and environmental factors. It is challenging to identify the exact combination of factors that caused immigrants to choose entrepreneurship as opposed to paid employment. Consequently, the literature differs in the conclusions from authors about the effect that these factors have on the immigrant's choice. Some differences can be attributed to scholars using different measures for some factors such as human capital, while other differences could be due to researching in different settings. There is evidence in the literature that immigrants who faced adverse environmental factors in the host country

(e.g., discrimination, recession in the economy upon arrival, etc.) are more likely to be entrepreneurs. However, immigrants might not have higher incomes than similarly skilled natives, and their establishments might also have a low survival propensity, which is evidence that they were pushed to entrepreneurship. There is also evidence of pull factors created by the advantageous circumstances in the host country, making immigrants more likely to be entrepreneurs. Immigrant entrepreneurs who were allured by an opportunity are more likely to have a higher income than similarly skilled immigrant-paid employees, indicating that an opportunity pulled them. Scholars agree that immigrant males and immigrants who spent more time in the host country are more likely to be entrepreneurs. However, the literature on immigrant entrepreneurship reached different conclusions about the effects that human capital, age, and social capital have on the probability of becoming an entrepreneur.

Research focus on immigrant-founded firms' commercialization performance is limited, and most of it is focused on immigrant-founded firms in the United States. Immigrant-founded firms are more likely to commercialize in high-tech, high-impact industries than native-founded firms (Brown et al., 2019).

The research reviewed here concentrated either on a single host country or parts of the host country, which compromises external validity of the results. Additionally, there is limited cross-country immigrant entrepreneur research that would help to dissect the effect of different immigration policies and different market environments in destination countries on immigrant entrepreneurship and help in the generalization of results. Even though some papers that researched immigrant entrepreneurship, including

(Andersson and Wadensjo, 2004; Mestres, 2010; Schuetze and Antecol, 2006; Van Tubergen, 2005) compared multiple countries, they often combined separate datasets or compared statistics between two or three countries. Only one study reviewed in this dissertation (Hermes and Leicht, 2010) utilized a uniform dataset to compare European countries, but it was descriptive and suffered from some limitations (e.g., some countries provided incomplete data).

The diversity of the founding team could boost innovation and commercialization. Ozgen et al. (2013) found that having diversity in the working force of the firm increases the innovativeness of the firm and since most firms in the AEGIS dataset have relatively fewer employees that would a cross section of firms in a country, I assume that having diversity in the founding team can have similar effect. Highly skilled immigrant entrepreneurs offer more to the economy in terms of opening new flows of technology through their connections and knowledge of their home countries (Saxenian, 2002). Coming from diverse backgrounds, immigrant entrepreneurs can have different perspectives which would increase the team's absorptive capability of innovative ideas.

Numerous studies have focused on the immigrant's propensity to start a business and some on earnings, but fewer are focused on the probability of survival and even less on innovation and commercialization activity of immigrant-founded firms. Also, most studies on immigrant entrepreneurship focused on high-tech industries, whereas in this dissertation, I utilize the AEGIS dataset which also have information about commercialization in low-tech industries.

The literature suggests that immigrant entrepreneurs, at least in the United States, are highly educated and tend to be sorted into industries that have higher commercialization potential (Fairlie and Lofstrom, 2015). However, this finding might only be relevant for the United States because of the way that it attracts talented and highly educated immigrants (Azoulay et al., 2020; Schuetze and Antecol, 2006; Wadhwa et al., 2007). While the United States has historically targeted immigrant mostly by talent, Europe targeted certain nationalities regardless of talent (OECD, 2010). However, some European countries changed their immigration policy recently to target talented immigrants (OECD, 2010).

This shortage of immigrant entrepreneurship studies makes the economic impact of immigrant-founded firms inconclusive and creates difficulties for deducing policy implications. Policy makers have recently identified the important association between entrepreneurship and growth where entrepreneurship is a valuable tool to boost knowledge diffusion (Braunerhjelm et al., 2010). Policy makers could enhance the entrepreneurial environment by identifying and eliminating obstacles or use incentives such as tax cuts (Ahmad and Hoffmann, 2008). The role of the policy maker stems from making sure that the limited resources are optimally allocated to spur economic growth and to increase welfare for the citizens. These targeted policies would help in tapping the potential from immigrant entrepreneurs and to have a competitive lead in a connected world.

CHAPTER III

OVERVIEW OF THE DATA

This chapter provides an overview of the data used in this dissertation. I use the AEGIS (Advancing knowledge-intensive entrepreneurship and innovation for growth and social well-being in Europe) dataset. This dataset is derived from a European Commission funded AEGIS project under Theme 8 "Socio-Economic Sciences and Humanities" of the 7th Framework Program for Research and Technological Development (Caloghirou et al., 2011). This project aimed to explore and observe knowledge-intensive entrepreneurship (KIE) recurrently in different sectors and countries that differ in their sizes and socioeconomic models (Caloghirou et al., 2011).

A definition of the socioeconomic model is that it is a unique system of institutions and regulations in a country that reflects the perspective of the majority of the population in that country (Combarnous and Rougier, 2011). The AEGIS survey team's interest in KIE was due to its proposed effect on economic growth and social prosperity (Caloghirou et al., 2011). To better see this connection, this prompts the need to define Knowledge-intensive entrepreneurship, which could be defined according to Malerba and McKelvey (2018, p. 6) as "Knowledge-intensive innovative entrepreneurial firms are new learning organizations that use and transform existing knowledge and generate new knowledge in order to innovate within innovation systems."

This definition captures the main elements that make entrepreneurship knowledge-intensive, which are: the firm must be a new one, must utilize existing knowledge, must be innovative, and finally must capitalize on an innovative opportunity (Malerba and McKelvey, 2018).

Other datasets were considered for the analysis in this dissertation such as the European Labor Force Survey (EU-LFS) and the Global Entrepreneurship Monitor (GEM). The European Labor Force Survey (EU-LFS) covers all EU countries allowing for cross-national comparisons. It has information on immigration status and reasons to immigrate and reasons to start a business, though it does not include information about innovation and knowledge-intensive businesses. The Global Entrepreneurship Monitor (GEM) is a general population survey that covers countries around the world, which enables cross-national comparisons. The GEM dataset contains information on the level of innovativeness in both informal and formal activities. Nonetheless, with independent research teams in participating countries, they have some differences in surveying methods, even if it is slight.

The AEGIS dataset has the advantage of cross-country coverage. As a unified dataset, the use of AEGIS will mitigate some of the limitations from using separate datasets for each country, as seen with some studies reviewed in Chapter II (Hermes and Leicht, 2010; Mestres, 2010; Neupert and Baughn, 2013; Van Tubergen, 2005).

Not using a unified dataset might result in differences in key definitions (e.g., the definition of self-employment or who is an immigrant), which could result in

overestimating or underestimating the magnitude of immigrant entrepreneurs in different countries leading to different or inaccurate conclusions.

The tool used in the AEGIS cross-sectional data was a computer-aided telephone interview survey conducted in late-2010 and through part of 2011 that contacted firms founded between 2001 and 2007 in ten European countries. The countries are: Croatia, Czech Republic, Denmark, France, Germany, Greece, Italy, Portugal, Sweden, and the United Kingdom. The sectors in AEGIS are the high-tech, medium-tech, and low-tech manufacturing sectors along with knowledge intensive business services (KIBS). The industries in AEGIS are coded with the statistical classification of economic activities (NACE Rev. 1.1).

According to Caloghirou et al. (2011), industries in AEGIS that are categorized as high-tech are aerospace; computers and office machinery; radio-television and communication equipment; manufacture of medical instruments; pharmaceuticals. Industries that are categorized as medium to high-tech are electrical machinery; machinery and equipment; chemical industry. Industries that are categorized as low-tech are paper and printing; textile and clothing; food, beverages and tobacco, while the medium-tech to low-tech manufacturing sectors are basic metals and fabricated metal products. Finally, the KIBS sector includes telecommunications; computer and related activities; research and experimental development; other business services activities. Table 3.1 shows the industries within each chosen sector in the survey.

Table 3.1 Industries within each Chosen Sector in the AEGIS Survey

Sectors and Industries
High-Tech Manufacturing Sectors
Aerospace
Computers and office machinery
Radio-television and communication equipment
Manufacturers of medical, precision & optical instruments
Pharmaceuticals
Medium to High-Tech Manufacturing Sectors
Manufacture of electrical machinery and apparatus
Manufacture of machinery and equipment
Chemical industry (excluding pharmaceuticals)
Medium to Low-Tech Manufacturing Sectors
Basic metals
Fabricated metal products
Low-Tech Manufacturing Sectors
Paper and printing
Textile and clothing
Food, beverages and tobacco
KIBS Sectors
Telecommunications
Computer and related activities
Research and experimental development
Other business services activities

Note: Adapted from "Advancing knowledge-intensive entrepreneurship and innovation", by Caloghirou et al., 2011, p. 16.

The AEGIS dataset's creators collected data that spanned ten European countries with differences in size, policies, region, and business environment. For instance, Calghirou et al. (2011) final report on AEGIS dataset states that a higher proportion of firms in Croatia, Greece, Italy, and Portugal and to a lesser extent the Czech Republic identified facing severe external barriers to their firms compared with the other group of countries in the dataset. Also, this group of countries (Croatia, Czech Republic, Greece, Italy, and Portugal) are considered moderate or modest innovative European countries compared with Denmark, France, Germany, Sweden, and the United Kingdom, who are considered innovative leaders or strong innovators (The European Innovation Scoreboard, European

Commission, 2019)[1]. Global Innovation Index (GII)[2] ranks Denmark, France, Germany, Sweden, and the United Kingdom at a higher ranking than Croatia, Czech Republic, Greece, Italy, and Portugal, as depicted in Table 3.2.

Country-level factors were identified by several institutions that have created indices, such as the Summary Innovation Index (SII)[3] and (GII).

Table 3.2 Global Innovation Index and Ranking, by Country

Country	Order	Global Innovation Index
Croatia	9	40.7
Czech Republic	6	49.7
Denmark	3	59.9
France	5	51.8
Germany	4	56.2
Greece	10	35.3
Italy	8	44.5
Portugal	7	45.3
Sweden	1	64.8
The United Kingdom	2	61.2

Source: The Global Innovation Index. (Dutta and Lanvin, 2012)

[1] The EIS uses the following classification scheme:
Innovation Leaders are all countries with a relative performance above 125% of the EU average.
Strong Innovators have relative performance between 95% and 125%.
Moderate Innovators have relative performance between 50% and 95%.
Modest Innovators have relative performance below 50%.

[2] This GII a composite indicator calculated as an average of many indices such as institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs.

[3] SII is a composite indicator calculated as an average of the following indicators: human resources, attractive research systems, innovation-friendly environment, finance and support, firm investments, innovators, linkages, intellectual assets, employment impacts, sales impacts, performance and structure of the economy, business and entrepreneurship, governance and policy framework, and demography.

These factors help identify differences across countries in entrepreneurship and business environments, especially the effect of such variations on innovation and commercialization. SII and GII are focused on several aspects, yet not calculated in the same way. The most prominent factors that are in both indices are pertaining to institutions and governance. For instance, having an infrastructure that allows a lower transaction cost and better access to markets might increase the firms' commercialization ability. Also, having a high score on the rule of law indicator, which measures the overall enforcement of the law in the country, such as contract enforcement, property rights, means that the firms in this country have a more trusting environment to innovate (Dutta and Lanvin, 2012). Other factors include income and size of the country, as countries with higher income or larger populations are expected to increase demand for innovative goods and services. Also, inflows of recent technologies from foreign direct investment (FDI) and having an attractive research environment that attracts research collaboration with international researchers can increase knowledge absorption and diffusion (i.e., commercialization) of the country's firms.

The AEGIS dataset contains information on 4,004 KIE firms from a possible sample of 202,286 firms, which was obtained from the Amadeus database and other sources as a starting point to contact eligible firms (Caloghirou et al., 2011). The source sample overrepresented companies from France, Italy, and Germany, which is precisely why in the final sample, AEGIS project team tried to oversample smaller countries (i.e., the Czech Republic and Croatia). Oversampling helps to have a better representation of smaller countries rather than trying to reflect the same distribution of firms as in the

original sample from Amadeus database and others. The effect of this non-random sampling could be tested in a robustness check in the analysis using weights obtained from Hodges and Link (2017), but these researchers and others have found that analyses using weighted data is virtually identical to using un-weighted data. Un-weighted data are used in this dissertation.

The survey starts with screener questions aimed at making sure that the firm is newly established, which is an essential part of the definition of KIE. Also, the objective was to establish the main activity of the firm and how it was established. Subsequently, the survey contained six main sections that asked comprehensive questions about the firm to one of the founders in his or her language, which are general information about the firm, detailed characteristics of the founding team, the formation process of the firm, the market environment, firm strategy, innovation and the business model, and firm performance and the effect of the economic crisis on the firm. If the founder was not available to answer the questions or did not know the answer to questions pertaining to other founding team members, another representative of the firm was reached. It is not clear whether the first founder in this dataset is the main founder of the firm. However, this dissertation defines the first founder of the firm as the main founder.

CHAPTER IV

DESCRIPTIVE STATISTICS

This chapter compares the characteristics of immigrant-founded firms to native-founded firms. In this dissertation, an immigrant-founded firm is defined as a firm that has an immigrant founder as the first founder of the founding team as recorded in the AEGIS's survey, and an immigrant is a person who was born in a foreign country. Information on the country of birth is not available in the AEGIS dataset.

The focus of this dissertation is to analyze the innovative performance of immigrant-founded firms and native-founded firms. Innovative performance is measured by whether the firm had commercialized novel products or services in the three years prior to the AEGIS survey. This measure of innovative performance offers a quantification of a dimension of innovative activity that merits investigation, and in this dissertation, this dimension is compared among firms based on the immigration status of the firm's founder (Brown et al., 2019; Hart et al., 2009). Thus, the central empirical question considered in this dissertation is whether immigrant-founded firms are more or less likely to commercialize than native-founded firms.

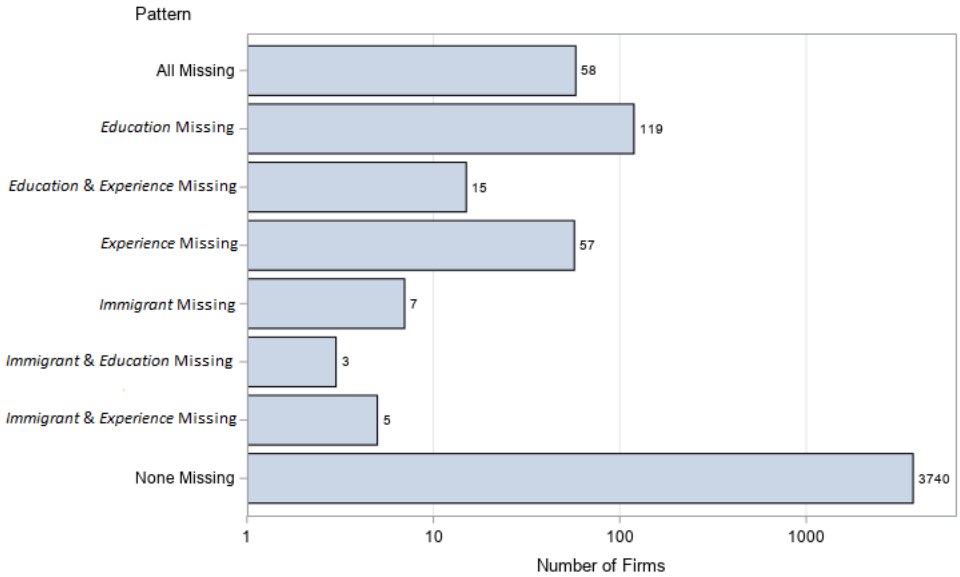
The descriptive analysis in this chapter shows variations among immigrant-founded firms and native-founded firms in the characteristics of the firm and of the lead founder. Also, variations among countries and sectors are shown. However, most of the comparative statistics focus on commercialization.

Sampling Distribution of Firms

The AEGIS survey resulted in a dataset of 4,004 firms. I deleted 57 firms for having missing information on the immigration status of all founders and other individual characteristics. Also, another 16 firms were deleted for having "I don't know" as a response from the lead founder when asked about his/her immigration status.

Educational attainment, a key human capital variable, was missing for 195 first founders, and the experience of first founders was missing for 135. Due to the overlapping of the missing variables, Figure 4.1 clarifies the missing pattern of education, experience, and the immigration status of the first founder that led to a sample of 3,740 firms.

Figure 4.1 Pattern of Missing Values



Note: Missing include invalid response such as "I don't know."

Table 4.1 lists the variables used in the analysis. *Commercialization* is the variable used to measure innovative performance. The firm is characterized as innovative with *Commercialization* = "1". *Commercialization* = 1 if it introduced any new or improved upon existing goods or services in the three years prior to the AEGIS survey.

Other variables are listed as controls or independent variables for their likely influence on the probability of commercialization, which are the most frequent determinants found in the literature. The individual variables are *Female* and human capital variables, either generic, such as *FounderAge* and *Education,* or specific, such as *Experience* which is years of experience in the same sector as the current firm and *LastOccupation* which is the founder's business experience prior to the establishment of the current firm. Also, Table 4.1 has firm specific variables, such as *FirmAge. R&D* measures the intensity of spending on R&D as a percentage of sales, and the size of the firm measured by the number of full and part time employees in addition to the number of founders (*Employees*). Other relevant firm-specific variables were constructed, such as *University,* which is an indicator of the importance of university as a source of knowledge to the firm. This variable is constructed from an original survey question that had a 5-point Likert scale. To construct this variable, I collapsed the responses to have a binary variable where *University* = "1" if the firm found that universities were an important or extremely important source of knowledge, and *University* = "0" if the firm found that universities were not important or of little importance or were neutral about the importance of universities as a source of knowledge.

Table 4.1 Description of Variables.

Variables	Definition	Survey Question
Dependent Variable		
Commercialization	= 1 if the firm introduced new or improved goods and services. = 0 otherwise	Q27a. Did this company introduce new or significantly improved goods or services during the past three years?
Independent Variables and Controls		
Female	=1 if female =0 otherwise	Q4. Who founded your firm?[a]
FounderAge	Continuous variable for the age of first founder[b].	Q9. What is the age of (the first listed founder)?
Education	Continuous variable for years of Education	Q5. What is/are the highest educational attainment of the first listed founder?
Experience	Continuous variable for the years of experience in the same sector as the firm for the first founder.	Q7. Approximately how many years of professional experience did (the first listed founder) have in the current sector your company is active before the establishment of this company?
LastOccupation	= 1 if the first founder was a business owner prior to the establishment of the current firm. = 0 otherwise	Q6. What was the last occupation of (the first listed founder) before the establishment of this company? (Owner of existing or ceased Firm or self-employed.)
FirmAge	Continuous variable for age of the firm (2011-established year)	S2. In which year was your firm established?
R&D	Continuous variable for the percentage of firm sales spent on R&D (R&D intensity)	Q32. On average, which percentage of your sales has been spent on R&D during the last three years?
Employees[c]	Continuous variable for the number of employees[d]	Q1. What is the total number of full-time and part-time employees in your company?
University	=1 if universities are important as a source of knowledge =0 otherwise	Q24_5. Please evaluate the importance of the following source of knowledge for exploring new business opportunities on a 5-point scale (universities).
Export	Continuous variable for the percentage of firm sales sold internationally.	Q16_3. During the last three years what was the % of your firm's sale in the international market?
TechCo	=1 if the firm has any type of technological cooperation agreements =0 otherwise	Q26 (1-7). Please indicate to what extent your company has participated in the following types of agreements.[e]
CompLevel	=1 if the firm faces many competitors. =0 otherwise	Q15. Right now, are there other businesses offering the same products and/or services to your potential? customers?

