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Institutions and Entrepreneurship Quality

Farzana Chowdhury[1], David B. Audretsch[2], and Maksim Belitski

Abstract

Entrepreneurship contributes importantly to the economy. However, differences in the quality and quantity of entrepreneurship vary significantly across developing and developed countries. We use a sample of 70 countries over the period of 2005-2015 to examine how formal and informal institutional dimensions (availability of debt and venture capital, regulatory business environment, entrepreneurial cognition and human capital, corruption, government size, government support) affect the quality and quantity of entrepreneurship between developed and developing countries.

Our results demonstrate that institutions are important for both the quality and quantity of entrepreneurship. However, not all institutions play a similar role; rather, there is a dynamic relationship between institutions and economic development.

Keywords: institutions, entrepreneurship, labor regulation, tax, bankruptcy, regulation, venture capital, debt finance, corruption, public policy, economic development

Introduction

Entrepreneurial activity makes an important contribution to economic growth (Carree & Thurik, 2003; Holcombe, 2000; van Stel et al., 2005). Existing research has examined the micro- (Kihlstrom & Laffont, 1979; van Praag, 1999) and macro-level (Stenholm et al., 2013; Grilo & Thurik, 2005; Noorderhaven et al. 2004) elements that explain why different countries have different levels of entrepreneurship. These studies demonstrate that it is important to determine the cause of variations in entrepreneurship levels. Existing studies have focused on the role of institutions in fostering entrepreneurship (Estrin et al., 2013; McMullen et al., 2008; Sobel, 2008), either from a within-country perspective (Cole et al. 2016; Amorós, 2009) or a quality-of-institution perspective (Armour & Cumming, 2006, 2008; Amorós, 2009; Stenholm et al. 2013; Estrin et al. 2013). The ways in which changes in economic development and institutional conditions affect the quantity and quality of entrepreneurship in a country have received much less attention (Dorado & Ventresca, 2013; Sobel, 2008). To fill this important gap in the literature, the current study focuses on the relationship between the quality of institutions and the quantity and quality of entrepreneurship between countries with different levels of economic development.

Institutional quality is often associated with more secure property rights, a well-functioning court system (Douhan & Henrekson, 2010; Mehlum et al., 2006; Acemoglu, Johnson, & Robinson, 2001), personal bankruptcy (Armour & Cumming, 2008), resource endowment (Lin, 2011), availability of finance (Samila & Sorenson, 2011; Cumming & Zhang, 2016; Cole et al. 2016), availability of knowledge (Polyhart & Moliterno, 2011) and entrepreneurial capital (Stenholm et al. 2013). As a country's institutional conditions change, a unique dynamic environment develops. This necessitates the need for a greater understanding of the match between the type (e.g. necessity, opportunity entrepreneurship) and quality (e.g. high growth,

innovative, productive) of entrepreneurial activity. Institutions that provide "secure property rights, a fair and balanced judicial system, contract enforcement, and effective limits on government's ability to transfer wealth through taxation and regulation" (Sobel, 2008: 644) versus their counterparts will see a difference in the quality of entrepreneurial activity.

It is important to consider both the quantity and quality of entrepreneurship because not all entrepreneurship contributes equally to economic activity. For instance, Hurst and Pugsley (2012) found that a significant number of start-ups in the United States have little or no intention to grow. These low-quality/subsistence entrepreneurship activities, often (Schoar, 2010) motivated by necessity, only create jobs for their owners (Davidsson & Henrekson, 2002) and are unlikely to benefit society as a whole (Baumol, 1990). Meanwhile growth-oriented, productive, and transformational entrepreneurship tends to be more innovative by creating new products, processes and jobs, and extending the tax base for the government (Sobel, 2008).