Continued...

Continued...

Variable	Definition	Survey Question
Immigrant	= 1 if the first founder is an immigrant = 0 otherwise	Q10. Was (the first listed founder) born in this country?
Independent Variables and Controls		
Country	10 EU countries of residence	N/A
High	=1 if the industry is High-tech =0 otherwise	Grouped from industry NACE rev 1.1 codes.[f]
KIBS	=1 if the industry is KIBS =0 otherwise	Grouped from industry NACE rev 1.1 codes.

[a] This question is answered by the first founder in this format and the gender of the first founder was deduced from the title of (Mr., Mrs., and Ms.)
[b] *FounderAge* is a continuous variable created by using the median of the following 4 categories: 18-29, 30-39, 40-49, and 50 and older where in the final category 55 was used as the median to be consistent with the previous categories.
[c] *Employees* is the number of total employees as a measure of the size of the firm, which is equal to (the number of founders + the number of full-time employees + ½ of the number of part-time employees).
[d] Calculation is adapted from "R&D as an investment in knowledge-based capital," by Link and Swann (2016 p. 17).
[e] The agreements are: strategic alliance, R&D agreement, technical cooperation agreement, licensing agreement, subcontracting, marketing or export promotion, and research contract-out.
[f] See Table 3.1 for more details on the industries under each sector.

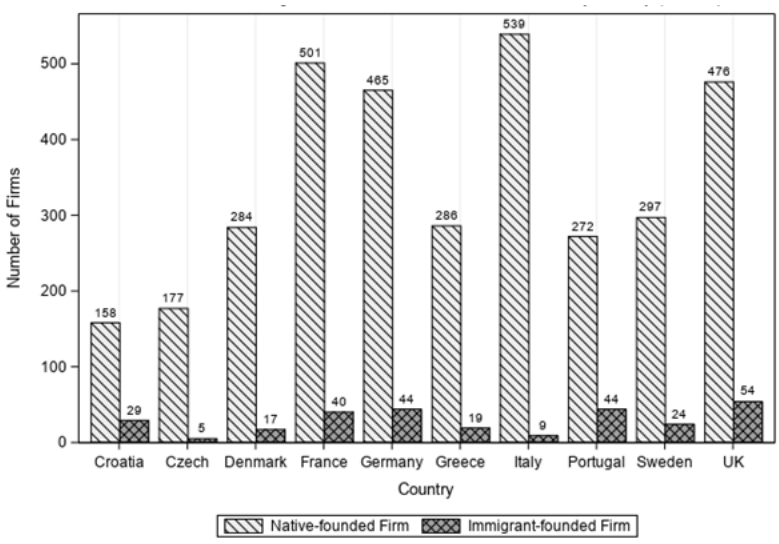
Other firm specific variables are *Export*, which is the percentage of international sales to total sales of the firm, and *TechCo*, which is a binary variable constructed from the responses of the founder of the firm to 7 questions about the firm's technological agreement participation with other partners. The original response has a 5-point Likert scale for the scope or the frequency of such agreements. Again, for construction, I collapsed the responses in the same manner as in the variable *University.* Then I constructed the dichotomous variable *TechCo* = "1" if any agreement existed and *TechCo* = "0" otherwise. Also, *CompLevel* was constructed to control for market conditions faced by the firms where *CompLevel* = "1" if the firm face many competitors and *CompLevel* = "0" otherwise. Many country-level factors could impact innovation and

commercialization of firms. Therefore, adding country fixed effects into the empirical model controls for these differences among countries.

Of the same of 3,740 firms, 3,455 are native-founded firms (92.4%). Figure 4.2 shows the distribution of immigrant-founded and native-founded firms across the ten European countries represented in the AEGIS dataset.

Table 4.2 shows the percentage of firms, by country, that are immigrant firms. For the full sample of firms, 8% have an immigrant founder. The percentage of immigrant-founded firms varies across countries. For example, the share of immigrant-founded firms in Croatia (16%) is the highest followed by Portugal (14%), the United Kingdom (10%) and Germany (9%). Italy (2%) and the Czech Republic (3%) have the least percentage of firms that are immigrant-founded.

Figure 4.2 Distribution of Immigrant-Founded Firms and Native-Founded Firms, by Country (n=3,740)



The percentage of firms that are native-founded and immigrant-founded also varies across sectors as shown in Table 4.3. The sector most represented by both immigrant-founded firms and native-founded firms is the KIBS sector.

Table 4.2 Distribution of Immigrant-Founded Firms, by Country (n=3,740)

Country	Number of Immigrant Firms	Percent
Croatia (n=187)	29	16%
Czech Republic (n=182)	5	3%
Denmark (n=301)	17	6%
France (n=541)	40	7%
Germany (n=509)	44	9%
Greece (n= 305)	19	6%
Italy (n=548)	9	2%
Portugal (n=316)	44	14%
Sweden (n=321)	24	7%
United Kingdom (n=530)	54	10%
Total	285	8%

Table 4.3 Distribution of Firms, by Sector (n=3,740)

Sector[a]	Immigrant-Founded Firms	Native-Founded Firms	Total
Low-tech[b]	100	1392	1492
	35.09%	40.29%	39.89%
	6.70%	93.30%	100%
High-tech[c]	38	356	394
	13.33%	10.30%	10.53%
	9.64%	90.36%	100%
KIBS[d]	147	1707	1854
	51.58%	49.41%	49.57%
	7.93%	92.07%	100%
Total	285	3455	3740
	100.00%	100.00%	100.00%

[a] In combining industries to sectors, I use the same definition used by Caloghirou et al. (2011), which was depicted in Table 3.1. I combined medium to low-tech manufacturing sector with the low-tech sector and combined medium to high-tech manufacturing sector with the high-tech sector, which resulted in three main sectors.

[b] Low-Tech manufacturing sectors includes paper and printing, textile and clothing food, beverages and tobacco, basic metals, fabricated metal products.

[c] High-Tech manufacturing sectors includes aerospace, computers and office machinery, radio-television and communication equipment, manufacturers of medical, precision, and optical instruments, pharmaceuticals, manufacture of electrical machinery and apparatus, manufacture of machinery and equipment, chemical industry (excluding pharmaceuticals)

[d] KIBS sector includes telecommunications, computer and related activities, research and experimental development, other business services activities.

The distribution of firms across countries by sectors is in Table 4.4 where in most countries, the greatest percentage of immigrant-founded firms is also in the KIBS sector. From Table 4.4, there are variations in the clustering of firms across countries and sectors. However, in no country is the highest concentration of immigrant-founded firms in the high-tech sector.

Relevant variables from Table 4.1 are shown in Tables 4.5, 4.6 and 4.7 where descriptive statistics on the immigrant status of founders is given for each variable and further divided by country in Table 4.6 and by sector in Table 4.7.

Table 4.5 shows that there is not a significant difference in *Commercialization* between immigrant-founded firms and native-founded firms. The variables for which there is a significant difference are *FounderAge*, *Education*, *Export*, and *TechCo*.

Table 4.4 Distribution of Firms, by Country and by Sector (n=3,740)

	Immigrant-Founded Firms				Native-Founded Firms			
Country	n	Low-tech	High-tech	KIBS	n	Low-tech	High-tech	KIBS
Croatia (n=187)	29	58.62%	31.03%	10.34%	158	58.23%	15.82%	25.95%
Czech Republic (n=182)	5	40.00%	0.00%	60.00%	177	45.76%	12.43%	41.81%
Denmark (n=301)	17	23.53%	17.65%	58.82%	284	19.72%	9.86%	70.42%
France (n=541)	40	20.00%	12.50%	67.50%	501	35.33%	11.78%	52.89%
Germany (n=509)	44	31.82%	9.09%	59.09%	465	28.39%	12.47%	59.14%
Greece (n= 305)	19	47.37%	5.26%	47.37%	286	55.94%	6.99%	37.06%
Italy (n=548)	9	55.56%	22.22%	22.22%	539	54.36%	9.83%	35.81%
Portugal (n=316)	44	40.91%	13.64%	45.45%	272	52.94%	9.19%	37.87%
Sweden (n=321)	24	45.83%	16.67%	37.50%	297	31.31%	9.09%	59.60%
United Kingdom (n=530)	54	22.22%	7.41%	70.37%	476	34.45%	8.19%	57.35%
Total (n=3,740)	285	35.09%	13.33%	51.58%	3455	40.29%	10.30%	49.41%

Table 4.5 Summary Statistics on Relevant Variables, by Immigrant-Founded Firms and Native-Founded Firms (n=3,740)

	Immigrant-Founded Firms (n=285)		Native-Founded Firms (n=3,455)	
Variable	Mean	Standard Deviation	Mean	Standard Deviation
Commercialization	0.64	0.48	0.63	0.48
Female	0.18	0.39	0.15	0.36
FounderAge	43.37**	8.54	44.53**	9.26
Education	15.56***	3.11	14.73***	3.63
Experience	12.21	9.18	13.37	10.57
LastOccupation	0.25	0.43	0.25	0.44
FirmAge	6.91	2.13	7.1	2.17
R&D	14.66	21.91	12.26	19.05
Employees	13.64	23.94	13.67	41.64
University	0.19	0.39	0.16	0.36
Export	20.73***	31.76	13.84***	25.75
TechCo	0.60***	0.49	0.52***	0.50
Complevel	0.61	0.49	0.59	0.49

*** $p<0.01$, ** $p<0.05$ (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Immigrant founders, on average, are younger and have more years of education than native founders. However the difference is low in magnitude. Immigrant-founded firms have, on average, a higher percentage of exports to sale which is expected based on the review of the literature as immigrant founders benefit from international ties with their home country (Neville et al., 2014). Also, a higher share of immigrant-founded firms have external technological cooperation agreements than native-founded firms.

Table 4.6 shows that the percentage of firms in the sample that have commercialized vary among countries. Croatia and the United Kingdom have significant differences in *Commercialization* among immigrant-founded and native-founded firms, where *Commercialization* is higher among native-founded firms in Croatia and higher among immigrant-founded firms in the United Kingdom. Table 4.6 also shows that some

variables from Table 4.1 have a significant difference among immigrant and native founders in some countries.

There are only significant differences in the percentage of female founders in Denmark and Portugal where among immigrant-founded firms, there is a higher percentage of female first founders than among native-founded firms.

Regarding human capital variables, immigrant founders are found to be on average older than native founders in France, and on average younger in Germany and the United Kingdom. Also, immigrant founders have more years of education than native founders in France, Italy, and Portugal.

From Table 4.6, native founders in Sweden and in the United Kingdom have more experience from the same sector as the firm than immigrant founders. This is not surprising because immigrant founders are more likely to change their experience field than natives. Also, there is a higher percentage of immigrant founders that had a business prior to the foundation of the current firm in the United Kingdom.

Among firm specific variables, immigrant-founded firms in Denmark and in Portugal were younger than native-founded firms on average. However, in this sample of firms, all firms are relatively young and the variation in age among them is minimum. *R&D* differs considerably among native-founded and immigrant-founded firms in France and Italy where immigrant-founded firms allocated 17.6% and 36.1% of sales to R&D compared with 10.6% and 16.9% allocated by native-founded firms. *R&D* variable is a complicated variable to interpret as the nine immigrant-founded firms in Italy that spent twenty percent more on average on R&D could be in a specific industry where higher

R&D is needed. Also, higher R&D allocation could indicate that the nine firms face many competitors and need to spend much more in R&D to compete. Higher R&D could also indicate that the immigrant-founded firms are younger and need to spend this much on R&D to grow the firm.

Firm size measured by the number of employees is similar among immigrant-founded and native-founded firms, but varies by country. However, Native-founded firms in Portugal have significantly more employees on average than immigrant-founded firms. Also, immigrant-founded firms in France view the importance of universities as a source of knowledge more frequently than native-founded firms. Immigrant-founded firms have a higher ratio of exports to sales than native-founded firms but only statistically significant in Sweden and the United Kingdom. This descriptive finding agrees with previous literature that immigrant founders would be more export oriented than native founders where immigrants can have higher social capital in their country of origin (Neville et al., 2014). In France and the United Kingdom, more immigrant-founded firms have external technological cooperation agreements than native-founded firms. Table 4.6 shows differences across countries in most of the variables among immigrant-founded and native-founded firms. This indicates the heterogeneity of immigrant-founded firms across the countries. Therefore, when the whole sample of countries is combined, such as in Table 4.5, we observe no difference in these variables among immigrant-founded and native-founded firms.

Table 4.6 Summary Statistics on Relevant Variables, by Immigrant-Founded Firms and Native-Founded Firms and by Country (n=3,740)

		Immigrant-Founded Firms			Native-Founded Firms		
	Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Commercialization	Croatia (n=187)	29	0.48**	0.51	158	0.73**	0.45
	Czech Republic (n=182)	5	0.40	0.55	177	0.71	0.46
	Denmark (n=301)	17	0.65	0.49	284	0.58	0.49
	France (n=541)	40	0.50	0.51	501	0.54	0.50
	Germany (n=509)	44	0.70	0.46	465	0.58	0.49
	Greece (n= 305)	19	0.84	0.37	286	0.69	0.47
	Italy (n=548)	9	0.67	0.50	539	0.75	0.44
	Portugal (n=316)	44	0.61	0.49	272	0.69	0.46
	Sweden (n=321)	24	0.75	0.44	297	0.60	0.49
	United Kingdom (n=530)	54	0.69*	0.47	476	0.58*	0.49
Female	Croatia (n=187)	29	0.21	0.41	158	0.21	0.41
	Czech Republic (n=182)	5	0.40	0.55	177	0.11	0.31
	Denmark (n=301)	17	0.35**	0.49	284	0.12**	0.32
	France (n=541)	40	0.08	0.27	501	0.18	0.38
	Germany (n=509)	44	0.18	0.39	465	0.10	0.30
	Greece (n= 305)	19	0.11	0.32	286	0.08	0.27
	Italy (n=548)	9	0.11	0.33	539	0.20	0.40
	Portugal (n=316)	44	0.36**	0.49	272	0.20**	0.40
	Sweden (n=321)	24	0.17	0.38	297	0.18	0.38
	United Kingdom (n=530)	54	0.07	0.26	476	0.15	0.36
FounderAge	Croatia (n=187)	29	43.93	9.5	158	45.08	9.36
	Czech Republic (n=182)	5	44.4	10.5	177	42.22	9.56
	Denmark (n=301)	17	44.38	10.5	284	45.34	8.57
	France (n=541)	40	48.48**	6.79	501	44.66**	9.02
	Germany (n=509)	44	42.11***	8.29	465	45.02***	8.91
	Greece (n= 305)	19	43.21	8.48	286	45.69	8.5
	Italy (n=548)	9	44.22	7.43	539	43.57	9.81
	Portugal (n=316)	44	40.27	7.49	272	41.05	9.35
	Sweden (n=321)	24	43.38	9.22	297	45.8	9.35
	United Kingdom (n=530)	54	42.31***	8.12	476	45.69***	9.12
Education	Croatia (n=187)	29	14.55	2.32	158	15.18	2.09
	Czech Republic (n=182)	5	16	3.74	177	15.25	3.09
	Denmark (n=301)	17	15.65	3.33	284	14.59	4.37
	France (n=541)	40	16.35**	3.17	501	15.12**	3.64
	Germany (n=509)	44	16.05	4.01	465	15.21	4.25
	Greece (n= 305)	19	15.47	2.29	286	15.27	2.92
	Italy (n=548)	9	16**	4.9	539	13.76**	3.64
	Portugal (n=316)	44	14.82***	2.49	272	12.83***	4.05
	Sweden (n=321)	24	15.83	2.76	297	15.55	2.88
	United Kingdom (n=530)	54	15.48	2.91	476	14.92	3

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		Immigrant-Founded Firms			Native-Founded Firms		
	Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Experience	Croatia (n=187)	29	12	8.1	158	11.01	9.5
	Czech Republic (n=182)	5	9	7.11	177	11.56	10.24
	Denmark (n=301)	17	9.35	9.93	284	12.53	9.63
	France (n=541)	40	15.8	10.34	501	13.12	10.56
	Germany (n=509)	44	12.09	8.89	465	13.34	10.23
	Greece (n= 305)	19	12.68	7.02	286	15.22	10.23
	Italy (n=548)	9	16.67	8.66	539	13.41	11.53
	Portugal (n=316)	44	11.18	10.08	272	10.96	10.56
	Sweden (n=321)	24	11.08*	9.94	297	15.15*	11.06
	United Kingdom (n=530)	54	11.41**	8.28	476	14.76**	10.15
LastOccupation	Croatia (n=187)	29	0.17	0.38	158	0.22	0.42
	Czech Republic (n=182)	5	0.40	0.55	177	0.37	0.48
	Denmark (n=301)	17	0.24	0.44	284	0.15	0.36
	France (n=541)	40	0.08	0.27	501	0.13	0.34
	Germany (n=509)	44	0.34	0.48	465	0.29	0.45
	Greece (n= 305)	19	0.37	0.50	286	0.25	0.43
	Italy (n=548)	9	0.56	0.53	539	0.47	0.50
	Portugal (n=316)	44	0.20	0.41	272	0.28	0.45
	Sweden (n=321)	24	0.17	0.38	297	0.15	0.36
	United Kingdom (n=530)	54	0.31**	0.47	476	0.19**	0.39
FirmAge	Croatia (n=187)	29	8	1.79	158	8.13	1.80
	Czech Republic (n=182)	5	8	2.55	177	7.47	1.85
	Denmark (n=301)	17	5***	1.17	284	6.72***	2.11
	France (n=541)	40	6.68	1.87	501	6.91	2.11
	Germany (n=509)	44	6.68	2.01	465	6.44	2.09
	Greece (n= 305)	19	7.58	2.29	286	7.42	2.04
	Italy (n=548)	9	7	1.73	539	7.23	2.13
	Portugal (n=316)	44	6**	2.19	272	6.97**	2.41
	Sweden (n=321)	24	7.54	2.28	297	7.04	2.30
	United Kingdom (n=530)	54	7.37	2.07	476	7.43	2.20
R&D	Croatia (n=187)	29	11.72	13.04	158	17.42	21.62
	Czech Republic (n=182)	5	13	21.1	177	9.28	13.09
	Denmark (n=301)	17	6.82	11	284	11.97	19.16
	France (n=541)	40	17.56**	23.37	501	10.57**	18.03
	Germany (n=509)	44	14.49	23.46	465	13.44	21.59
	Greece (n= 305)	19	9.05	9.54	286	9.06	15.99
	Italy (n=548)	9	36.11*	35.6	539	16.86*	20.01
	Portugal (n=316)	44	17.55	21.91	272	10.93	15.66
	Sweden (n=321)	24	12.08	28.04	297	10	18.35
	United Kingdom (n=530)	54	14.05	21.93	476	11.35	19.88
Employees	Croatia (n=187)	29	18.62	31.68	158	19.71	37.88
	Czech Republic (n=182)	5	8.90	7	177	15.32	22.17
	Denmark (n=301)	17	6.24	5.8	284	11.43	66.29
	France (n=541)	40	9.38	18.04	501	7.60	10.95
	Germany (n=509)	44	14.48	18.34	465	12.96	25.16

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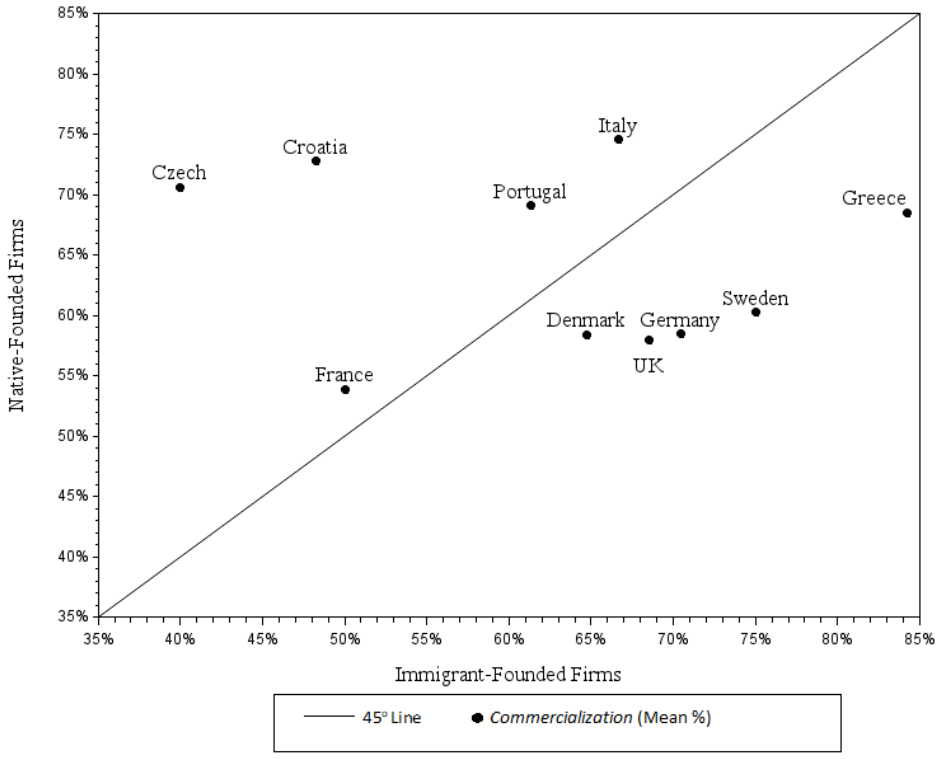
		Immigrant-Founded Firms			Native-Founded Firms		
	Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Employees	Greece (n= 305)	19	25.13	41.66	286	21.42	53.65
	Italy (n=548)	9	18.17	22.89	539	14.64	19.38
	Portugal (n=316)	44	9.95***	9.8	272	22.98***	100.12
	Sweden (n=321)	24	6.27	7.71	297	7.21	15.39
	United Kingdom (n=530)	54	17.68	33.04	476	12.39	20.01
University	Croatia (n=187)	29	0.17	0.38	158	0.30	0.46
	Czech Republic (n=182)	5	0	0	177	0.06	0.23
	Denmark (n=301)	17	0.18	0.39	284	0.13	0.33
	France (n=541)	40	0.18**	0.38	501	0.07**	0.26
	Germany (n=509)	44	0.16	0.37	465	0.15	0.36
	Greece (n= 305)	19	0.11	0.32	286	0.20	0.40
	Italy (n=548)	9	0.22	0.44	539	0.22	0.41
	Portugal (n=316)	44	0.41	0.50	272	0.32	0.47
	Sweden (n=321)	24	0.08	0.28	297	0.14	0.35
	United Kingdom (n=530)	54	0.13	0.34	476	0.09	0.29
Export	Croatia (n=187)	29	18.1	27.47	158	18.57	28.89
	Czech Republic (n=182)	5	28	38.5	177	21	30.41
	Denmark (n=301)	17	29.71	40.56	284	17.22	28.95
	France (n=541)	40	9.08	20.79	501	8.11	18.5
	Germany (n=509)	44	21.36	30.16	465	15.12	25.32
	Greece (n= 305)	19	16.68	27.21	286	12.75	26.74
	Italy (n=548)	9	27.22	39.14	539	12.56	24.59
	Portugal (n=316)	44	17.45	32.1	272	13.85	24.81
	Sweden (n=321)	24	27.08**	34.09	297	12.90**	26.28
	United Kingdom (n=530)	54	26.94**	36.07	476	15.04**	27.31
TechCo	Croatia (n=187)	29	0.52	0.51	158	0.61	0.49
	Czech Republic (n=182)	5	0.80	0.45	177	0.53	0.50
	Denmark (n=301)	17	0.53	0.51	284	0.59	0.49
	France (n=541)	40	0.58*	0.50	501	0.43*	0.49
	Germany (n=509)	44	0.59	0.50	465	0.54	0.50
	Greece (n= 305)	19	0.53	0.51	286	0.52	0.50
	Italy (n=548)	9	0.67	0.50	539	0.45	0.50
	Portugal (n=316)	44	0.57	0.50	272	0.52	0.50
	Sweden (n=321)	24	0.63	0.49	297	0.54	0.50
	United Kingdom (n=530)	54	0.72*	0.45	476	0.61*	0.49
Complevel	Croatia (n=187)	29	0.52	0.51	158	0.57	0.50
	Czech Republic (n=182)	5	0.60	0.55	177	0.66	0.48
	Denmark (n=301)	17	0.53	0.51	284	0.55	0.50
	France (n=541)	40	0.60	0.50	501	0.53	0.50
	Germany (n=509)	44	0.68	0.47	465	0.61	0.49
	Greece (n= 305)	19	0.53	0.51	286	0.57	0.50
	Italy (n=548)	9	0.56	0.53	539	0.60	0.49
	Portugal (n=316)	44	0.73	0.45	272	0.71	0.45
	Sweden (n=321)	24	0.46	0.51	297	0.57	0.50
	United Kingdom (n=530)	54	0.63	0.49	476	0.59	0.49

*** p<0.01, ** p<0.05, * p<0.1 (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Figure 4.3 highlights the differences in *Commercialization* among firms by country, where the commercialization percentage of immigrant-founded firms is presented on the x-axis and native-founded firms on the y-axis. The closer *Commercialization* get to the 45-degree line, the less difference in *Commercialization* among immigrant-founded and native-founded firms in the same country. From Figure 4.3, France, Portugal, Italy, and Denmark are closer to the line which means less differences in *commercialization* among firms. In contrast, Greece, Czech Republic, and Croatia are furthest from the line and have more differences in *Commercialization.*

Figure 4.3 *Commercialization* by Immigrant-Founded and Native-Founded Firms, by Country (n=3,740)



Relevant variables from Table 4.1 are shown in Table 4.7, and descriptive statistics on the immigration status of founders by sector are given for each variable. Native-founded firms have significantly higher *Commercialization* than immigrant-founded firms only in the high-tech sector. Also, there are more female immigrant founders in the low-tech sector compared with native founders. In the KIBS sector, native founders are older by only two years on average. Immigrant founders have on average approximately one additional year of education than native founders in the low-tech and KIBS sectors. Also, from Table 4.7 in KIBS sector, immigrant-founded firms have higher percentage of exports to sale and are involved in technological cooperation more often than native-founded firms. In general, there are difference albeit statistically insignificant among sectors in *Female*, *R&D*, *Export*, *Complevel* variables. *University* variable is only higher in the high-tech sector in immigrant firms.

Tables 4.8, 4.9 and 4.10 show *Commercialization* of firms in the low-tech, high-tech and KIBS sectors by country for immigrant-founded firms and native-founded firms. Immigrant-founded firms in the low-tech sector have a higher *Commercialization* than native-founded firms in France and the United Kingdom. Native-founded firms in the high-tech sector in Croatia have significantly higher *Commercialization* than immigrant-founded firms. Also, KIBS sector native-founded firms have higher *Commercialization* in Croatia and France, but lower *Commercialization* in Sweden and the United Kingdom. However, the differences among native-founded firms and immigrant-founded firms from Tables 4.8, 4.9 and 4.10 are marginal in France compared with the difference found in other countries.

Table 4.7 Summary Statistics on Relevant Variables, by Immigrant-Founded Firms and Native-Founded Firms, by Sector (n=3,740)

		Immigrant-Founded Firms			Native-Founded Firms		
Variable	Industry	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Commercialization	Low-Tech	100	0.63	0.49	1392	0.63	0.48
	High-Tech	38	0.58*	0.50	356	0.71*	0.45
	KIBS	147	0.66	0.48	1707	0.62	0.49
Female	Low-Tech	100	0.26*	0.44	1392	0.19*	0.39
	High-Tech	38	0.05	0.23	356	0.09	0.28
	KIBS	147	0.16	0.37	1707	0.14	0.35
FounderAge	Low-Tech	100	42.91	8.09	1392	43.95	9.5
	High-Tech	38	46.74	8.34	356	45.74	8.97
	KIBS	147	42.81***	8.75	1707	44.75***	9.09
Education	Low-Tech	100	14.34**	3.08	1392	13.5**	3.63
	High-Tech	38	15.16	3.74	356	14.09	3.92
	KIBS	147	16.49*	2.62	1707	15.87*	3.19
Experience	Low-Tech	100	11.55	9.56	1392	13.07	11.36
	High-Tech	38	13.66	9.43	356	15.42	10.51
	KIBS	147	12.29	8.87	1707	13.19	9.85
LastOccupation	Low-Tech	100	0.23	0.42	1392	0.28	0.45
	High-Tech	38	0.34	0.48	356	0.26	0.44
	KIBS	147	0.24	0.43	1707	0.24	0.42
FirmAge	Low-Tec	100	6.97	2.22	1392	7.32	2.18
	High-Tech	38	7.18	2.01	356	7.1	2.08
	KIBS	147	6.79	2.11	1707	6.92	2.16
R&D	Low-Tech	100	9.98	16.14	1392	10.07	16.62
	High-Tech	38	15.99	19.42	356	15.96	23.03
	KIBS	147	17.51	25.26	1707	13.27	19.78
Employees	Low-Tech	100	12.82	17.98	1392	13.81	20.86
	High-Tech	38	12.8	19.07	356	15.02	23.53
	KIBS	147	14.41	28.32	1707	13.27	55.14
University	Low-Tech	100	0.17	0.38	1392	0.15	0.36
	High-Tech	38	0.24	0.43	356	0.17	0.37
	KIBS	147	0.18	0.39	1707	0.16	0.37
Export	Low-Tech	100	17.31	30.27	1392	12.81	24.42
	High-Tech	38	30.74	36.28	356	23.13	31.93
	KIBS	147	20.47***	31.19	1707	12.73***	24.97
TechCo	Low-Tech	100	0.50	0.50	1392	0.44	0.50
	High-Tech	38	0.66	0.48	356	0.56	0.50
	KIBS	147	0.66*	0.48	1707	0.59*	0.49
CompLevel	Low-Tech	100	0.67	0.47	1392	0.60	0.49
	High-Tech	38	0.45	0.50	356	0.40	0.49
	KIBS	147	0.61	0.49	1707	0.62	0.48

*** p<0.01, ** p<0.05, * p<0.1 (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Table 4.8 Descriptive Statistics on *Commercialization* in the Low-tech sector by Immigrant-Founded and Native-Founded Firms, by Country (n= 1,492)

	Immigrant-Founded Firms			Native-Founded Firms		
Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Croatia (n=187)	17	0.65	0.49	92	0.72	0.45
Czech Republic (n=182)	2	0.50	0.71	81	0.68	0.47
Denmark (n=301)	4	0.25	0.50	56	0.59	0.50
France (n=541)	8	0.50*	0.53	177	0.46*	0.50
Germany (n=509)	14	0.64	0.50	132	0.60	0.49
Greece (n= 305)	9	0.89	0.33	160	0.66	0.48
Italy (n=548)	5	0.80	0.45	293	0.73	0.45
Portugal(n=316)	18	0.50	0.51	144	0.69	0.47
Sweden (n=321)	11	0.64	0.50	93	0.59	0.49
United Kingdom (n=530)	12	0.75*	0.45	164	0.58*	0.50
Total	100	0.65	0.48	1392	0.64	0.48

* p<0.1 (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Table 4.9 Descriptive Statistics on *Commercialization* in the High-tech sector by Immigrant-Founded and Native-Founded Firms, by Country (n= 394)

	Immigrant-Founded Firms			Native-Founded Firms		
Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Croatia (n=187)	9	0.22*	0.44	25	0.80*	0.41
Czech Republic (n=182)	0	0	0	22	0.82	0.39
Denmark (n=301)	3	0.33	0.58	28	0.64	0.49
France (n=541)	5	0.40	0.55	59	0.68	0.47
Germany (n=509)	4	0.75	0.50	58	0.64	0.48
Greece (n= 305)	1	1	0	20	0.55	0.51
Italy (n=548)	2	0.50	0.71	53	0.83	0.38
Portugal(n=316)	6	0.83	0.41	25	0.76	0.44
Sweden (n=321)	4	1	0	27	0.63	0.49
United Kingdom (n=530)	4	0.75	0.50	39	0.72	0.46
Total	38	0.56*	0.50	356	0.72*	0.45

* p<0.1 (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Table 4.10 Descriptive Statistics on *Commercialization* in the KIBS sector by Immigrant-Founded and Native-Founded Firms, by Country (n= 1,854)

	Immigrant-Founded Firms			Native-Founded Firms		
Country	n	Mean	Standard Deviation	n	Mean	Standard Deviation
Croatia (n=187)	3	0.33*	0.58	41	0.71*	0.46
Czech Republic (n=182)	3	0.33	0.58	74	0.70	0.46
Denmark (n=301)	10	0.90	0.32	200	0.58	0.50
France (n=541)	27	0.52*	0.51	265	0.56*	0.50
Germany (n=509)	26	0.73	0.45	275	0.57	0.50
Greece (n= 305)	9	0.78	0.44	106	0.75	0.43
Italy (n=548)	2	0.50	0.71	193	0.75	0.43
Portugal (n=316)	20	0.65	0.49	103	0.68	0.47
Sweden (n=321)	9	0.78**	0.44	177	0.60**	0.49
United Kingdom (n=530)	38	0.66*	0.48	273	0.56*	0.50
Total	147	0.66	0.48	1707	0.62	0.49

** p<0.05, * p<0.1 (statistically significant differences among immigrant-founded firms and native-founded firms using two-tailed Wilcoxon-Mann-Whitney test).

Table 4.11 Means of Explanatory Variables by *Commercialization* (n= 3,740)

Variable	*Commercialization*=1	*Commercialization*=0
Female	0.15	0.17
FounderAge	44.23**	44.81**
Education	14.94***	14.52***
Experience	13.05*	13.69*
LastOccupation	0.26	0.24
FirmAge	7.13*	6.99*
R&D	15.56***	7.05***
Employees	15.3***	10.83***
University	0.19***	0.11***
Export	16.36***	10.91***
TechCo	0.59***	0.42***
CompLevel	0.56*	0.65*
Immigrant	0.08	0.08
n	2371	1369

*** p<0.01, ** p<0.05, * p<0.1 (statistically significant differences among firms that commercialized and firms that did not using two-tailed Wilcoxon-Mann-Whitney test).

Table 4.11 shows the mean of independent variables for those firms that reported commercialization and those who did not. It appears that the founders of commercializing firms are younger and have higher education and less experience than

the founders of non-commercializing firms. However, these differences are subtle and not practically meaningful. Also, commercializing firms are slightly older, larger, and have spent a larger percentage of sales on R&D than non-commercializing firms. Higher percentage of commercializing firms realize the importance of universities as a source of knowledge, have higher percentage of exports to sales, and a higher percentage of commercializing firms have technological cooperation agreement with external partners. Fewer commercializing firms on average face fierce competition than non-commercializing firms. The significantly higher *R&D*, *Export*, *Employees* in commercializing firms could be an indicator of endogeneity as previous literature have hypothesized that the level of these variables in a firm is decided simultaneously (Aw et al.,2011). Nevertheless, further inspection is needed to determine the endogeneity of the variables.

Interpreting Descriptive Statistics in Terms of the Literature

The studies on female founder commercialization activity are limited but most studies predict a negative relationship between *Female* on *Commercialization*. Some researchers such as Ferrucci et al. (2020) have found that immigrant females are more likely to commercialize than native females with similar qualifications yet still less likely than males. The statistical analysis revealed that in some countries, there is a higher share of female founders among immigrant-founded firms than native-founded firms. However, the share of female founders of commercialized firms does not appear to be significantly different from the share of female founders of non-commercializing firms.

Human capital of the founder, whether specific or generic, is expected to have a positive association with commercialization of the firm. From Table 4.11, founders of commercialized firms have more years of education, which is in line with the literature and founders of commercialized firms have less experience in the same sector and are younger than the founders of non-commercializing firms. However, these differences, albeit statistically significant, are not empirically meaningful.

The evidence on the impact of age of the firm on commercialization is mixed (Becheikh et al., 2006; Hansen, 1992). There is a slight variation in the firm's age among firms in this dataset as all firms are considerably new firms. However, Table 4.11 shows that commercialized firms are slightly older.

In the literature, the association between the size of the firm and commercialization is mostly positive with some studies that found negative association (Alarcón et al., 2019; Bhattacharya and Bloch, 2004, Cohen, 2010; Hansen, 1992; Symeonidis,1996). Nevertheless, from Table 4.11 commercialized firms are larger than non-commercialized firms by approximately 5 employees on average.

R&D spending is hypothesized to increase commercialization activity and some studies even used R&D spending as a measure of the firm's innovativeness (Parisi et al., 2006; Brown et al., 2019; Hart et al, 2009; Souitaris, 1999). While not directly comparable to the literature, Table 4.11 shows that commercialized firms have spent higher percentage of sales on R&D than firms that did not commercialize which agrees with past studies.

Firms with export orientation are more likely to possess competitive advantage and thus have reasons to keep this advantage by commercialization (Alarcón et al., 2019; Bhattacharya and Bloch, 2004; Hadjimanolis, 2000; Protogerou et al., 2017; Souitaris, 1999). From Table 4.11 commercialized firms have a higher percentage of sales in international markets (*Export*) which agree with prior findings.

Firms that actively seek external knowledge and strategically engage in cooperative agreement are more likely to have higher commercialization activity (Hadjimanolis, 2000; Protogerou et al., 2017). From Table 4.11, higher shares of commercialized firms have such agreements and place higher importance of external knowledge than non-commercialized firms.

Studies have generally found that immigrant-founded firms are more likely to commercialize, especially those in the high-tech sector (Brown et al., 2019; Hart et al., 2009). However, Mueller (2014) is an exception; he has found no significant difference in the commercialization activity of immigrant-founded and native-founded firms by using patents as a measure of commercialization.

While Hart er al. (2009) concluded that immigrant firms might have higher level of innovation than natives, they measured innovation using patents and R&D levels and focused on the sample of high performance firms in the high-tech sector. Brown et al. (2019) used a much richer dataset yet they also focused on high-tech sector and found immigrants to be more innovative than natives. Brown et al. (2019) measured innovativeness from a direct question of whether the firm conducted any innovation in the past three years, and from other indirect measures of innovation (i.e., patents,

copyrights, R&D). Mueller (2014) focused on a homogenous immigrant group in Germany. This group of low skilled immigrants initially came from south and southeast Europe in the period of 1960-1970 to fill shortages in labor supply. In this dissertation, the group of immigrants is heterogenous and have various skill and human capital levels.

From Table 4.5, there is not a significant difference in *Commercialization* among native-founded and immigrant-founded firms, which is consistent with Mueller's (2014) finding. When *Commercialization* was segmented by country in Table 4.6, immigrant-founded firms were found to have higher *Commercialization* in the United Kingdom and lower *Commercialization* in Croatia compared than native-founded firms. Also, from Table 4.7 *Commercialization* was higher for native-founded firms in KIBS sector which contradicts the findings from Brown et al. (2019) and from Hart et al. (2009).