This study contributes to several strands of literature. First, we contribute to the entrepreneurship and institutions literature by combining North's (1990) institutional theory with Williamson's (2000) institutional hierarchy approach, Whitley's (1999) national business systems (NBS) perspective and Baumol's (1990) theory of the productivity of entrepreneurship. This allows us to explore the interactive and dynamic relationships between the formal and informal institutions and the quality and quantity of entrepreneurship. Entrepreneurial decision-making does not occur in a vacuum; it is based on a meticulous analysis of the institutional environment and available support structures (Whitley, 1999; Williamson, 2000). Our empirical results directly support the synergies between the four different approaches in the institutional literature. Our most novel findings are that the relationship between institutional dimensions and the quality and quantity of entrepreneurial activity varies (Armour & Cumming, 2006, 2008; Amorós, 2009), and that the strength of this relationship depends on the level of the country's economic development.

A more nuanced relationship between a type of institutional dimension and entrepreneurial choice was established and measured. Our 'quality of entrepreneurship' measure further expands upon Sobel's (2008) measure.

Secondly, this study contributes to the economic development literature by combining the North-Williamson-Whitley-Baumol framework and using the economic development perspective (Wennekers et al. 2005). This demonstrates that countries with different levels of economic development, quality of formal and informal institutions are likely to have different marginal effects on both quality and quantity of entrepreneurship. We also explore a non-linear relationship between various institutional dimensions and entrepreneurial activity.

This study makes an important methodological contribution by merging data from various sources at a country level, including the World Bank Group Entrepreneurship Snapshot, World Development Indicators, Doing Business Statistics, the World Intellectual Property Organization, the Global Entrepreneurship Monitor (GEM), the Index of Economic Freedom of the Heritage Foundation, the World Economic Forum and World Governance Indicators expanding Cumming's et al. (2014) approach to measuring entrepreneurship internationally. The following changes and their effect on entrepreneurship quality are investigated: changes in financial development and financial institutional support to entrepreneurship in the form of debt and equity financing; changes in labor, fiscal (corporate tax rate) and bankruptcy regulations (resolving insolvency); changes in informal regulations and corruption levels; changes in government size; and changes to regulatory measures related to government support of entrepreneurship and government programs. In addition, we also control for the availability of entrepreneurial capital and entrepreneurial cognition of the quality and quantity of entrepreneurship.

Sobel's (2008) study developed measures to establish the quality of entrepreneurship using cross-sectional data for the 50 US states. Cumming and Li's (2013) study identified the

shortcomings of Sobel's (2008) study and argued that studies relating to the impact of institutions on the quality and quantity of entrepreneurship should always use panel data, which enables consistent and robust findings. . Building on the existent institutional and entrepreneurship literature and using the panel data technique, our major contribution is explaining the strength and size of the relationship between each institutional dimension and the quality and quantity of entrepreneurial activity in developed and developing countries (Cumming & Li, 2013; Bloom, 2014; Sobel, 2008).

Finally, this study contributes to the resource-based view (RBV) literature by demonstrating that different types of entrepreneurship need different types of resources while changes in economic development change demand and supply for different types of resources. This dynamic environment requires an adjustment in policies allowing the combination and productive use of these resources. The results are both unexpected and intriguing.

In the following sections we set the foundation of our theoretical argument and present our hypotheses that relate the quality of institutions to two types of entrepreneurship. We then present our data analysis and methodology, followed by a discussion of the results. We discuss policy implications and draw a number of conclusions. Finally, we analyze the limitations of this study and make suggestions for future research.

The Dynamic Relationship between Institutions and Economic Development

The relationship between institutions and economic development has long been debated. North (1997) argued that the institution is the primary source of development, and is also a factor in the poor performance of many developing countries: "Third World countries are poor because the institutional constraints define a set of payoffs to political/economic activity that does not encourage productive activity" (North, 1990, p. 110). Przeworski (2004, p. 15) argued that institutions and economic development are endogenous and suggested that institutions and development follow a feedback loop: "[if] institutions shape development, but development affects institutions, then institutions are

endogenous with regard to their consequences". While these studies demonstrate that institutions play an important role in economic development, other scholars have argued that institutions are not created in a vacuum; rather, historical events dictate the current quality of institutions in a country. For example, Banerjee and Iyer (2002, p. 1) suggest that "In the new institutionalist view, history matters because history shapes institutions and institutions shape the economy." Other studies have suggested that institutions and subsequent development have a circular relationship, since political actors prefer to maintain the institutions that enabled them to rise to power: "Not only were certain fundamental characteristics of the New World economies and their factor endowments difficult to change, but government policies and other institutions tended to reproduce the conditions that gave rise to them" (Sokoloff, 2000, p. 5). As these existing studies demonstrate, the relationship between institutions and economic development is very important. The following section will therefore discuss how institutions are related to entrepreneurial activities.

Changes in Institutions and Entrepreneurship

Institutions and entrepreneurial activities tend to have a bidirectional relationship. The theoretical underpinning of this paper is built on North (1990; 1994; 1997), Baumol (1990), Williamson (2000), and Whitley (1999). The literature on institutions (North, 1990; Baumol, 1990; Sobel, 2008) and entrepreneurship (Estrin et al., 2013; Stenholm et al., 2013) assumes that institutional environments create the conditions for individual decision-making, which plays an important role in entrepreneurial cognition and the quality of entrepreneurship (Bowen & De Clercq, 2008). The "Institutional framework within which an activity is performed often determines whether this activity is productive, unproductive or destructive" (Douhan & Henrekson, 2010: 630). This implies that exogenous institutional reforms change the quality and quantity of entrepreneurial activity by changing the environment where decisions are taken and implemented. On the other hand, scholars argue that entrepreneurs act as agents of change by generating "… new organizational models and policies that

change the direction and flow of organizational activity" (Hwang & Powell, 2005; p. 179) that lead to changes in the institutional environment.

Institutions are "humanly devised constraints that structure political, economic and social interaction" (North, 1990: 3). According to North (1990; 1994; 1997), institutions create and establish the norms, rules, constraints, and incentives that operate as tools of governance for exchanges among individuals. Formal and informal institutions interact together and the impact of formal institutions can be influenced by the informal institutions (North, 2006; Smallbone & Welter, 2012, North, 1997, 1990; Aparicio et al., 2016). Sobel (2008) built on Baumol (1990) and concluded that the political and legal institutions help to explain differences in the levels and quality of entrepreneurial activity across US states, as well as economic prosperity. Baumol (1990) examined different historical institutional contexts such as Ancient Rome, the Sung Dynasty in China and the United Kingdom. The study concluded that institutional conditions were a major determinant of different types of entrepreneurship in these countries. Baumol's (1990) theory suggested that entrepreneurs exploit and commercialize opportunities both within private markets and within the political and legal environment, which Whitley (1999) defined as National Business Systems. Differences in the rates and quality of entrepreneurship are thus influenced by differences in entrepreneurial decision-making. These are channeled through the system of incentives by a specific combination of economic, political and legal institutions (Baumol, 1990).

As institutions influence individual behavior, over time entrepreneurs also take the initiative to change the institutions that are beneficial to them. Maguire et al. (2004: 657) refer to these individuals as 'institutional entrepreneurs': "actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones". These actors "create a whole new system of meaning that ties the functioning of disparate sets of institutions together" (Garud et al., 2002). DiMaggio (1988: 14) argued that "new institutions arise when organized actors with sufficient resources see in them an opportunity to realize interests that

they value highly". Since entrepreneurial decision-making is determined by the quality of institutions (Sobel, 2008), productive entrepreneurship will generate more rewarding experiences for the entrepreneurs as the quality of the institutions changes (Baumol, 1990).

The works of North (1990), Williamson (2000), and Whitley (1999) further help us to establish the four institutional factors that influence the quality of entrepreneurial activity. The highest layer is the *Informal institutions* of a country, which are embedded in a society and can become habitual (Estrin et al., 2013, North, 2006, Aparicio et al., 2015; North, 1990). A country's formal *regulatory institutions* are critical because they can reduce the uncertainty and risk associated with entrepreneurial activity (Smallbone & Welter, 2012, Klapper et al., 2006; Busenitz et al., 2000). However, they can also be burdensome and negatively influence entrepreneurship if, for example, the cost of complying with regulations is high (Klapper et al., 2006). The third layer of Williamson's (2000) institutional framework that drives resource allocation is the *governance* layer.