These differences in conclusions from contradicting the literature in the full sample to agreeing with the literature in certain countries or sectors necessitate the need to control for country and sector when analyzing innovation performance among immigrant-founded and native-founded firms.

CHAPTER V

EMPIRICAL ANALYSIS

This chapter presents the econometric model applied to the AEGIS dataset from Chapter III using variables identified in Table 4.1.

In developing the model, first I use a Probit regression model to estimate the following:

$$Y^*_i = \beta X_i + \varepsilon_i \qquad (1)$$
$$\varepsilon_i \sim N(0, \sigma^2_\varepsilon)$$

Y^*_i is an unobservable latent variable for the propensity to commercialize, where *Commercialization*$_i$ = 1 if $Y^*_i > 0$ and *Commercialization*$_i$ = 0 otherwise. ε_i is a standard normal error term. X_i in equation (1) is a vector of founder specific and firm specific variables identified in Table 4.1 that can possibly affect *Commercialization,* which are *Immigrant, Female, FounderAge, Education, Experience, LastOccupation, FirmAge, R&D, logEmployees*[1]*, University, Export, TechCo, CompLevel,* and dummy variables for *country* and *sector*. The transformation of *Employees* to *logEmployees* is to have a distribution that is closer to the normal distribution. A quadratic term for *R&D* is added to capture diminishing return of R&D intensity. In estimating the model, following the framework of Wooldridge (2010), I maximize the following log-likelihood function:

[1] *logEmployees* is the logarithm of *Employees.*

$$Max\ \Sigma_i \log L(Commercialization_i | X_i\ \beta) = \Sigma_i (Commercialization_i \log [G(X_i\ \beta)] + (1 - Commercialization_i) \log [1-G(X_i\ \beta)]) \quad (2)$$

$$0 < G(X_i\ \beta) < 1$$

$$P(Commercialization_i = 1 | X_i\ \beta) = G(X_i\ \beta)$$

$$G(X_i\ \beta) = \Phi(X_i\ \beta)$$

Where β in equation (2) indicates all parameter estimates from equation (1) including the constant, and X_i indicates all independent variables. $\Phi(.)$ is the cumulative distribution function of the standard normal.

Table 5.1 shows the correlation matrix between the dependent variable and some of the independent variables and controls to observe possible relationships. The upper values are Spearman's correlation coefficients, and the lower values are p-values that correspond to the significance levels of the association between two variables where a value lower than (0.1) indicates a statistically significant correlation between the two variables in the correlation matrix. The reason for choosing Spearman's correlation coefficient over Pearson's correlation coefficient is that most of the variables are not continuous and mostly do not have a normal distribution which is assumed by the use of Pearson's correlation coefficient.

Table 5.1 shows that many independent variables are correlated, yet mostly have a weak correlation with some exceptions. *FounderAge* is highly correlated with *Experience*, where the correlation is .484. This correlation can be expected since *Experience* increases with *FounderAge*. Including them both in the estimation will cause difficulty in disentangling their effect on *Commercialization*. Table 5.1 also shows that

R&D is significantly correlated with *TechCo* (.201), and with *University* (.178), and *Export* have a correlation of (.193) with each of *logEmployees* and *R&D*.

These correlations, especially the *FounderAge* and *Experience* correlation, prompt further examination.

To test for multicollinearity, I calculated Variance Inflation Factor (VIF) which is done by regressing each independent variable on other independent variables and obtaining R^2 from that regression then VIF would be the reciprocal of that R^2. The lowest value of VIF is 1.01, which would mean that the variable in question was almost uncorrelated with all the other regressors, and the variance of this variable is not inflated due to the correlation with other regressors. Higher values of VIF might indicate multicollinearity. From Table 5.2 the highest VIF was 1.39 for *FounderAge* and 1.38 for *Experience*, but it is not a remarkably high value, and it corresponds to an R^2 of .28. This means that while *FounderAge* and *Experience* are highly correlated, including them together in the model might not be as problematic. Other VIF values indicate that there is no multicollinearity issue with the other dependent variables.

Table 5.1 Correlation Matrix (n=3,740)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	*Commercialization*	1													
2	*Female*	-0.02 0.15	1												
3	*FounderAge*	-0.03 0.02	-0.09 <.00	1											
4	*Education*	0.06 0.00	-0.02 0.14	0.02 0.28	1										
5	*Experience*	-0.03 0.09	-0.15 <.00	0.48 <.00	-0.06 0.00	1									
6	*LastOccupation*	0.02 0.31	-0.08 <.00	0.12 <.00	-0.04 0.02	0.10 <.00	1								
7	*FirmAge*	0.03 0.05	-0.03 0.09	0.11 <.00	-0.03 0.04	-0.02 0.32	0.01 0.50	1							
8	*R&D*	0.30 <.00	-0.07 <.00	-0.04 0.01	0.12 <.00	-0.00 0.80	0.05 0.00	0.01 0.45	1						
9	*logEmployees*	0.19 <.00	-0.12 <.00	-0.02 0.36	-0.06 0.00	0.00 0.82	0.08 <.00	0.07 <.00	0.12 <.00	1					
10	*University*	0.10 <.00	0.02 0.29	0.04 0.02	0.05 0.00	0.02 0.17	-0.01 0.52	-0.00 0.93	0.18 <.00	0.03 0.05	1				
11	*Export*	0.16 <.00	-0.05 0.00	0.06 0.00	0.09 <.00	0.03 0.10	0.02 0.18	0.05 0.01	0.19 <.00	0.19 <.00	0.02 0.20	1			
12	*TechCo*	0.16 <.00	-0.05 0.00	-0.00 0.88	0.12 <.00	0.01 0.41	0.04 0.02	-0.03 0.13	0.20 <.00	0.05 0.01	0.13 <.00	0.15 <.00	1		
13	*Complevel*	-0.09 <.00	0.04 0.01	-0.06 0.00	-0.06 0.00	-0.02 0.37	0.01 0.47	-0.04 0.02	-0.14 <.00	-0.02 0.20	-0.03 0.05	-0.13 <.00	-0.05 0.00	1	
14	*Immigrant*	0.00 0.87	0.02 0.20	-0.04 0.02	0.05 0.00	-0.02 0.21	-0.00 0.84	-0.22 0.17	0.02 0.23	-0.02 0.27	0.02 0.22	0.06 0.00	0.03 0.00	0.01 0.58	1

Table 5.2 Multicollinearity Test Results

Variable	Eigenvalue	Condition Index	Variance Inflation Factor
Intercept	7.86	1.00	0.00
Female	0.95	2.88	1.05
FounderAge	0.93	2.90	1.39
Education	0.88	2.98	1.05
Experience	0.77	3.20	1.38
LastOccupation	0.67	3.44	1.03
FirmAge	0.57	3.72	1.03
R&D	0.43	4.28	1.12
logEmployees	0.38	4.53	1.05
University	0.29	5.19	1.05
Export	0.16	7.08	1.09
TechCo	0.07	10.47	1.06
CompLevel	0.03	15.13	1.04
Immigrant	0.01	25.00	1.01

Estimation Results

The results from maximizing the log-likelihood function in Equation (2) are presented in Table 5.3. The first two columns are the basic Probit model and the marginal effects with country fixed effects added to the model to control for regional differences, while the last two columns are the basic model with no regional controls. From column (1) in Table 5.3, the coefficient on the *Immigrant* variable is negative, but statistically insignificant. This basic result fails to identify a difference in innovative performance among immigrant-founded and native-founded firms. However, statistical analysis from Chapter IV suggested a difference among the firms by some sectors and countries. Therefore, I will segment the data to sub samples below based on the identified differences established in Chapter IV.

Marginal effects estimation remains similar with or without regional controls so interpreting column (4) should suffice. The average marginal effect results in column (4)

for *Education* is 0.004 which indicates that a founder with one more year of *Education* is expected to have an increase in the probability of *Commercialization* by 0.40 percentage point. Increasing *R&D* by 10 percentage points is expected to increase the probability of *Commercialization* by 10 percentage points. Average *Commercialization* was 0.64 so this is a significant effect. Larger firms are more likely to commercialize. Firms that believe that universities are important as a source of knowledge are 6.6 percentage points more likely to commercialize. Firms that increase *Export* by 10 percentage points are expected to increase the probability of *Commercialization* by 1 percentage points. Finally, firms that have *TechCo* are 9.5 percentage points more likely to commercialize. Firms that face a lot of competitors are 5.1 percentage points less likely to commercialize. This finding means that fierce competition might hinder the firm's ability to commercialize. KIBS firms are 3 percentage points less likely to *Commercialize* compared with low-tech firms. This could be because KIBS firms need more effort to commercialize than low-tech firms.

Table 5.3 Results from Probit Estimation of *Commercialization* on Explanatory Variables, (n=3,740)

	(1)	(2)	(3)	(4)
	Country Fixed Effects		No Country Fixed Effects	
Method	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.028	-0.009	-0.061	-0.021
	(0.086)	(0.029)	(0.086)	(0.030)
Female	0.010	0.003	0.026	0.009
	(0.064)	(0.021)	(0.063)	(0.021)
FounderAge	-0.002	-0.001	-0.003	-0.001
	(0.003)	(0.001)	(0.003)	(0.001)
Education	0.013**	0.004**	0.012*	0.004*
	(0.007)	(0.002)	(0.006)	(0.002)
Experience	-0.003	-0.001	-0.002	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)
LastOccupation	-0.060	-0.020	-0.015	-0.005
	(0.053)	(0.018)	(0.051)	(0.017)
Firmage	0.009	0.003	0.012	0.004
	(0.010)	(0.004)	(0.010)	(0.003)
R&D	0.035***	0.010***	0.036***	0.010***
	(0.003)	(0.001)	(0.003)	(0.001)
$R\&D^2$	-0.000***	-	-0.000***	
	(0.000)	-	(0.000)	
logEmployees	0.198***	0.067***	0.212***	0.072***
	(0.026)	(0.008)	(0.024)	(0.008)
University	0.168**	0.056***	0.198***	0.066***
	(0.066)	(0.021)	(0.064)	(0.021)
Export	0.002*	0.001*	0.002**	0.001**
	(0.001)	(0.000)	(0.001)	(0.000)
TechCo	0.288***	0.098***	0.277***	0.095***
	(0.046)	(0.016)	(0.045)	(0.016)
Complevel	-0.155***	-0.052***	-0.151***	-0.051***
	(0.046)	(0.016)	(0.046)	(0.016)
Sector				
KIBS	-0.063	-0.021	-0.088*	-0.030*
	(0.051)	(0.017)	(0.050)	(0.017)
High-Tech	0.031	0.011	0.002	0.001
	(0.079)	(0.026)	(0.078)	(0.026)
Constant	-0.616***		-0.490***	
	(0.184)		(0.169)	
Country Fixed Effects†	YES		NO	
Log likelihood	-2209.40		-2223.04	
Pseudo R^2	0.10		0.10	
Wald χ^2	427.721		403.065	
Prob > χ^2	0.000		0.000	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
† More detailed estimation results are in the Appendix.

Endogeneity of Some Independent Variables in the Model

The basic model results in Table 5.3 does not account for the possible endogeneity of *R&D*. The association between *R&D* and *Commercialization* could be simultaneous and it could have temporal lagged effects. Chapter IV statistical analysis revealed that commercialized firms spend more than double on *R&D* than non-commercialized firms. Also, many of the studies reviewed in Chapter II used *R&D* as a measure of the innovativeness of the firm. Therefore, *R&D* could be endogenous in this model. *R&D* stimulates *Commercialization* and is one of the inputs to commercialization and at the same time the R&D intensity of the firm could be affected by the past commercialization of the firm. For instance, if the firm have commercialized successfully in the past which resulted in higher financial performance, this could be an incentive for more spending on R&D in the future (Bottazzi and Peri, 2000). This association would make regressing *Commercialization* on *R&D* suffer from endogeneity bias which makes estimation inconsistent for all variables in the model.

Solving the explanatory variable endogeneity commonly requires implementing an instrumental variable method (IV) by first finding a valid instrument. Two conditions must be met to obtain an instrument that is valid, it should be correlated with the endogenous explanatory variable in question (i.e., relevance condition) but uncorrelated with the error term from the original model (i.e., exclusion condition) (Stock et al., 2002). More specifically the association between the endogenous variable *R&D* and the instrument is observed from the following first stage model:

$$R\&D_i = \lambda_1 Z_i + \lambda_2 X_i + \upsilon_i \quad (3)$$

Where Z_i is the instrument or set of instruments and X_i is the same set of covariates as in Equation (1) without the endogenous *R&D* variable. The assumption of the exclusion condition is that E [Z_i ε_i] = 0. Also, the instrument should be strong in terms of magnitude and statistical significance of λ_1 in the first stage. Having weak instrument would cause biased estimation and unreliable inference (Stock et al., 2002).

An ideal instrument would be a variable correlated with *R&D*, but only affects *Commercialization* through *R&D,* and preferably the instrument would vary at the firm level. There are many candidates for a valid instrument in the literature, such as using financial information in the firm level as cash flow would effect R&D allocation without directly affecting commercialization decisions . However, data availability does not allow finding such instruments. Therefore, I am using government policy variables, which are direct government funding *Direct2007,* and government indirect subsidies from 2007 *Indirect2007* as instruments. These variables are retrieved from the OECD (2020) R&D tax incentive indicators, and from Croatian Competition Agency (2009) for Croatia.

Governments support firms' R&D through direct support such as R&D grants and indirect support such as tax relief or tax incentives for R&D. The government main reason for intervening with supporting *R&D* expenditure is the socially sub-optimal allocation of R&D spending by private firms (Warda, 2001).

Therefore, this policy requires firms to prove the eligibility for the tax subsidy[1], yet the government have less control over what firms use this incentive for. Countries differ in regulating and implementing *R&D* incentive where some countries allow firms to deduct *R&D* capital expenditure along with *R&D* flow expenditure, and some countries allow for higher deduction for each dollar spent on R&D (Warda, 2001). *Direct2007* and *Indirect2007* are used as instrumental variable to demonstrate the impact of the government's tax incentive on the firm's decision to invest in R&D as the instruments should only effect *Commercialization* through *R&D*.

Estimation Results from Instrumental Variable Approach

Table 5.4 provides the results obtained from using an instrumental variable approach. The simple Probit from Table 5.3 is added to Table 5.4 to enhance visual comparison. The instruments used are country-specific and highly correlated with countries. Therefore, country fixed effects were not added as controls. Immigrant estimation remains negative and statistically insignificant. *R&D* estimates increased in magnitude. Many variable estimates in Table 5.4 have switched signs. This might be because both instruments are weak[2], which could distort the estimates. Also, financial crisis could have impacted the government's allocation of financial resources towards incentivizing *R&D* which could jeopardize the instrument's exogeneity.

[1] Firms who invest in R&D are entitled to claim tax incentives.

[2] First stage estimates of the instruments are not significant (F-statistic <10)

Table 5.4 Results from Probit Estimation of *Commercialization* on Explanatory Variables with Excluded Instruments, (n=3,740)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument			Direct2007		Indirect2007		Direct2007 +Indirect2007	
Method†	Probit	Marginal Effects	IV Probit	Marginal Effects	IV Probit	Marginal Effects	IV Probit	Marginal Effects
Immigrant	-0.061	-0.021	-0.065	-0.021	-0.039	-0.012	-0.060	-0.019
	(0.086)	(0.030)	(0.070)	(0.023)	(0.066)	(0.021)	(0.067)	(0.022)
Female	0.026	0.009	0.075	0.025	0.077*	0.025	0.078	0.026
	(0.063)	(0.021)	(0.052)	(0.017)	(0.047)	(0.015)	(0.049)	(0.016)
FounderAge	-0.003	-0.001	0.005	0.002	0.009***	0.003***	0.006*	0.002**
	(0.003)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Education	0.012*	0.004*	-0.014	-0.004	-0.024***	-0.008***	-0.017*	-0.005**
	(0.006)	(0.002)	(0.010)	(0.003)	(0.007)	(0.002)	(0.009)	(0.003)
Experience	-0.002	-0.001	-0.004**	-0.001**	-0.004*	-0.001*	-0.004**	-0.001**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
LastOccupation	-0.015	-0.005	-0.077*	-0.025*	-0.092**	-0.029**	-0.084**	-0.027**
	(0.051)	(0.017)	(0.046)	(0.015)	(0.038)	(0.012)	(0.043)	(0.014)
Firmage	0.012	0.004	0.014	0.005	0.009	0.003	0.013	0.004
	(0.010)	(0.003)	(0.009)	(0.003)	(0.009)	(0.003)	(0.009)	(0.003)
R&D	0.036***	0.010***	0.054***	0.018***	0.055***	0.018***	0.056***	0.018***
	(0.003)	(0.001)	(0.006)	(0.002)	(0.005)	(0.002)	(0.003)	(0.001)
$R\&D^2$	-0.000***							
	(0.000)							
logEmployees	0.212***	0.072***	0.110	0.036	-0.007	-0.002	0.081	0.026
	(0.024)	(0.008)	(0.067)	(0.023)	(0.085)	(0.027)	(0.070)	(0.023)
University	0.198***	0.066***	-0.258*	-0.084*	-0.446***	-0.136***	-0.318**	-0.101**
	(0.064)	(0.021)	(0.155)	(0.047)	(0.097)	(0.026)	(0.137)	(0.039)
Export	0.002**	0.001**	-0.004**	-0.001**	-0.005***	-0.002***	-0.004***	-0.001***
	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)

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Continued…

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument			Direct2007		Indirect2007		Direct2007 +Indirect2007	
Method†	Probit	Marginal Effects	IV Probit	Marginal Effects	IV Probit	Marginal Effects	IV Probit	Marginal Effects
TechCo	0.277***	0.095***	-0.011	-0.004	-0.204*	-0.065*	-0.065	-0.021
	(0.045)	(0.016)	(0.131)	(0.043)	(0.122)	(0.038)	(0.125)	(0.040)
Complevel	-0.151***	-0.051***	0.133	0.044	0.258***	0.082***	0.172*	0.056**
	(0.046)	(0.016)	(0.101)	(0.032)	(0.070)	(0.021)	(0.091)	(0.028)
Sector								
KIBS	-0.088*	-0.030*	-0.123*	-0.040*	-0.156***	-0.049***	-0.136**	-0.044**
	(0.050)	(0.017)	(0.073)	(0.023)	(0.058)	(0.018)	(0.067)	(0.021)
High-Tech	0.002	0.001	-0.131***	-0.043***	-0.108**	-0.034**	-0.128***	-0.042***
	(0.078)	(0.026)	(0.041)	(0.014)	(0.047)	(0.015)	(0.041)	(0.013)
Constant	-0.490***		-0.634***		-0.514***		-0.621***	
	(0.169)		(0.141)		(0.191)		(0.142)	
Country Fixed Effects	NO		NO		NO		NO	
Log likelihood	-2223.03		-18413.9		-18415.6		-18413.5	
Pseudo R^2	0.10							
Wald χ^2	403.065		2103.33		4197.44		3790.64	
Prob > χ^2	0.000		0.000		0.000		0.000	

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

† More detailed first-stage estimation results are in the Appendix.

Estimation Results from Sub-samples

From Tables 5.3 and 5.4, *Immigrant*, which is the key variable in this dissertation, is not statistically significant. However, Tables 4.9, 4.10, and 4.11 show some variations among immigrant-founded and native-founded firms in some sectors and countries. Therefore, Tables 5.5, 5.6 and 5.7 show the results from segmenting the data into sub-samples, and estimating those samples separately by sectors, countries, and country groups. Specifically, Table 5.5 shows the results from estimating the sub-sample of high-tech sector, and Table 5.6 is for Croatia[1].