All of these layers influence the fourth and last layer - the resource allocation. Whitley's (1999) four factors include a financial system, the availability of skills and development, the state and the relationship with governmental authority. The quality of the institutional environment influences an entrepreneur's attitudes, motives, and the ability to mobilize resources (Martinelli, 2004; Shane, 2003). It also shapes the 'rules of the game', which in turn affects the quality of entrepreneurship (North, 1990; Baumol, 1990; Bowen & De Clercq, 2008; McMullen et al., 2008). Combining the theoretical frameworks developed by North (1990), Williamson (2000), Whitley (1999) and Baumol (1990, 1993), we argue that the quality and rate of entrepreneurship in a country is likely to be significantly influenced by six important dimensions - 1) level of financial development; 2) availability of entrepreneurial capital and cognition; 3) the regulatory framework; 4) corruption; 5) government size; and 6) government support. We will now discuss each of these dimensions and how they influence the quality and quantity of entrepreneurship in the context of developed and developing countries (Rodrik et al., 2004).

Changes in the Level of Financial Development and Entrepreneurship

The need for financial resources for entrepreneurs varies across countries. The extant literature suggests that are several reasons for this, such as the structure of laws and their enforcement (La Porta et al., 1997a, b, 2002; La Porta, et al., 2006), regulations relating to liabilities and rules and their influence on the stock market (La Porta et al., 2006), and the protection of minority shareholders (La Porta et al., 2002).

In developing countries, scarcity drives up the value of financial resources in stark contrast to the relative abundance of finance in developed countries. Whitley (1999) argued that a country's financial system, such as its credit-market or capital-market, is important for shaping its economic behavior. This paper argues that financial development and economic development are interdependent. This is because pressure grows on financial institutions to develop in response to increased demands for economic activity as economic development continues.

Entrepreneurs often rely on their personal wealth (Evans & Jovanovic, 1989) or inheritance (Holtz-Eakin et al., 1994a, b). They may also use informal networks such as friends and family to acquire financial resources (Gaston, 1989), or formal networks such as customers, suppliers and so on (Gregson, 2014). In addition, they often face difficulties in obtaining external financial sources due to a lack of collateral (Boot & Thakor, 1994; Evans & Jovanovic, 1989), legitimacy (Webb et al., 2009) and asymmetry of information (Black & Strahan, 2002). This lack of financial resources often leads to a lack of investment in activities needed for high-growth entrepreneurship.

As the level of economic development changes, financial institutions also experience an increase in both savings and competition. This changing environment is better able to contribute to productive entrepreneurial activity since entreprenurs can channel these increased savings rate into entrepreneurial activity through their own lending and investments at a lower cost (Beck et al., 2000). Black and Strahan (2002) found that increased competition increased investments in productive entrepreneurial

activities rather than the non-productive type. Alternative sources of funding for entrepreneurs have also increased across countries (Cumming & Zhang, 2016).

An improved economic state coupled with improvement in institutional conditions helps to develop the confidence of outside investors, such as venture capitalists, angels and so on (Cumming & Zhang, 2016). As the existing literature suggests, an increase in the supply of venture capital (VC) has a positive relationship with entrepreneurship. Samila and Sorenson (2011) included venture capital as an explanatory variable in their analysis of US metropolitan areas during the period 1993-2002 and found that the increased availability of venture capital increases the numbers of firms and causes employment and aggregate incomes to grow. Cole et al. (2016) found venture capital had a similar positive effect on US states during 1995-2011. Access to finance is likely to improve the quality of entrepreneurship through channeling their business into more productive activities (Sobel, 2008). Haselman and Wachtel's (2010) study included 20 transition economies and found that banks expand credit access to small business in a relatively well-functioning legal environment to a greater extent than their counterparts in countries where the legal environment does not function as well. Similar results were obtained by La Porta et al. (1997a, 1999) and Djankov et al. (2007). Taken together, the evidence suggests that improvements to institutions have a greater effect on the quality of entrepreneurship in developing economies than in developed economies due to the differing distances from the production frontier and the need for institutional improvement. Based on this, we hypothesize that:

Hypothesis 1a: The positive effects of financial development on the quantity of entrepreneurship will be stronger in developing countries than developed countries.
Hypothesis 1b: The positive effects of financial development on the quality of entrepreneurship will be stronger in developing countries than developed countries.

Changes in the Availability of Entrepreneurial Capital

The availability of resources and incentives to use them to create wealth are additional determinants of productive entrepreneurial activity (Sobel, 2008). The resource-based view (RBV) suggests that combining a firm's internal resources can create a competitive advantage (Barney, 1991).

The same concept can be applied to countries, which can combine their own resources such as human capital (both individual and collective) (Polyhart & Moliterno, 2011, Kraaijenbrink, 2011) to create a competitive advantage. Knowledge improves an individual's cognitive abilities and helps them identify, analyze and use opportunities, leading to more productive economic activities (Schultz, 1959; Becker, 1964; Mincer, 1974, Stenholm et. al. 2013). This paper uses the terms 'human capital' and 'entrepreneurial capital' interchangeably. Higher entrepreneurial capital is associated with the greater commercialization of knowledge and ideas if those exist in the market and enhance the quantity of entrepreneurship. The existing literature shows that experiences related to the labor market, management experience and entrepreneurial experience have a positive relationship with entrepreneurial activity (Davidsson & Honig, 2003; Whitley, 1999). Meanwhile, Sobel (2008) referred to the importance of incentive structures, where individuals with high levels of human capital are more likely to engage in the creation of new wealth through productive market entrepreneurship.

As a country's economic conditions change, the quality of its labor force also changes due to different experiences in the labor market (Boucekkine et al., 2002). This enables individuals to leverage various institutional contexts to channel their formal and tacit knowledge to market and improve the quality of entrepreneurial activity. The availability of entrepreneurial capital can act as a 'resource slack' - a useable resource that can be deployed to adapt to the changing institutional environment and create a competitive landscape (Levinthal, 1997).

Changes in the quality of human capital in both developed and developing economies due to higher education and labor market experience may change the self-efficacy of individuals and their level of cognition (Korosteleva & Belitski, 2015). We define self-efficacy as "a person's confidence in their ability to perform tasks" (Cassar & Friedman, 2009, p. 2), which is positively associated with increased expectations and better performance (Luszczynska, et al., 2005). The increased availability of entrepreneurial capital at various levels of economic development is likely to have a positive effect on both the quantity and quality of the entrepreneurship. Entrepreneurial capital affects entrepreneurial

decision-making and the ability to recognize opportunities when undertaking entrepreneurial activity (Chen et al., 1998). In addition to the institutional context, economic development plays an important role in a relationship between institutions and entrepreneurship quality. In developing countries where the opportunity cost of starting a business is low, entrepreneurial capital is likely to increase entrepreneurial entry and self-select highly educated individuals into more productive activities. Based on this we hypothesize that:

Hypothesis 2a: The positive effect of entrepreneurial capital on the quantity of entrepreneurship will be stronger for developing countries than developed countries.
Hypothesis 2b: The positive effect of entrepreneurial capital on the quality of entrepreneurship will be stronger for developing countries than developed countries.