Among high-tech firms (n= 394), immigrant-founded firms are 18.9 percentage points less likely to commercialize than native-founded firms. *Education* has more impact on *Commercialization* in this sector than in the full sample. A founder with one more year of education is associated with a 1.3 percentage point increase in *Commercialization*. This could have been the reason *Immigrant* estimation is negative it could be due to unobserved innovative ability differential among immigrant and native founders. Older firms are less likely to commercialize as a one-year increase in *Firmage* is associated with a decrease in *Commercialization* by 1.9 percentage points. Estimated marginal effects of *R&D* is .014 which means that an increase in *R&D* by 10 percentage points is associated with an increase in *Commercialization* by 14 percentage point. Also, firms that consider universities as an important source of external knowledge are 11.5

[1] Other country and sector *Immigrant* estimation results were insignificant and are illustrated in the Appendix

percentage points more likely to commercialize. Finally, firms with 10 parentage point increase in *Export* are 20 percentage point more likely to commercialize.

Table 5.6 reports estimation results from the sub-sample of Croatia (n=187) where 29 firms are immigrant-founded firms, and 14 firms of which have commercialized. Immigrant firms in Croatia are 20 percentage points less likely to commercialize compared with native firms. 10 percentage points higher *R&D* is associated with an increase in *Commercialization by* 7 percentage points, which is less than the estimation from the full sample. Firms with many competitors are 12.1 percentage points less likely to commercialize. Other variable estimates have switched signs or are no longer significant.

Table 5.7 segments the full sample of countries into two groups based on EIS (The European innovation scoreboard) classification of the innovativeness of countries from Chapter III. Based on this index, (Croatia, Czech Republic, Greece, Italy, and Portugal) are considered modest innovative countries and (Denmark, France, Germany, Sweden, and the United Kingdom) are considered strong innovators (European Commission, 2019). In the sample of Strong innovators (n=2202), *Immigrant* estimator is positive but not significant. However, in the sample of moderate innovators (n=1538) Immigrant firms are 9.2 percentage points less likely to commercialize than native firms. The group of moderate innovators also possess less income than the group of strong innovators. Lower income countries could have smaller market size, less human capital, or have more obstacles faced by immigrant-founded firms especially, thus became less innovative.

Table 5.5 Results from Probit Estimation of *Commercialization* on Explanatory Variables in the High-tech sector (n=394).

	(1)	(2)	(3)	(4)
Sample	All Firms		High-tech Firms	
Method	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.028	-0.009	-0.640***	-0.189**
	(0.086)	(0.029)	(0.244)	(0.074)
Female	0.010	0.003	0.081	0.022
	(0.064)	(0.021)	(0.238)	(0.064)
FounderAge	-0.002	-0.001	-0.007	-0.002
	(0.003)	(0.001)	(0.010)	(0.003)
Education	0.013**	0.004**	0.049**	0.013**
	(0.007)	(0.002)	(0.022)	(0.006)
Experience	-0.003	-0.001	0.006	0.002
	(0.002)	(0.001)	(0.009)	(0.002)
LastOccupation	-0.060	-0.020	0.174	0.047
	(0.053)	(0.018)	(0.187)	(0.050)
Firmage	0.009	0.003	-0.068*	-0.019*
	(0.010)	(0.004)	(0.036)	(0.010)
R&D	0.035***	0.010***	0.061***	0.014***
	(0.003)	(0.001)	(0.013)	(0.003)
$R\&D^2$	-0.000***	-	-0.001***	
	(0.000)	-	(0.000)	
logEmployees	0.198***	0.067***	0.034	0.009
	(0.026)	(0.008)	(0.094)	(0.026)
University	0.168**	0.056***	0.438*	0.115**
	(0.066)	(0.021)	(0.233)	(0.056)
Export	0.002*	0.001*	0.006**	0.002**
	(0.001)	(0.000)	(0.003)	(0.001)
TechCo	0.288***	0.098***	0.250	0.071
	(0.046)	(0.016)	(0.155)	(0.045)
Complevel	-0.155***	-0.052***	-0.186	-0.052
	(0.046)	(0.016)	(0.156)	(0.044)
Sector				
KIBS	-0.063	-0.021		
	(0.051)	(0.017)		
High-Tech	0.031	0.011		
	(0.079)	(0.026)		
Constant	-0.616***		-0.189	
	(0.184)		(0.606)	
Country Fixed Effects†	YES		YES	
n	3740	3740	394	394
Log likelihood	-2209.40		-193.062	
Pseudo R^2	0.10		0.20	
Wald χ^2	427.721		91.429	
Prob > χ^2	0.000		0.000	

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

† More detailed estimation results are in the Appendix.

Table 5.6 Results from Probit Estimation of *Commercialization* on Explanatory Variables in Croatia.

	(1)	(2)	(3)	(4)
Sample	All Countries		Croatia	
Method	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.061	-0.021	-0.608**	-0.200**
	(0.086)	(0.030)	(0.284)	(0.097)
Female	0.026	0.009	-0.102	-0.031
	(0.063)	(0.021)	(0.284)	(0.088)
FounderAge	-0.003	-0.001	0.003	0.001
	(0.003)	(0.001)	(0.013)	(0.004)
Education	0.012*	0.004*	0.014	0.004
	(0.006)	(0.002)	(0.050)	(0.015)
Experience	-0.002	-0.001	0.002	0.001
	(0.002)	(0.001)	(0.013)	(0.004)
LastOccupation	-0.015	-0.005	0.097	0.029
	(0.051)	(0.017)	(0.250)	(0.074)
Firmage	0.012	0.004	-0.032	-0.010
	(0.010)	(0.003)	(0.059)	(0.018)
R&D	0.036***	0.010***	0.023	0.007*
	(0.003)	(0.001)	(0.017)	(0.004)
$R\&D^2$	-0.000***		-0.000	
	(0.000)		(0.000)	
logEmployees	0.212***	0.072***	0.066	0.020
	(0.024)	(0.008)	(0.115)	(0.035)
University	0.198***	0.066***	0.441*	0.129*
	(0.064)	(0.021)	(0.263)	(0.072)
Export	0.002**	0.001**	0.005	0.002
	(0.001)	(0.000)	(0.004)	(0.001)
TechCo	0.277***	0.095***	-0.091	-0.027
	(0.045)	(0.016)	(0.225)	(0.067)
Complevel	-0.151***	-0.051***	-0.401*	-0.121*
	(0.046)	(0.016)	(0.222)	(0.065)
Sector				
KIBS	-0.088*	-0.030*	-0.325	-0.102
	(0.050)	(0.017)	(0.295)	(0.095)
High-Tech	0.002	0.001	-0.172	-0.053
	(0.078)	(0.026)	(0.256)	(0.079)
Constant	-0.490***		0.245	
	(0.169)		(1.077)	
Country Fixed Effects†	NO		NO	
n	3760	3760	187	187
Log likelihood	-2223.03		-100.09	
Pseudo R^2	0.10		0.14	
Wald χ^2	403.065		38.771	
Prob > χ^2	0.000		0.001	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

† More detailed estimation results are in the Appendix.

Also from Table 5.7, *Female* estimates differ between the two sub-samples. In the strong innovator group of countries, female founders are more likely to commercialize than male founders. In contrast, *Female* estimate is negative in the group of modest innovators. This could mean that female founders located in the strong innovator countries are faced with fewer obstacles than female founders in moderate innovator countries. Other controls remain similar between sub-samples and the full sample with some estimates having the same sign but became insignificant.

Table 5.8 reports estimation results from using instrumental variable approach to deal with *R&D* possible endogeneity using the same instruments from Table 5.4. The instrument *Indirect2007* is stronger in the estimation of modest innovator countries sub-sample, but remains weak. The instrument variables are having different effects on some variable estimates based on the group of countries in the sample. Therefore, this finding confirms that the instruments might not be exogenous. For instance, in the strong innovative countries sample, *R&D* estimate switched sign and became negative, while *R&D* estimate remained positive in the modest innovative countries sample.

Table 5.7 Results from Probit Estimation of *Commercialization* on Explanatory Variables by Country Groups.

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All Countries		Strong Innovative Countries		Modest Innovative Countries	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.028	-0.009	0.127	0.043	-0.273*	-0.092*
	(0.086)	(0.029)	(0.109)	(0.037)	(0.141)	(0.050)
Female	0.010	0.003	0.163*	0.055**	-0.179*	-0.059*
	(0.064)	(0.021)	(0.084)	(0.028)	(0.096)	(0.033)
FounderAge	-0.002	-0.001	-0.003	-0.001	-0.001	-0.000
	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
Education	0.013**	0.004**	0.018**	0.006**	0.002	0.001
	(0.007)	(0.002)	(0.008)	(0.003)	(0.011)	(0.004)
Experience	-0.003	-0.001	-0.003	-0.001	-0.001	-0.000
	(0.002)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)
LastOccupation	-0.060	-0.020	-0.080	-0.028	-0.068	-0.022
	(0.053)	(0.018)	(0.073)	(0.025)	(0.078)	(0.025)
Firmage	0.009	0.003	0.011	0.004	0.001	0.000
	(0.010)	(0.004)	(0.013)	(0.005)	(0.017)	(0.005)
R&D	0.035***	0.010***	0.039***	0.011***	0.030***	0.008***
	(0.003)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
R&D^{2}	-0.000***	-	-0.000***		-0.000***	
	(0.000)	-	(0.000)		(0.000)	
logEmployees	0.198***	0.067***	0.223***	0.077***	0.155***	0.050***
	(0.026)	(0.008)	(0.032)	(0.011)	(0.043)	(0.014)
University	0.168**	0.056***	0.075	0.026	0.245***	0.076***
	(0.066)	(0.021)	(0.098)	(0.033)	(0.090)	(0.027)
Export	0.002*	0.001*	0.002*	0.001*	0.001	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
TechCo	0.288***	0.098***	0.334***	0.117***	0.202***	0.065***
	(0.046)	(0.016)	(0.059)	(0.021)	(0.072)	(0.023)
Complevel	-0.155***	-0.052***	-0.206***	-0.071***	-0.073	-0.023
	(0.046)	(0.016)	(0.059)	(0.021)	(0.074)	(0.023)
Sector						
KIBS	-0.063	-0.021	-0.105	-0.036	0.014	0.004
	(0.051)	(0.017)	(0.067)	(0.023)	(0.084)	(0.027)
High-Tech	0.031	0.011	0.032	0.011	0.025	0.008
	(0.079)	(0.026)	(0.106)	(0.036)	(0.120)	(0.038)
Constant	-0.616***		-0.737***		-0.201	
	(0.184)		(0.228)		(0.321)	
Country Fixed Effects†	YES		YES		YES	
n	3760		2202		1538	
Log likelihood	-2209.40		-1326.49		-868.340	
Pseudo R^2	0.10		0.11		0.06	
Wald χ^2	427.721		302.777		106.139	
Prob > χ^2	0.000		0.000		0.000	

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

† More detailed estimation results are in the Appendix.

Table 5.8 Results from Probit Estimation of *Commercialization* on Explanatory Variables by Country Groups with Excluded Instruments.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Strong Innovative Countries				Modest Innovative Countries			
Instruments	Direct2007+ Indirect2007				Direct2007+Indirect2007			
Method	Probit	Marginal Effect	IV	Marginal Effect	Probit	Marginal Effect	IV	Marginal Effect
Immigrant	0.127	0.043	0.042	0.014	-0.273*	-0.092*	-0.306**	-0.102*
	(0.109)	(0.037)	(0.100)	(0.032)	(0.141)	(0.050)	(0.151)	(0.052)
Female	0.163*	0.055**	-0.097	-0.032	-0.179*	-0.059*	-0.159	-0.053
	(0.084)	(0.028)	(0.100)	(0.032)	(0.096)	(0.033)	(0.102)	(0.034)
FounderAge	-0.003	-0.001	-0.008***	-0.003***	-0.001	-0.000	0.004	0.001
	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.006)	(0.002)
Education	0.018**	0.006**	0.040***	0.013***	0.002	0.001	-0.003	-0.001
	(0.008)	(0.003)	(0.007)	(0.002)	(0.011)	(0.004)	(0.010)	(0.003)
Experience	-0.003	-0.001	0.001	0.000	-0.001	-0.000	-0.003	-0.001
	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
LastOccupation	-0.080	-0.028	0.081	0.026	-0.068	-0.022	-0.032	-0.010
	(0.073)	(0.025)	(0.080)	(0.025)	(0.078)	(0.025)	(0.069)	(0.023)
Firmage	0.011	0.004	-0.003	-0.001	0.001	0.000	0.007	0.002
	(0.013)	(0.005)	(0.012)	(0.004)	(0.017)	(0.005)	(0.017)	(0.005)
R&D	0.039***	0.011***	-0.045***	-0.014***	0.030***	0.008***	0.044**	0.014**
	(0.004)	(0.001)	(0.014)	(0.004)	(0.005)	(0.001)	(0.020)	(0.007)
$R\&D^2$	-0.000***				-0.000***			
	(0.000)				(0.000)			
logEmployees	0.223***	0.077***	0.094	0.031	0.155***	0.050***	0.145***	0.047***
	(0.032)	(0.011)	(0.080)	(0.027)	(0.043)	(0.014)	(0.054)	(0.017)
University	0.075	0.026	0.521***	0.160***	0.245***	0.076***	-0.002	-0.001
	(0.098)	(0.033)	(0.103)	(0.027)	(0.090)	(0.027)	(0.242)	(0.079)
Export	0.002*	0.001*	0.008***	0.003***	0.001	0.000	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)	(0.001)
TechCo	0.334***	0.117***	0.391***	0.128***	0.202***	0.065***	0.093	0.031
	(0.059)	(0.021)	(0.098)	(0.037)	(0.072)	(0.023)	(0.141)	(0.046)
Complevel	-0.206***	-0.071***	-0.350***	-0.114***	-0.073	-0.023	0.066	0.022
	(0.059)	(0.021)	(0.055)	(0.020)	(0.074)	(0.023)	(0.144)	(0.047)

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Strong Innovative Countries				Modest Innovative Countries			
Instruments			Direct2007+ Indirect2007				Direct2007+Indirect2007	
Method	Probit	Marginal Effect	IV	Marginal Effect	Probit	Marginal Effect	IV	Marginal Effect
Sector								
KIBS	-0.105	-0.036	0.075	0.024	0.014	0.004	-0.034	-0.011
	(0.067)	(0.023)	(0.071)	(0.023)	(0.084)	(0.027)	(0.101)	(0.033)
High-Tech	0.032	0.011	0.204**	0.065**	0.025	0.008	-0.051	-0.017
	(0.106)	(0.036)	(0.093)	(0.029)	(0.120)	(0.038)	(0.125)	(0.041)
Constant	-0.737***		-0.046		-0.201		-0.586	
	(0.228)		(0.297)		(0.321)		(0.542)	
Country Fixed Effects†	YES		NO		YES		NO	
n	2202	2202	2202	2202	1538	1538	1538	1538
Log likelihood	-1326.49		-10862.60		-868.34		-7492.62	
Pseudo R^2	0.11				0.06			
Wald χ^2	302.777		677.735		106.139		143.285	
Prob > χ^2	0.000		0.000		0.000		0.000	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

† More detailed estimation results are in the Appendix.

CHAPTER VI

CONCLUSION

Research focus on immigrant-founded firms' commercialization performance, a proxy for firm's innovativeness, is limited, and most of it is concentrated on immigrant founded-firms in the United States. Firm founders possess a considerable role in the decision-making process that leads to commercialization, especially in smaller firms. Therefore, having higher human capital and social capital can make a founder more attentive to opportunities and therefore to be more innovative.

Immigrant-founded firms are less likely to commercialize in the high-tech sector in European countries, which contradicts the finding from literature in the United States. This finding could be due to unobserved heterogeneity in entrepreneurship ability, or it could be due to heterogeneity in the obstacles faced by immigrant-founded firms and native-founded firms in the high-tech sector.

European countries differ in their immigration policy from the United States, where the United States have successfully attracted exceptionally talented immigrants whom contribute greatly to the innovativeness and economic growth of the country. Some European countries mostly preferred immigrants from certain origins and therefore might not have purposefully attracted talented immigrants.

The relationship between immigrant firms and innovation in Europe evidence is inconclusive. Nonetheless, after segmenting the countries into two groups by the innovative performance of these countries, I find a negative association between immigrant-founded firms and commercialization in the group of countries that are less innovative.

This group of countries also have less income and face the most obstacles according to Calghirou et. al (2011) final report on AEGIS dataset. It is difficult to discern without further investigation the main reason for the lower innovative performance of immigrants in the countries that also possess the most obstacles. It could be that immigrant-founded firms face higher obstacles than native-founded firms.

Sub-sample analysis of countries revealed that in Croatia (n=187), immigrant-founded firms are less innovative than native-founded firms. Croatia is the smallest country in the sample measured by GDP per capita. It is also the newest member of the European Union as it joined in 2013 after AEGIS survey was conducted.

CHAPTER VII

LIMITATIONS AND AREAS FOR FUTURE RESEARCH

Limitations

One limitation of this dissertation is in the limited definition of immigrant firm. The only available information in AEGIS dataset is on the immigration status of the founder (i.e., whether the founder was born in another country). This limited information hinders the ability to disentangle possible attributes that differ immigrants based on the place of birth. Previous literature has identified differences among European immigrants and non-European immigrants in their entrepreneurship abilities in Europe among other attributes. Another missing information about immigrant founders is the length of stay in the host country. Chapter II has identified from the literature that immigrant founders build more social capital and assimilate more successfully with more time in the host country. Also, source of education for the founder is not available, where it was established in some of the previous literature that it matters whether the immigrant had accumulated his/her education in the host or home country.

Another limitation in the AEGIS dataset is that it only provides information about the number of employees in the firm. There is no information about the immigration status of the employees which will help in informing me about the degree of diversity in the firm. Also, I do not have access to the education level for the employees which will approximate the level of human capital available in the firm.

If I had access to employees' human capital, I might be able to control for it and infer why in the high technology sector, immigrant-founded firms have negative association with commercialization or have lower propensity to commercialize.

Another limitation is a common limitation with all cross-sectional studies where a causal effect is more challenging to establish. Also, AEGIS dataset was collected during an economic shock, which could have affected firms in the sample altering their decisions about allocation of R&D among other decisions. This economic shock could also possibly have affected the policy variables obtained as instrumental variables in this dissertation. In theory these variables should have a stronger correlation with R&D. However, the external shock might have invalidated the instruments.

The results established in this dissertation are extremely sensitive to the sample used. The effect of immigrant firms on commercialization is not established for the full sample of firms. However, I was able to find a negative association between immigrant firms on commercialization in the high-tech sector and in a sub sample of countries.

Future Research

More research is needed to investigate the difference of results based on the host country. This might be done by using external dataset and merging with AEGIS dataset.

Also, the results are sensitive to the time frame of the AEGIS survey were it coincided with the outcome of the global financial crisis. A more recent dataset might mitigate this problem where countries have more steady economy.

Immigrant-founded firms are less innovative in the high-tech sector. This needs further investigation to see what differences among sectors that caused this conclusion. A future research might use sub-samples of industries to observe further discrepancies in innovative performance.

I recommend for future research using AEGIS dataset to examine the difference in commercialization of firms based on the homogeneity of the founding teams. More specifically, whether having teams of only immigrant founders differ from having teams of only native founders or mixed teams' founders. Also, examining the homogeneity of the founding teams by gender might produce interesting results. Another possibility is to gain access to more variables in AEGIS dataset, especially on the human capital of employees and obstacles faced by the firms. Also, having access to information about turnover might help in understanding firm decisions. This is because firms decide on the level of R&D based on cashflow that should not affect commercialization decisions of the firm directly but only through the effect on R&D.

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APPENDIX A

DETAILED TABLES FROM CHAPTER V

Table A5.3 Results from Probit Estimation of Commercialization on Explanatory Variables, (n=3,740)

	Country fixed Effects		No Country fixed Effects	
Method	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.028	-0.009	-0.061	-0.021
	(0.086)	(0.029)	(0.086)	(0.030)
Female	0.010	0.003	0.026	0.009
	(0.064)	(0.021)	(0.063)	(0.021)
FounderAge	-0.002	-0.001	-0.003	-0.001
	(0.003)	(0.001)	(0.003)	(0.001)
Education	0.013**	0.004**	0.012*	0.004*
	(0.007)	(0.002)	(0.006)	(0.002)
Experience	-0.003	-0.001	-0.002	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)
LastOccupation	-0.060	-0.020	-0.015	-0.005
	(0.053)	(0.018)	(0.051)	(0.017)
Firmage	0.009	0.003	0.012	0.004
	(0.010)	(0.004)	(0.010)	(0.003)
R&D	0.035***	0.010***	0.036***	0.010***
	(0.003)	(0.001)	(0.003)	(0.001)
$R\&D^2$	-0.000***		-0.000***	
	(0.000)		(0.000)	
logEmployees	0.198***	0.067***	0.212***	0.072***
	(0.026)	(0.008)	(0.024)	(0.008)
University	0.168**	0.056***	0.198***	0.066***
	(0.066)	(0.021)	(0.064)	(0.021)
Export	0.002*	0.001*	0.002**	0.001**
	(0.001)	(0.000)	(0.001)	(0.000)
TechCo	0.288***	0.098***	0.277***	0.095***
	(0.046)	(0.016)	(0.045)	(0.016)
Complevel	-0.155***	-0.052***	-0.151***	-0.051***
	(0.046)	(0.016)	(0.046)	(0.016)
Croatia	0.023	0.008		
	(0.119)	(0.040)		
Czech Republic	0.250**	0.081**		
	(0.118)	(0.036)		
Denmark	0.078	0.026		
	(0.094)	(0.031)		
France	-0.011	-0.004		
	(0.082)	(0.028)		

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	Country fixed Effects		No Country fixed Effects	
Method	Probit	Marginal Effects	Probit	Marginal Effects
Germany	0.003	0.001		
	(0.083)	(0.028)		
Greece	0.233**	0.076**		
	(0.098)	(0.031)		
Italy	0.292***	0.095***		
	(0.088)	(0.027)		
Portugal	0.168*	0.055*		
	(0.100)	(0.032)		
Sweden	0.235**	0.076***		
	(0.094)	(0.029)		
KIBS	-0.063	-0.021	-0.088*	-0.030*
	(0.051)	(0.017)	(0.050)	(0.017)
High-Tech	0.031	0.011	0.002	0.001
	(0.079)	(0.026)	(0.078)	(0.026)
Constant	-0.616***		-0.490***	
	(0.184)		(0.169)	
Pseudo R^2	0.10		0.10	
chi2	427.721		403.065	
p	0.000		0.000	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.4 Results from Probit Estimation of *Commercialization* on Explanatory Variables with Excluded Instruments, (n=3,740)

	(1)	(2)	(3)	(4)	(5)	(6)
Instrument	Direct2007		Indirect2007		Direct2007 +Indirect2007	
Method	IV Probit	Marginal Effects	IV Probit	Marginal Effects	IV Probit	Marginal Effects
Immigrant	-0.065	-0.021	-0.039	-0.012	-0.060	-0.019
	(0.070)	(0.023)	(0.066)	(0.021)	(0.067)	(0.022)
Female	0.075	0.025	0.077*	0.025	0.078	0.026
	(0.052)	(0.017)	(0.047)	(0.015)	(0.049)	(0.016)
FounderAge	0.005	0.002	0.009***	0.003***	0.006*	0.002**
	(0.004)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
Education	-0.014	-0.004	-0.024***	-0.008***	-0.017*	-0.005**
	(0.010)	(0.003)	(0.007)	(0.002)	(0.009)	(0.003)
Experience	-0.004**	-0.001**	-0.004*	-0.001*	-0.004**	-0.001**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
LastOccupation	-0.077*	-0.025*	-0.092**	-0.029**	-0.084**	-0.027**
	(0.046)	(0.015)	(0.038)	(0.012)	(0.043)	(0.014)
Firmage	0.014	0.005	0.009	0.003	0.013	0.004
	(0.009)	(0.003)	(0.009)	(0.003)	(0.009)	(0.003)
R&D	0.054***	0.018***	0.055***	0.018***	0.056***	0.018***
	(0.006)	(0.002)	(0.005)	(0.002)	(0.003)	(0.001)
logEmployees	0.110	0.036	-0.007	-0.002	0.081	0.026
	(0.067)	(0.023)	(0.085)	(0.027)	(0.070)	(0.023)
University	-0.258*	-0.084*	-0.446***	-0.136***	-0.318**	-0.101**
	(0.155)	(0.047)	(0.097)	(0.026)	(0.137)	(0.039)
Export	-0.004**	-0.001**	-0.005***	-0.002***	-0.004***	-0.001***
	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
TechCo	-0.011	-0.004	-0.204*	-0.065*	-0.065	-0.021
	(0.131)	(0.043)	(0.122)	(0.038)	(0.125)	(0.040)
Complevel	0.133	0.044	0.258***	0.082***	0.172*	0.056**
	(0.101)	(0.032)	(0.070)	(0.021)	(0.091)	(0.028)
KIBS	-0.123*	-0.040*	-0.156***	-0.049***	-0.136**	-0.044**
	(0.073)	(0.023)	(0.058)	(0.018)	(0.067)	(0.021)
High-Tech	-0.131***	-0.043***	-0.108**	-0.034**	-0.128***	-0.042***
	(0.041)	(0.014)	(0.047)	(0.015)	(0.041)	(0.013)
Constant	-0.634***		-0.514***		-0.621***	-0.634***
	(0.141)		(0.191)		(0.142)	(0.141)
FIRST Stage R&D						
Immigrant	0.634		0.692		0.690	
	(1.131)		(1.133)		(1.132)	
Female	-1.452*		-1.398*		-1.419*	
	(0.843)		(0.844)		(0.844)	

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	(1)	(2)	(3)	(4)	(5)	(6)
Instrument	Direct2007		Indirect2007		Direct2007 +Indirect2007	
Method	IV Probit	Marginal Effects	IV Probit	Method	IV Probit	Marginal Effects
FounderAge	0.634		0.692		0.690	
	(1.131)		(1.133)		(1.132)	
Education	-1.452*		-1.398*		-1.419*	
	(0.843)		(0.844)		(0.844)	
Experience	-0.154***		-0.157***		-0.155***	
	(0.038)		(0.038)		(0.038)	
LastOccupation	0.453***		0.439***		0.447***	
	(0.089)		(0.089)		(0.089)	
Firmage	0.068**		0.067**		0.068**	
	(0.033)		(0.033)		(0.033)	
logEmployees	1.554**		1.671**		1.558**	
	(0.698)		(0.698)		(0.700)	
University	-0.163		-0.152		-0.157	
	(0.140)		(0.140)		(0.140)	
Export	0.060		0.199		0.097	
	(0.322)		(0.313)		(0.324)	
TechCo	7.945***		8.203***		8.023***	
	(0.835)		(0.822)		(0.837)	
Complevel	0.099***		0.099***		0.098***	
	(0.012)		(0.012)		(0.012)	
KIBS	3.807***		3.831***		3.807***	
	(0.616)		(0.616)		(0.616)	
High-Tech	-4.792***		-4.753***		-4.782***	
	(0.618)		(0.618)		(0.618)	
Instruments						
Direct2007	-14.478*				-10.069	
	(8.190)				(8.910)	
Indirect2007			-0.450		-4.784	
			(8.600)		(4.700)	
Constant	10.244***		9.256***		10.166***	
	(2.362)		(2.328)		(2.388)	
/						
athrho2_1	-1.210*		-4.604		-1.518*	
	(0.626)		(19.106)		(0.794)	
lnsigma2	2.903***		2.903***		2.903***	
	(0.012)		(0.012)		(0.012)	
Pseudo R^2						
chi2	2103.325		4197.445		3790.641	
p	0.000		0.000		0.000	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.5 Results from Probit Estimation of *Commercialization* on Explanatory Variables in the High-tech sector (n=394).

	(1)	(2)	(3)	(4)	(5)	(6)
Sector	Low-tech		High-tech		KIBS	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	0.003	0.001	-0.640***	-0.189**	0.042	0.014
	(0.144)	(0.050)	(0.244)	(0.074)	(0.123)	(0.040)
Female	0.005	0.002	0.081	0.022	0.043	0.014
	(0.093)	(0.032)	(0.238)	(0.064)	(0.093)	(0.031)
FounderAge	0.008*	0.003*	-0.007	-0.002	-0.010**	-0.003**
	(0.004)	(0.001)	(0.010)	(0.003)	(0.004)	(0.001)
Education	0.005	0.002	0.049**	0.013**	0.011	0.003
	(0.010)	(0.003)	(0.022)	(0.006)	(0.010)	(0.003)
Experience	-0.003	-0.001	0.006	0.002	-0.003	-0.001
	(0.004)	(0.001)	(0.009)	(0.002)	(0.004)	(0.001)
LastOccupation	-0.076	-0.027	0.174	0.047	-0.084	-0.028
	(0.082)	(0.029)	(0.187)	(0.050)	(0.077)	(0.026)
Firmage	0.021	0.007	-0.068*	-0.019*	0.012	0.004
	(0.016)	(0.006)	(0.036)	(0.010)	(0.016)	(0.005)
R&D	0.034***	0.010***	0.061***	0.014***	0.031***	0.009***
	(0.006)	(0.002)	(0.013)	(0.003)	(0.004)	(0.001)
$R\&D^2$	-0.000***		-0.001***		-0.000***	
	(0.000)		(0.000)		(0.000)	
logEmployees	0.170***	0.059***	0.034	0.009	0.242***	0.080***
	(0.042)	(0.014)	(0.094)	(0.026)	(0.037)	(0.012)
University	0.212**	0.072**	0.438*	0.115**	0.116	0.038
	(0.106)	(0.035)	(0.233)	(0.056)	(0.093)	(0.030)
Export	0.000	0.000	0.006**	0.002**	0.002*	0.001*
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.000)
TechCo	0.254***	0.088***	0.250	0.071	0.321***	0.109***
	(0.072)	(0.025)	(0.155)	(0.045)	(0.065)	(0.023)
Complevel	-0.051	-0.018	-0.186	-0.052	-0.231***	-0.077***
	(0.071)	(0.025)	(0.156)	(0.044)	(0.067)	(0.022)
Croatia	0.065	0.022	-0.383	-0.111	-0.013	-0.004
	(0.168)	(0.057)	(0.343)	(0.103)	(0.219)	(0.073)
Czech Republic	0.199	0.067	0.101	0.027	0.305*	0.097*
	(0.181)	(0.059)	(0.400)	(0.107)	(0.174)	(0.052)
Denmark	0.018	0.006	0.066	0.018	0.150	0.049
	(0.191)	(0.066)	(0.347)	(0.094)	(0.118)	(0.038)

Continued…

Continued…

	(1)	(2)	(3)	(4)	(5)	(6)
Sector	Low-tech		High-tech		KIBS	
Method	Probit	Marginal Effects	Probit	Method	Probit	Marginal Effects
France	-0.155	-0.055	0.027	0.007	0.101	0.033
	(0.139)	(0.050)	(0.293)	(0.080)	(0.111)	(0.036)
Germany	0.002	0.001	-0.226	-0.064	0.039	0.013
	(0.145)	(0.050)	(0.292)	(0.085)	(0.109)	(0.036)
Greece	0.142	0.048	-0.449	-0.131	0.426***	0.133***
	(0.144)	(0.048)	(0.377)	(0.115)	(0.152)	(0.044)
Italy	0.210	0.072	0.286	0.076	0.430***	0.135***
	(0.133)	(0.044)	(0.315)	(0.080)	(0.137)	(0.040)
Portugal	0.123	0.042	0.364	0.094	0.167	0.054
	(0.150)	(0.050)	(0.375)	(0.090)	(0.150)	(0.048)
Sweden	0.175	0.059	0.053	0.015	0.338***	0.107***
	(0.162)	(0.053)	(0.335)	(0.091)	(0.127)	(0.038)
Constant	-0.925***		-0.189		-0.363	
	(0.295)		(0.606)		(0.272)	
Pseudo R^2	0.08		0.20		0.12	
chi2	130.023		91.429		260.588	
p	0.000		0.000		0.000	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.6-a Results from Probit Estimation of *Commercialization* on Explanatory Variables in Croatia.

	(1)	(2)	(3)	(4)	(5)	(6)
Country	Croatia		Czech Republic		Denmark	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.608**	-0.200**	-0.644	-0.212	0.323	0.095
	(0.284)	(0.097)	(0.541)	(0.185)	(0.350)	(0.099)
Female	-0.102	-0.031	-0.378	-0.120	-0.019	-0.006
	(0.284)	(0.088)	(0.332)	(0.110)	(0.256)	(0.077)
FounderAge	0.003	0.001	-0.018	-0.005	-0.018	-0.005*
	(0.013)	(0.004)	(0.014)	(0.004)	(0.011)	(0.003)
Education	0.014	0.004	0.008	0.002	0.030	0.009
	(0.050)	(0.015)	(0.037)	(0.011)	(0.019)	(0.006)
Experience	0.002	0.001	-0.019	-0.006	-0.005	-0.002
	(0.013)	(0.004)	(0.014)	(0.004)	(0.010)	(0.003)
LastOccupation	0.097	0.029	-0.125	-0.038	-0.180	-0.055
	(0.250)	(0.074)	(0.219)	(0.067)	(0.220)	(0.067)
Firmage	-0.032	-0.010	-0.078	-0.023	0.024	0.007
	(0.059)	(0.018)	(0.061)	(0.018)	(0.043)	(0.013)
R&D	0.023	0.007*	0.047**	0.012***	0.069***	0.018***
	(0.017)	(0.004)	(0.019)	(0.005)	(0.013)	(0.003)
$R\&D^2$	-0.000		-0.000*		-0.001***	
	(0.000)		(0.000)		(0.000)	
logEmployees	0.066	0.020	0.180	0.054	0.246***	0.074***
	(0.115)	(0.035)	(0.131)	(0.038)	(0.093)	(0.027)
University	0.441*	0.129*	1.071*	0.237***	0.155	0.046
	(0.263)	(0.072)	(0.547)	(0.077)	(0.290)	(0.086)
Export	0.005	0.002	0.000	0.000	0.007**	0.002**
	(0.004)	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)
TechCo	-0.091	-0.027	0.027	0.008	0.291*	0.090*
	(0.225)	(0.067)	(0.211)	(0.063)	(0.168)	(0.053)
Complevel	-0.401*	-0.121*	0.037	0.011	-0.330**	-0.100**
	(0.222)	(0.065)	(0.225)	(0.068)	(0.166)	(0.050)
KIBS	-0.325	-0.102	-0.055	-0.016	-0.077	-0.023
	(0.295)	(0.095)	(0.240)	(0.072)	(0.209)	(0.063)
High-Tech	-0.172	-0.053	0.355	0.100	0.035	0.011
	(0.256)	(0.079)	(0.428)	(0.110)	(0.308)	(0.093)
Constant	0.245		1.294		-0.347	
	(1.077)		(0.935)		(0.557)	
Pseudo R^2			0.14		0.22	
chi2			28.217		66.895	
p			0.030		0.000	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.6-b Results from Probit Estimation of *Commercialization* on Explanatory Variables in Croatia.

	(1)	(2)	(3)	(4)	(5)	(6)
Country	France		Greece		Germany	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.325	-0.114	0.510	0.140	0.312	0.102
	(0.238)	(0.082)	(0.406)	(0.094)	(0.220)	(0.069)
Female	0.133	0.047	-0.068	-0.021	0.108	0.036
	(0.154)	(0.054)	(0.284)	(0.090)	(0.207)	(0.069)
FounderAge	-0.002	-0.001	-0.015	-0.005	-0.012	-0.004
	(0.008)	(0.003)	(0.011)	(0.003)	(0.008)	(0.003)
Education	0.013	0.004	0.029	0.009	0.004	0.001
	(0.018)	(0.006)	(0.032)	(0.010)	(0.015)	(0.005)
Experience	-0.001	-0.000	0.016	0.005	0.004	0.001
	(0.006)	(0.002)	(0.010)	(0.003)	(0.007)	(0.002)
LastOccupation	-0.317*	-0.112*	-0.051	-0.016	-0.046	-0.016
	(0.176)	(0.061)	(0.200)	(0.062)	(0.132)	(0.045)
Firmage	-0.060**	-0.021**	0.096**	0.030**	0.051*	0.017*
	(0.028)	(0.010)	(0.043)	(0.013)	(0.029)	(0.010)
R&D	0.039***	0.012***	0.036***	0.010***	0.037***	0.011***
	(0.008)	(0.002)	(0.014)	(0.004)	(0.009)	(0.002)
$R\&D^2$	-0.000***		-0.000*		-0.000***	
	(0.000)		(0.000)		(0.000)	
logEmployees	0.255***	0.090***	0.217**	0.067**	0.102	0.034
	(0.066)	(0.022)	(0.090)	(0.027)	(0.062)	(0.021)
University	0.002	0.001	0.353*	0.104*	-0.288	-0.098
	(0.222)	(0.078)	(0.210)	(0.058)	(0.182)	(0.062)
Export	0.003	0.001	0.001	0.000	-0.000	-0.000
	(0.003)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)
TechCo	0.242**	0.086**	0.363**	0.114**	0.435***	0.152***
	(0.118)	(0.042)	(0.173)	(0.055)	(0.126)	(0.044)
Complevel	-0.087	-0.031	0.107	0.033	-0.307**	-0.105**
	(0.117)	(0.041)	(0.168)	(0.052)	(0.133)	(0.045)
KIBS	0.054	0.019	0.113	0.035	-0.062	-0.021
	(0.139)	(0.049)	(0.193)	(0.059)	(0.140)	(0.047)
High-Tech	0.228	0.080	-0.254	-0.082	0.018	0.006
	(0.200)	(0.069)	(0.332)	(0.111)	(0.207)	(0.070)
Constant	-0.343		-1.264		-0.132	
	(0.424)		(0.831)		(0.476)	
Pseudo R^2	0.11		0.11		0.12	
chi2	68.560		36.299		77.298	
p	0.000		0.003		0.000	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.6-c Results from Probit Estimation of *Commercialization* on Explanatory Variables in Croatia.