Regulatory Framework

The institutional environment of a country consists of both formal and informal components (North, 1990; Williamson, 2000), differentiated by what is codified and 'official' versus what is common practice (North, 1990; Bowen & De Clercq, 2008). Formal institutions include regulatory policy, which has many different dimensions (e.g. tax policy, environmental compliance, contract enforcement, bankruptcy law, licensing and permits) and a wide range of policy tools (e.g. fees, paperwork requirements, time to deal with regulation). A country's regulatory environment entails both the complexity of the regulations and enforcement of the regulations. Cumbersome regulations and delays in obtaining necessary permits and licenses may delay the start-up process, and could even deter individuals from engaging in entrepreneurship (van Stel et al., 2007; Klapper et al., 2006).

Changes in a country's economic conditions can force policymakers to adopt specific policies that are more aligned with the changing environment of a country (Sobel, Clark & Lee 2007). We look at three important types of regulation, the first of which is labor market regulation. Grossman and Shapiro (1982) found that when there is a change in an economy, the labor market is more responsive than other areas of the economy. Any regulations that hinder an entrepreneur's opportunity to make an adjustment to the labor force will thus reduce entrepreneurial entry and negatively affect the incentives motivating high-quality entrepreneurship. The second type is fiscal regulation and tax rates. The

empirical research on the relationship between corporate taxation and entrepreneurship has been mixed (Da Rin et al., 2011). High taxation on earned income by entrepreneurs reduces the portion of income available to entrepreneurs, because if the tax rate is applied uniformly regardless of size then small businesses may bear a higher burden of taxes. This creates a moral hazard (Keuschnigg & Nielsen, 2004). The existing literature suggests that taxation of business profits and the ability to offset losses when entrepreneurs face troubling times can serve as a form of insurance (Domar & Musgrave 1944; Kaplow 1994).

The third type is bankruptcy law. Prior research has found bankruptcy law to be a strong predictor of the quantity of entrepreneurship (Fan & White, 2003; Armour & Cumming, 2006, 2008), with only limited evidence available on the quality of entrepreneurship (Fan & White, 2003; Armour & Cumming, 2006). Bankruptcy law is a type of formal institution that is a concern of policymakers and can affect the level of entrepreneurship present in a country (Gamboa-Cavazos & Schneider, 2007; Lee et al., 2011). It is a central institutional factor related to a formal layer of regulation along with fiscal and labor market reform, as well as other doing business environments (Armour & Cumming, 2008).

Empirical evidence suggests that bankruptcy laws have an important impact on the quantity of entrepreneurship. Armour and Cumming (2008) investigated the relationship between bankruptcy laws and entrepreneurship using data on self-employment over the period 1990-2005 and between fifteen countries in order to study the importance of personal bankruptcy laws for self-employment. Lee's et al (2011) study included 29 countries covering 19 years and concluded that business-friendly bankruptcy laws positively influence firm entry. Fan and White's (2003) study covered all of the states in the US, and found that states with business-friendly bankruptcy laws encouraged risk-averse entrepreneurs to engage in entrepreneurial activity. A similar result can be found in Armour and Cumming's (2006) paper, which included 14 European countries and the US. The study concluded that bankruptcy laws that allow failed entrepreneurs to close their failed business and restart quickly

increase the demand for venture capital. The ability to recover from insolvency quickly is directly associated with the strength of the insolvency framework.

Other studies also showed that policymakers interested in increasing entrepreneurship levels in a country can help by reducing the cost and time associated with bankruptcy (Armour & Cumming, 2008; Halliday & Carruthers, 2007; Peng et al., 2010; Lee at al., 2007). In summary, stricter regulations and higher compliance costs with different forms of regulation constrain entrepreneurial activities in countries and affect the choice between productive or unproductive entrepreneurship (Sobel, 2008).

Hypothesis 3a: The positive effects of an improved regulatory environment (labor markets, fiscal and bankruptcy laws) on the quantity of entrepreneurship will be stronger in developing countries than developed countries.
Hypothesis 3b: The positive effects of an improved regulatory environment (labor markets, fiscal and bankruptcy laws) on the quality of entrepreneurship will be stronger in developing countries than developed countries.