	(1)	(2)	(3)	(4)	(5)	(6)
Country	Italy		Portugal		Sweden	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.471	-0.157	-0.204	-0.068	0.462	0.137
	(0.495)	(0.177)	(0.235)	(0.081)	(0.328)	(0.089)
Female	-0.076	-0.023	-0.269	-0.090	0.728***	0.210***
	(0.155)	(0.048)	(0.193)	(0.067)	(0.222)	(0.056)
FounderAge	0.010	0.003	-0.001	-0.000	0.016	0.005
	(0.007)	(0.002)	(0.011)	(0.003)	(0.011)	(0.003)
Education	-0.011	-0.003	0.014	0.005	-0.013	-0.004
	(0.017)	(0.005)	(0.023)	(0.008)	(0.028)	(0.009)
Experience	0.002	0.000	-0.009	-0.003	-0.024**	-0.007***
	(0.006)	(0.002)	(0.009)	(0.003)	(0.009)	(0.003)
LastOccupation	-0.065	-0.019	-0.089	-0.029	0.205	0.063
	(0.131)	(0.039)	(0.174)	(0.058)	(0.232)	(0.070)
Firmage	-0.024	-0.007	0.023	0.007	0.016	0.005
	(0.029)	(0.009)	(0.034)	(0.011)	(0.036)	(0.011)
R&D	0.027***	0.006***	0.036***	0.008***	0.043***	0.012***
	(0.008)	(0.002)	(0.012)	(0.003)	(0.012)	(0.003)
$R\&D^2$	-0.000*		-0.001***		-0.000***	
	(0.000)		(0.000)		(0.000)	
logEmployees	0.246***	0.073***	0.075	0.024	0.375***	0.117***
	(0.081)	(0.024)	(0.095)	(0.031)	(0.092)	(0.027)
University	0.063	0.018	0.307*	0.098*	0.582**	0.173**
	(0.154)	(0.045)	(0.176)	(0.055)	(0.259)	(0.070)
Export	0.004	0.001	-0.002	-0.001	0.002	0.001
	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
TechCo	0.206*	0.061*	0.279*	0.092*	0.301*	0.097*
	(0.124)	(0.036)	(0.160)	(0.053)	(0.163)	(0.053)
Complevel	0.038	0.011	-0.410**	-0.129**	-0.125	-0.039
	(0.127)	(0.038)	(0.182)	(0.054)	(0.169)	(0.053)
KIBS	0.199	0.058	-0.209	-0.069	0.039	0.012
	(0.150)	(0.042)	(0.195)	(0.064)	(0.193)	(0.060)
High-Tech	0.144	0.041	0.091	0.029	-0.026	-0.008
	(0.221)	(0.061)	(0.294)	(0.093)	(0.305)	(0.096)
Constant	-0.510		0.218		-1.097	
	(0.481)		(0.641)		(0.691)	
Pseudo R^2	0.07		0.09		0.17	
chi2	40.737		29.686		71.402	
p	0.001		0.020		0.000	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.6-e Results from Probit Estimation of *Commercialization* on Explanatory Variables in Croatia.

Country	The United Kingdom	
Method	Probit	Marginal Effects
Immigrant	0.215	0.071
	(0.206)	(0.067)
Female	-0.003	-0.001
	(0.170)	(0.057)
FounderAge	0.005	0.002
	(0.007)	(0.002)
Education	0.053**	0.018***
	(0.021)	(0.007)
Experience	-0.001	-0.000
	(0.006)	(0.002)
LastOccupation	-0.136	-0.046
	(0.142)	(0.048)
Firmage	0.041	0.014
	(0.028)	(0.009)
R&D	0.030***	0.009***
	(0.009)	(0.002)
$R\&D^2$	-0.000**	
	(0.000)	
logEmployees	0.268***	0.090***
	(0.073)	(0.024)
University	0.325	0.106
	(0.225)	(0.071)
Export	0.002	0.001
	(0.002)	(0.001)
TechCo	0.345***	0.119***
	(0.121)	(0.042)
Complevel	-0.214*	-0.072*
	(0.126)	(0.043)
KIBS	-0.281**	-0.094**
	(0.132)	(0.043)
High-Tech	-0.105	-0.036
	(0.258)	(0.088)
Constant	-1.779***	
	(0.487)	
Pseudo R^2	0.13	
chi2	75.504	
p	0.000	

Table A5.7 Results from Probit Estimation of *Commercialization* on Explanatory Variables by Country Groups.

Sample	All Countries		All Countries		Strong Innovative Countries		Modest Innovative Countries	
Method	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects	Probit	Marginal Effects
Immigrant	-0.028	-0.009	-0.061	-0.021	0.127	0.043	-0.273*	-0.092*
	(0.086)	(0.029)	(0.086)	(0.030)	(0.109)	(0.037)	(0.141)	(0.050)
Female	0.010	0.003	0.026	0.009	0.163*	0.055**	-0.179*	-0.059*
	(0.064)	(0.021)	(0.063)	(0.021)	(0.084)	(0.028)	(0.096)	(0.033)
FounderAge	-0.002	-0.001	-0.003	-0.001	-0.003	-0.001	-0.001	-0.000
	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
Education	0.013**	0.004**	0.012*	0.004*	0.018**	0.006**	0.002	0.001
	(0.007)	(0.002)	(0.006)	(0.002)	(0.008)	(0.003)	(0.011)	(0.004)
Experience	-0.003	-0.001	-0.002	-0.001	-0.003	-0.001	-0.001	-0.000
	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)
LastOccupation	-0.060	-0.020	-0.015	-0.005	-0.080	-0.028	-0.068	-0.022
	(0.053)	(0.018)	(0.051)	(0.017)	(0.073)	(0.025)	(0.078)	(0.025)
Firmage	0.009	0.003	0.012	0.004	0.011	0.004	0.001	0.000
	(0.010)	(0.004)	(0.010)	(0.003)	(0.013)	(0.005)	(0.017)	(0.005)
R&D	0.035***	0.010***	0.036***	0.010***	0.039***	0.011***	0.030***	0.008***
	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
$R\&D^2$	-0.000***		-0.000***		-0.000***		-0.000***	
	(0.000)		(0.000)		(0.000)		(0.000)	
logEmployees	0.198***	0.067***	0.212***	0.072***	0.223***	0.077***	0.155***	0.050***
	(0.026)	(0.008)	(0.024)	(0.008)	(0.032)	(0.011)	(0.043)	(0.014)
University	0.168**	0.056***	0.198***	0.066***	0.075	0.026	0.245***	0.076***
	(0.066)	(0.021)	(0.064)	(0.021)	(0.098)	(0.033)	(0.090)	(0.027)
Export	0.002*	0.001*	0.002**	0.001**	0.002*	0.001*	0.001	0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
TechCo	0.288***	0.098***	0.277***	0.095***	0.334***	0.117***	0.202***	0.065***
	(0.046)	(0.016)	(0.045)	(0.016)	(0.059)	(0.021)	(0.072)	(0.023)
Complevel	-0.155***	-0.052***	-0.151***	-0.051***	-0.206***	-0.071***	-0.073	-0.023
	(0.046)	(0.016)	(0.046)	(0.016)	(0.059)	(0.021)	(0.074)	(0.023)

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Countries		All Countries		Strong Innovative Countries		Modest Innovative Countries	
Croatia	0.023	0.008						
	(0.119)	(0.040)						
Czech Republic	0.250**	0.081**					0.145	0.045
	(0.118)	(0.036)					(0.145)	(0.044)
Denmark	0.078	0.026			0.102	0.035		
	(0.094)	(0.031)			(0.097)	(0.033)		
France	-0.011	-0.004			0.000	0.000		
	(0.082)	(0.028)			(0.085)	(0.029)		
Germany	0.003	0.001			0.021	0.007		
	(0.083)	(0.028)			(0.085)	(0.029)		
Greece	0.233**	0.076**					0.114	0.036
	(0.098)	(0.031)					(0.130)	(0.040)
Italy	0.292***	0.095***					0.184	0.058
	(0.088)	(0.027)					(0.122)	(0.038)
Portugal	0.168*	0.055*					0.062	0.020
	(0.100)	(0.032)					(0.131)	(0.041)
Sweden	0.235**	0.076***			0.259***	0.087***		
	(0.094)	(0.029)			(0.096)	(0.031)		
KIBS	-0.063	-0.021	-0.088*	-0.030*	-0.105	-0.036	0.014	0.004
	(0.051)	(0.017)	(0.050)	(0.017)	(0.067)	(0.023)	(0.084)	(0.027)
High-Tech	0.031	0.011	0.002	0.001	0.032	0.011	0.025	0.008
	(0.079)	(0.026)	(0.078)	(0.026)	(0.106)	(0.036)	(0.120)	(0.038)
Constant	-0.616***		-0.490***		-0.737***		-0.201	
	(0.184)		(0.169)		(0.228)		(0.321)	
Pseudo R^2	0.10		0.10		0.11		0.06	
chi2	427.721		403.065		302.777		106.139	
p	0.000		0.000		0.000		0.000	
N	3740	3740	3740	3740	2202	2202	1538	1538

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5.8 Results from Probit Estimation of *Commercialization* on Explanatory Variables by Country Groups with Excluded Instruments.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Strong Innovative Countries				Modest Innovative Countries			
Instruments	Direct2007 +Indirect2007				Direct2007 +Indirect2007			
Method	Probit	Marginal	IV Probit	Marginal	Probit	Marginal	IV Probit	Marginal
Immigrant	0.127	0.043	0.042	0.014	-0.273*	-0.092*	-0.306**	-0.102*
	(0.109)	(0.037)	(0.100)	(0.032)	(0.141)	(0.050)	(0.151)	(0.052)
Female	0.163*	0.055**	-0.097	-0.032	-0.179*	-0.059*	-0.159	-0.053
	(0.084)	(0.028)	(0.100)	(0.032)	(0.096)	(0.033)	(0.102)	(0.034)
FounderAge	-0.003	-0.001	-0.008***	-0.003***	-0.001	-0.000	0.004	0.001
	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.006)	(0.002)
Education	0.018**	0.006**	0.040***	0.013***	0.002	0.001	-0.003	-0.001
	(0.008)	(0.003)	(0.007)	(0.002)	(0.011)	(0.004)	(0.010)	(0.003)
Experience	-0.003	-0.001	0.001	0.000	-0.001	-0.000	-0.003	-0.001
	(0.003)	(0.001)	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
LastOccupation	-0.080	-0.028	0.081	0.026	-0.068	-0.022	-0.032	-0.010
	(0.073)	(0.025)	(0.080)	(0.025)	(0.078)	(0.025)	(0.069)	(0.023)
Firmage	0.011	0.004	-0.003	-0.001	0.001	0.000	0.007	0.002
	(0.013)	(0.005)	(0.012)	(0.004)	(0.017)	(0.005)	(0.017)	(0.005)
R&D	0.039***	0.011***	-0.045***	-0.014***	0.030***	0.008***	0.044**	0.014**
	(0.004)	(0.001)	(0.014)	(0.004)	(0.005)	(0.001)	(0.020)	(0.007)
$R\&D^2$	-0.000***				-0.000***			
	(0.000)				(0.000)			
logEmployees	0.223***	0.077***	0.094	0.031	0.155***	0.050***	0.145***	0.047***
	(0.032)	(0.011)	(0.080)	(0.027)	(0.043)	(0.014)	(0.054)	(0.017)
University	0.075	0.026	0.521***	0.160***	0.245***	0.076***	-0.002	-0.001
	(0.098)	(0.033)	(0.103)	(0.027)	(0.090)	(0.027)	(0.242)	(0.079)
Export	0.002*	0.001*	0.008***	0.003***	0.001	0.000	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)	(0.001)
TechCo	0.334***	0.117***	0.391***	0.128***	0.202***	0.065***	0.093	0.031
	(0.059)	(0.021)	(0.098)	(0.037)	(0.072)	(0.023)	(0.141)	(0.046)
Complevel	-0.206***	-0.071***	-0.350***	-0.114***	-0.073	-0.023	0.066	0.022
	(0.059)	(0.021)	(0.055)	(0.020)	(0.074)	(0.023)	(0.144)	(0.047)

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Sample	Strong Innovative Countries				Modest Innovative Countries			
Method	Probit	Marginal	IV Probit	Marginal	Probit	Marginal	IV Probit	Marginal
KIBS	-0.105	-0.036	0.075	0.024	0.014	0.004	-0.034	-0.011
	(0.067)	(0.023)	(0.071)	(0.023)	(0.084)	(0.027)	(0.101)	(0.033)
High-Tech	0.032	0.011	0.204**	0.065**	0.025	0.008	-0.051	-0.017
	(0.106)	(0.036)	(0.093)	(0.029)	(0.120)	(0.038)	(0.125)	(0.041)
Denmark	0.102	0.035						
	(0.097)	(0.033)						
France	0.000	0.000						
	(0.085)	(0.029)						
Germany	0.021	0.007						
	(0.085)	(0.029)						
Sweden	0.259***	0.087***						
	(0.096)	(0.031)						
Czech Republic					0.145	0.045		
					(0.145)	(0.044)		
Greece					0.114	0.036		
					(0.130)	(0.040)		
Italy					0.184	0.058		
					(0.122)	(0.038)		
Portugal					0.062	0.020		
					(0.131)	(0.041)		
Constant	-0.737***		-0.046		-0.201		-0.586	
	(0.228)		(0.297)		(0.321)		(0.542)	
R&D								
Immigrant			-0.154				2.040	
			(1.576)				(2.024)	
Female			-3.199***				0.278	
			(0.884)				(1.291)	
FounderAge			-0.130***				-0.170***	
			(0.045)				(0.058)	
Education			0.639***				0.071	
			(0.113)				(0.144)	
Experience			0.057				0.067	
			(0.046)				(0.051)	

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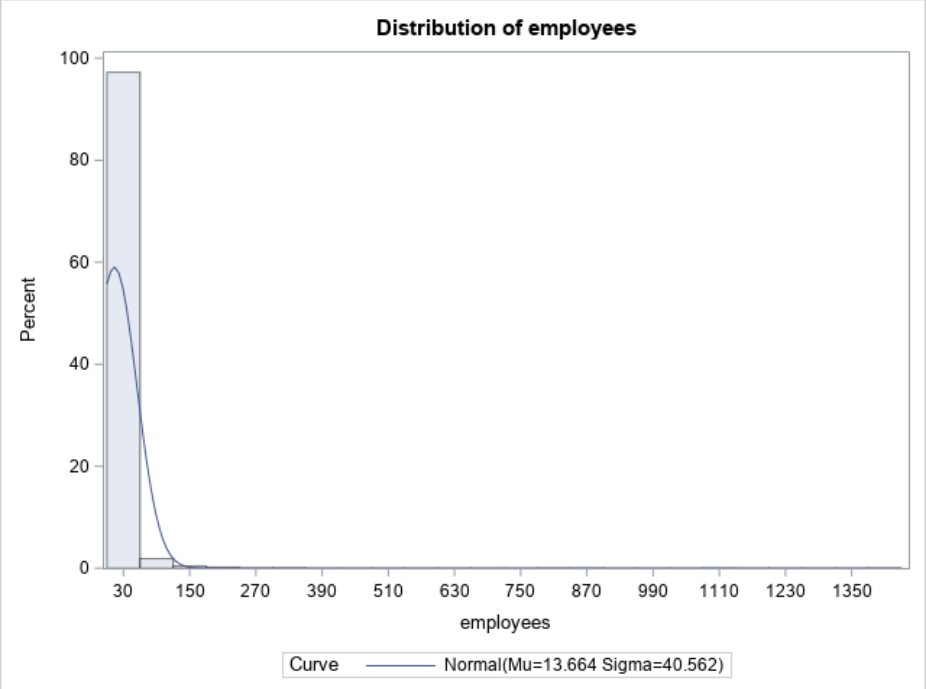
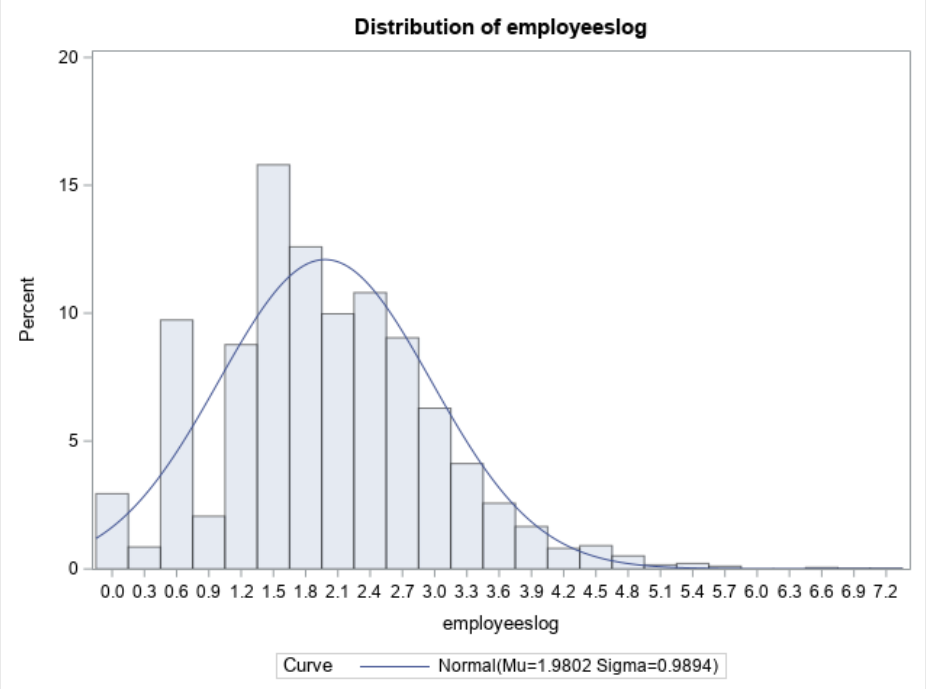
Sample	Strong Innovative Countries				Modest Innovative Countries			
Method	Probit	Marginal	IV Probit	Marginal	Probit	Marginal	IV Probit	Marginal
LastOccupation			2.339**				-0.014	
			(1.116)				(0.945)	
Firmage			-0.192				-0.261	
			(0.174)				(0.218)	
logEmployees			0.163				-0.597	
			(0.407)				(0.532)	
University			9.624***				6.156***	
			(1.679)				(1.247)	
Export			0.136***				0.046**	
			(0.022)				(0.021)	
TechCo			4.826***				2.366***	
			(0.729)				(0.916)	
Complevel			-5.207***				-3.883***	
			(0.829)				(1.009)	
KIBS			2.197***				2.303**	
			(0.809)				(1.070)	
High-Tech			3.698**				2.526	
			(1.594)				(1.686)	
Indirect2007			14.636				-41.305**	
			(12.898)				(18.945)	
Direct2007			-10.682				-3.846	
			(9.059)				(15.845)	
Constant			4.267				21.777***	
			(2.673)				(3.893)	
athrho2_1			1.563				-0.675	
			(1.004)				(0.675)	
lnsigma2			2.901***				2.883***	
			(0.031)				(0.037)	
Pseudo R^2	0.11				0.06			
chi2	302.777		677.735		106.139		143.285	
p	0.000		0.000		0.000		0.000	
N	2202	2202	2202	2202	1538	1538	1538	1538

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX B

VARIABLE TRANSFORMATION





APPENDIX C

COUNTRY INDICATORS

GDP per capita growth (annual %), by Country

Country	2007	2008	2009	2010
Croatia	5.09%	1.91%	-7.23%	-1.09%
Czech Republic	4.96%	1.84%	-5.20%	2.14%
Denmark	0.46%	-1.09%	-5.41%	1.42%
Germany	1.79%	-0.30%	-3.37%	1.45%
Greece	3.11%	1.15%	-5.45%	4.34%
France	3.01%	-0.60%	-4.55%	-5.60%
Italy	0.98%	-1.62%	-5.71%	1.40%
Portugal	2.31%	0.17%	-3.21%	1.69%
Sweden	2.68%	-1.22%	-5.15%	5.05%
United Kingdom	1.64%	-1.06%	-4.97%	1.15%
Source of data	World Development Indicators			

GDP per capita (constant 2010 US$), by Country

	2007	2008	2009	2010
Croatia	14,917.7	15,201.9	14,103.4	13,949.3
Czech Republic	20,242.1	20,614.2	19,542.5	19,960.1
Denmark	61,174.5	60,504.8	57,229.0	58,041.4
Germany	41,621.5	42,101.0	39,804.6	41,531.9
Greece	30,054.9	29,874.7	28,514.8	26,917.8
France	41,582.8	41,456.5	40,058.7	40,638.3
Italy	38,272.2	37,653.7	35,503.2	36,000.5
Portugal	22,819.5	22,859.4	22,124.6	22,498.7
Sweden	53,716.4	53,059.5	50,326.2	52,869.0
United Kingdom	41,465.5	41,024.8	38,986.1	39,435.8
Source of data	World Development Indicators			

From the above tables, all the countries have decreased growth after the financial crises hit especially in 2009 with differences in severity and most countries slowly recovered in subsequent years except in France. Also, the GDP per capita shows that the

countries could be divided into two groups based on size of the economy or GDP per capita into (Croatia, Czech Republic, Greece, Italy, Portugal) that have a lower income, and (Denmark, France, Germany, Sweden, The United Kingdom) country group that have higher income.

Unemployment Annual Data, by Country

	2007	2008	2009	2010	2011
	9.9	8.6	9.2	11.7	13.7
Croatia	-12.39%	-13.13%	6.98%	27.17%	17.09%
	5.3	4.4	6.7	7.3	6.7
Czech Republic	-26.39%	-16.98%	52.27%	8.96%	-8.22%
	3.8	3.7	6.4	7.7	7.8
Denmark	-2.56%	-2.63%	72.97%	20.31%	1.30%
	8.7	7.5	7.8	7	5.8
Germany	-15.53%	-13.79%	4.00%	-10.26%	-17.14%
	8.4	7.8	9.6	12.7	17.9
Greece	-6.67%	-7.14%	23.08%	32.29%	40.94%
	8.0	7.4	9.1	9.3	9.2
France	-9.09%	-7.50%	22.97%	2.20%	-1.08%
	6.1	6.7	7.8	8.4	8.4
Italy	-10.29%	9.84%	16.42%	7.69%	0.00%
	8.1	7.7	9.6	11	12.9
Portugal	3.85%	-4.94%	24.68%	14.58%	17.27%
	6.2	6.2	8.4	8.6	7.8
Sweden	-12.68%	0.00%	35.48%	2.38%	-9.30%
	5.3	5.6	7.6	7.8	8.1
United Kingdom	-1.85%	5.66%	35.71%	2.63%	3.85%

Source of data Eurostat

The table above shows that unemployment increased in most countries after the financial crisis. Some countries were already at a high unemployment rate, especially in Croatia, Germany, Greece. Also, some countries were more affected by the crisis than others.

Czech Republic and Denmark have the highest increase in their unemployment rate despite having the lowest unemployment rate in 2009. Germany was the only country that experienced decrease in the unemployment rate in 2010, while in 2011, Croatia, Denmark, Greece, Portugal, and the United Kingdom experienced further increases in unemployment.

APPENDIX D

TEAM DIVERSITY

Team Diversity by Immigration Status of Founders

Team		Native-founded Firm	Immigrant-founded Firm	Total
Immigrants Only	N	0	170	170
	Row%	0	%4.55	%4.55
	Column%	0	%59.65	
Mixed Teams	N	179	115	294
	Row%	%4.79	%3.07	%7.86
	Column%	%5.18	%39.12	
Natives Only	N	3276	0	3276
	Row%	%87.59	0	%87.59
	Column%	%94.82	0	
Total	N	3455	285	3740
	Row%	%92.38	%7.62	%100

In the above table I created a new dataset based on the unique identifier for each firm in AEGIS and captured the immigration status of the founding team of the firm. I categorized the new variable *Team* into three categories, immigrant only teams, native only teams, and mixed teams.

Then I created a frequency table and counted how many founders from the team that founded each firm are immigrants or natives and saved the results in a new dataset. This is to find the percentage or the frequency of firms that are native-founded firms based on the first founder but have an immigrant in the founding team and vice versa. Mixed team firms are only 292 (7.81%) of all firms in this sample, and the percentage that an immigrant-founded firm is a mixed firm is approximately 40%, while among native-founded firms, only 5% of the firms are mixed firms.

I created a gender diversity variable as in the following table. This will help in investigating the association between diversity in teams based on gender or immigration status and innovation.

Team Diversity by Gender of Founders

Team	Frequency	%
Females Only	298	7.97
Mixed Teams	871	23.29
Males Only	2571	68.74
Total	3740	100

APPENDIX E

AEGIS SURVEY INSTRUMENT

APPENDIX

AEGIS QUESTIONNAIRE

Introduction

We are contacting you in the context of a survey funded by the European Commission that is carried out in 10 countries across Europe.

The aim of the survey is to investigate new companies that incorporate knowledge and have significant innovative activity. The results of this survey, which will be communicated to your firm, will provide valuable recommendations for shaping EU policies in this field.

I would like to speak with one of the founders and ask some general questions about your company. This interview will take around 15 minutes.

Please note that the information you provide will not be used at an individual level nor handed over by name to the European Commission or any other third party. The information will only be used for aggregate analysis.

Screener Questions

S1

S1. We are looking for new firms that were established during the period 2001-2007, is it correct that your firm is established under the current legal status in <Start year >?

Items	Code	Description
	1	Yes
	2	No

S2

Condition S1 = 2

S2. In which year is your firm established?

S3

S3. Was this a new establishment or just a change in the legal status?

Code	Description
1	Yes, new establishment
2	No, change of legal status

S4a. Was the company in its current legal form established as a spin off of an established company with more than 25% ownership?

Code	Description
1	Yes
2	No

S4b. A subsidiary of another company?

Code	Description
1	Yes
2	No

S4c. A merger, acquisition or joint venture?

Code	Description
1	Yes
2	No

S5. Please indicate what are the firm's most important activities?

SECTION 1: General information about the firm

Q1. What is the total number of ...

Code	Description
1	Full time employees in your company
2	Part time employees in your company

Q2. What is the total number of employees in your firm with a University Degree?

Code	Description
1	Employees with an University Degree

Q2B

Q2b. How many of them hold a:

Code	Description
1	Postgraduate degree

2	PhD

SECTION 2a: General information about the founder or the founding team

Q3. How many people founded your firm?

Code	Description
1	Number of people

Q4. Who founded your firm?

Q4A

	Code	Description
Items	1	Founder 1
	2	Founder 2
	3	Founder 3
	4	Founder 4
Labels	1	Mr
	2	Mrs
	3	Ms

Q5. What is/are the highest educational attainment of the founder(s)?

	Code	Description
Items	1	Founder 1:
	2	Founder 2:
	3	Founder 3:
	4	Founder 4:
Labels	1	Elementary education
	2	Secondary education
	3	Bachelor degree
	4	Postgraduate degree
	5	PhD
	6	Don't know

Q6. What was the last occupation of the founder(s) before the establishment of this company?

	Code	Description
Items		

	1	Founder 1:
	2	Founder 2:
	3	Founder 3:
	4	Founder 4:

Labels	Code	Description
	1	Owner of a firm still in existence
	2	Owner of a firm that has ceased operations
	3	Employee of a firm in the same industry
	4	Employee of a firm in a different industry
	5	Self-employed
	6	University or research institute employee
	7	Government employee
	8	Unemployed
	9	None of the above - this is his/her first job
	10	Don't know

Q7. Approximately how many years of professional experience did the founder(s) have in the current sector your company is active before the establishment of this company?

Items	Code	Description
	1	Founder 1:
	2	Founder 2:
	3	Founder 3:
	4	Founder 4:

Q8. What are the main areas of expertise of the founder(s) that are relevant for the operation of this company?

Items	Code	Description
	1	Founder 1:
	2	Founder 2:
	3	Founder 3:
	4	Founder 4:

Labels	Code	Description
	1	Technical and engineering knowledge
	2	General management
	3	Product design
	4	Marketing
	5	Finance
	6	None of these / Don't know

Q9. What is the age of the founder(s)?

Items		
	1	Founder 1:
	2	Founder 2:

	3	Founder 3:
	4	Founder 4:

Labels

Code	Description
1	18-29
2	30-39
3	40-49
4	>50
5	Don't know

Q10. Were/was the founder(s) born in this country?

Items

Code	Description
1	Founder 1:
2	Founder 2:
3	Founder 3:
4	Founder 4:

Labels

Code	Description
1	Yes
2	No
3	Don't know

SECTION 2b:Formation process

Q11. Did the company come out of another pre-existing organization?

Items

Code	Description
1	Yes
2	No

Q12a

Condition Q11 = 1

Q12a. What is the parent organization?

Items

Code	Description
1	University
2	Company
3	Other, specify

Q12b

Condition (Q11 = 1) and (Q12a = 2)

Q12b. Is this company still related to the firm as a:

Items

Code	Description

1	Partner
2	Competitor
3	Customer
4	Supplier
5	None of these

Q13. Please indicate the importance of the following factors for the formation of the company on a 5 point scale, were 1 is not important and 5 is extremely important.

Items	Code	Description
	1	Work experience in the current activity field
	2	Technical/engineering knowledge in the field
	3	Design knowledge
	4	Knowledge of the market
	5	Networks built during previous career
	6	Availability of finance
	7	Opportunities in a public procurement initiative
	8	Existence of a large enough customer
	9	Opportunity deriving from technological change
	10	Opportunity deriving from a new market need
	11	Opportunity deriving from new regulations or institutional requirements

Q14. Please, estimate the percentage of funding coming from the following sources for setting up your company.

Items	Code	Description
	1	Own financial resources (savings)
		| %
	2	Funding from family member
		| %
	3	Funding from previous employer (corporate venture capital, university incubator technology transfer)
		| %
	4	Venture capital
		| %
	5	Funding from a bank
		| %
	6	Public fund from national government or local authorities (programs supporting entrepreneurship, etc)
		| %

7	European Union funds (programs supporting SMEs etc)	| %
8	Other sources (please specify)	| %

SECTION 3: Market environment

Competitive and institutional environment

Q15. Right now, are there other businesses offering the same products and/or services to your potential? customers?

Items	Code	Description
	1	Yes, many business competitors
	2	Only a few business competitors
	3	No other business competitors

Q16. During the last three years (2007-2009) what was the % of your firm's sales in :

Items	Code	Description
	1	The local/regional market
	2	The national market
	3	The international market

Q17. Please identify the most important type of customer of the company.

Items	Code	Description
	1	Large firms
	2	Small and medium sized firms
	3	Final consumers (e.g. private households, private consumption)
	4	Public sector
	5	Other (please specify)

Q18. Please indicate to what extent you agree or disagree with the following statements characterizing your business environment. On a 5 point scale, were 1 is completely disagree and 5 is completely agree.

In the principal industry in which our firm operates...

Items	Code	Description
	1	... the life cycle of products is typically short
	2	... customers regularly ask for new products and/or services
	3	... the speed of technological changes is high
	4	... the activities of our major competitors are unpredictable and

	competition is very intense
5	... a company only succeeds if it is able to launch new products/services continuously
6	... price competition is prevalent
7	... quality competition is prevailing

Success factors

Q19. Please, indicate the contribution of the following factors in creating and sustaining the competitive advantage of this company. On a 5 point scale, were 1 is no impact and 5 huge impact.

Code	Description
1	Capability to offer novel products/services
2	Capacity to adapt the products/services to the specific needs of different customers/market niches
3	Capability to offer expected products/services at low cost
4	R&D activities
5	Establishment of alliances/partnerships with other firms
6	Capability to offer high quality product/services at a premium price
7	Networking with scientific research organizations (universities, institutes, etc.)
8	Marketing and promotion activities

Obstacles

Q20. Please indicate to what extent the following factors have been obstacles to the firm growth and expansion of business activities. On a 5 point scale, were 1 is not at all and 5 is to a great extent.

Items	Code	Description
	1	Technology risk / uncertainty
	2	Market risk /uncertainty
	3	Large initial investment
	4	Difficulty in finding the necessary funding for growth investments
	5	Difficulty in finding business partners
	6	Difficulties in recruiting highly-skilled employees
	7	Lack of technological know-how

Q21. Please indicate how serious the following barriers have been to the firm growth and expansion of business activities. On a 5 point scale, were 1 is no barriers and 5 is very serious barriers.

Items	Code	Description
	1	Continuously changing taxation regulations
	2	High tax rates
	3	Time consuming regulatory requirements for issuing permits and licenses

	4	Poorly enforced competition law to curb monopolistic practices
	5	Poorly enforced property rights, copyright and patent protection
	6	Strict property, copyright and patent protection
	7	Government officials favor well connected individuals
	8	Bankruptcy legislation makes immense the cost of failure
	9	Rigid labor market legislation

SECTION 4: Strategy

Identification and utilization of technical and market opportunities

Q22. What is the main strategy of the company?

Items	Code	Description
	1	Offer standardized products and services at low cost (cost leadership strategy)
	2	Offer unique products and services (differentiation strategy).
	3	Exploit opportunities in new market niches (focus strategy).
	4	Other, specify

Q23. Please indicate to what extent you agree or disagree with the following statements regarding the sensing and seizing of opportunities within your firm. On a 5 point scale, were 1 is strongly disagree and 5 is strongly agree.

Items	Code	Description
	1	Our firm actively observes and adopts the best practices in our sector
	2	Our firm responds rapidly to competitive moves
	3	We change our practices based on customer feedback
	4	Our firm regularly considers the consequences of changing market demand in terms of new products and services
	5	Our firm is quick to recognize shifts in our market (e.g. competition, regulation, demography)
	6	We quickly understand new opportunities to better serve our customers
	7	There is a formal R&D department in our firm
	8	There is a formal engineering and technical studies department in our firm
	9	Design activity is important in introducing new products/services to the market
	10	We implement systematic internal and external personnel training
	11	Employees share practical experiences on a frequent basis

Sources of knowledge

Q24. Please evaluate the importance of the following sources of knowledge for exploring new business opportunities on a 5 point scale, were 1 is not important and 5 is extremely important.

Items	Code	Description
	1	Clients or customers
	2	Suppliers
	3	Competitors

4	Public research institutes
5	Universities
6	External commercial labs/R&D firms/technical institutes
7	In-house (know how, R&D laboratories in your firm)
8	Trade fairs, conferences and exhibitions
9	Scientific journals and other trade or technical publications
10	Participation in nationally funded research programmes
11	Participation in EU funded research programmes (Framework Programmes)

Networking

Q25. To what extent do the networks your firm participates in have contributed to the following operations of the company? On a 5 point scale, were 1 is not important and 5 is extremely important.

Items	Code	Description
	1	Contacting customers/clients
	2	Selecting suppliers
	3	Recruiting skilled labor
	4	Collecting information about competitors
	5	Accessing distribution channels
	6	Assistance in obtaining business loans/attracting funds
	7	Advertising and promotion
	8	Developing new products/services
	9	Managing production and operations
	10	Assistance in arranging taxation or other legal issues
	11	Exploring export opportunities

Q26. Please indicate to what extent your company has participated in the following types of agreements? On a 5 point scale, were 1 is not at all and 5 is very often.

Items	Code	Description
	1	Strategic alliance
	2	R&D agreement
	3	Technical cooperation agreement
	4	Licensing agreement
	5	Subcontracting
	6	Marketing/export promotion
	7	Research contract-out
	8	Other (please specify)

SECTION 5: Innovation and business models

Q27a. Did this company introduce new or significantly improved goods or services during the past three years? (Exclude the simple resale of new products purchased from other enterprises and changes of solely aesthetic nature).

Items	Code	Description
	1	Yes
	2	No

Q27b. Please estimate:

Items	Code	Description
	1	The share of new or significantly improved goods to total sales
	2	The share of new or significantly improved services to total sales

Multiple response

Q28. The new or significantly improved goods or services were ...

Items	Code	Description
	1	New to the firm
	2	New to the market
	3	New to the world

Q29. Please indicate to what extent has the firm introduced new or significantly improved goods or services as a result of participation in a publicly supported or subsidised activity? On a 5 point scale, where 1 is not at all and 5 to a great extent, is that ...

Labels	Code	Description
	1	Not at all
	2	2
	3	3
	4	4
	5	To a great extent
	6	Don't know

Q30. Please indicate which of the following methods were used by your firm to protect its intellectual property during the last three years.

Items	Code	Description
	1	Patents
	2	Trademarks
	3	Copyrights
	4	Confidentiality agreements
	5	Secrecy
	6	Lead-time advantages on competitiors
	7	Complexity of design

Labels	Code	Description
	1	Yes

	2	No
	3	Don't know

Q31 During the last three years the company has introduced new or significantly improved ...

	Code	Description
Items	1	Methods of manufacturing
	2	Logistics, supply chain, delivery or distribution methods for its inputs, goods or services
	3	Supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing
	4	Improved knowledge management systems
	5	Changes in the managing structure
Labels	Code	Description
	1	Yes
	2	No
	3	Don't know

Q32 On average, which percentage of your sales has been spent on R&D during the last three years?

	Code	Description
Items	1	which percentage of sales is spend on R&D? ….. %

SECTION 6: Firm performance and the effect of economic crisis

Q33. Please estimate the average increase/decrease of ...

Q33A

2007 - 2009

	Code	Description
Items	1	sales
		| %
	2	employment
		| %
	3	exports
		| %
	4	R&D to sales ratio
		| %

Q33B

End of 2010

Items	Code	Description
	1	sales
		| %
	2	employment
		| %
	3	exports
		| %
	4	R&D to sales ratio

Q34. Could you please indicate the impact (if any) of the current economic crisis on your firm in terms of the following elements (please consider the effect on the activity of 2009 compared to the activity of 2008).

Items	Code	Description
	1	Sales
	2	Exports
	3	Employment
	4	Profits
	5	Investments
Labels	Code	Description
	1	Significant increase (>5%)
	2	No significant changes (+/- 5%)
	3	Slight Decrease (-5%to -10%)
	4	Significant Decrease (-10% to -20%)
	5	Very Significant Decrease (>-20%)
	6	Don't know

Q35. How do you think your firm /sector will be affected in terms of financing and creation of new opportunities in the post crisis period?

Items	Code	Description
	1	Liquidity will be significantly restricted in my sector
	2	Borrowing costs will significantly increase
	3	A lot of my customers / suppliers will face significant liquidity problems which may cause problems to my firm
	4	Bankruptcies and restructuring in my sector might create new opportunities for my firm
Labels	Code	Description
	1	Yes
	2	No
	3	Don't know

Q36. Please indicate the average turnover of your firm during the last three years (2007-2009)

Items	Code	Description
	1	upto 200 thousand pounds
	2	200-400 thousand pounds
	3	401-1700 thousand pounds
	4	1701-4000 thousand pounds
	5	4001-8500 thousand pounds
	6	8501-40000 thousand pounds
	7	More than 40000 thousand pounds
	8	Don't know
	9	Refused

Q37. Please indicate average profits of your firm during the last three years (2007-2009)

Items	Code	Description
	1	Losses
	2	upto 40 thousand pounds
	3	41 to 130 thousand pounds
	4	131 to 170 thousand pounds
	5	171 to 450 thousand pounds
	6	451 to 850 thousand pounds
	7	850 thousand to 4 Million pounds
	8	More than 4 Million pounds
	9	Don't know
	10	Refused

Thank you very much for your time and cooperation.