Corruption and Entrepreneurship

Informal institutions include norms and customs which govern behavior (e.g. corruption, customary land rights). Corruption can be considered as an informal institution and an indicator of poor quality institutions (Mohammadi Khyareh, 2017; Wiseman, 2015). This paper defines corruption as the use of public office for private gain (Rose-Ackerman, 2007, 1999). The existence of corruption in a society increases uncertainty and ambiguity for its entrepreneurs (Rodriguez et al., 2005; Shleifer & Vishny, 1993) and renders every transaction less transparent (Uhlenbruck et al., 2006) and adds additional costs onto each transaction. Entrepreneurs situated in a corrupt country, be it developed or developing, can be vulnerable to exploitation by government authorities. Such circumstances can include high transaction costs when waiting for permits or services, as representatives of government authorities can demand bribes. Festus et al. (2014) investigated the impact of corruption on entrepreneurship in Nigeria and found it to be a major inhibitor of both rural and urban entrepreneurs. Wiseman (2015) studied all the states of the US and found that corruption (as a measure of institutional quality) had a negative impact on productive entrepreneurship.

Another strand of literature suggests that corruption can pave the way to avoid an inefficient regulatory environment. Scholars argue that in countries where corruption is expected in every transaction (Meon & Sekkat, 2005), the expectation ameliorates the 'arbitrariness' of corruption and greases the wheels of business. Dhreher and Gassebner (2013) studied 43 countries and found a positive relationship between corruption and entrepreneurship in highly regulated countries. Szyliowicz and Wadhwani (2007) study analyzed cross-sectional panel data from 175 countries and found a positive relationship between corruption and entrepreneurship. The study suggested that entrepreneurs can use corruption as a mechanism to enter new markets that were previously blocked.

Economic development and efficiency of regulation in a country can gradually change the culture of corruption (Williams & Vorley, 2015; Estrin & Mickiewicz, 2011) by increasing the level of transparency and freedom of the press and improving the functioning of the legal systems; all of which are required for the organized market system to function (Broadman & Recanatini, 2001). Corruption can be a deterrent for both the quality and quantity of entrepreneurship by increasing entry barriers (Shleifer & Vishney 1993). Anokhin and Schulze (2009) examined the relationship between corruption, innovation and entrepreneurship in 64 countries. The study concluded that countries that are able to control and reduce corruption experience an increase in entrepreneurship and innovation. The quality of entrepreneurship may be particularly affected by corruption as government officials see more opportunities to charge high-growth entrepreneurs. This is because they have a higher rate of return to productive activity than to unproductive activity (Sobel, 2008). Based on this we hypothesize that:

Hypothesis 4a: Corruption has a stronger positive effect on the quantity of entrepreneurship in developing countries.
Hypothesis 4b: Corruption has a stronger negative effect on the quality of entrepreneurship in developed countries.

Government Size

The size of a government reflects its fiscal, legal and collective capacity (Gasper et al., 2016) to function effectively (Besley & Persson, 2011, 2013, 2014a, 2014b). In order to create strong social

institutions and implement its policies, the government needs to have stable sources of revenue. Taxes are a major source of government revenue. Compared to developed countries, many developing countries lack the sources of revenue needed to provide quality government services. The taxation and economic development literature suggests that developing countries are at a disadvantage with respect to their tax bases as a source of government revenue. For instance, Tanzi (1992) and Burgess and Stern (1993) found that countries that rely on agriculture tend to have lower tax rates. Ebeke and Ehrhart (2011) investigated sub-Saharan African countries and concluded that public investment suffers when a government lacks stable sources of revenue.

Compared to developed countries, developing countries have a large informal sector. This makes it difficult for the government to generate revenue from the unproductive or destructive entrepreneurs who conduct opaque transactions (Joshi et al., 2014). La Porta and Shleifer (2014) argued that individuals are motivated to remain in the informal sector in order to avoid paying taxes. Another study by Gordon and Li (2009) found that firms are more likely to conduct their business in cash if the financial sector is not well developed. Government resources in developed countries with high levels of compliance with regulations are thus likely to be used in more productive activities (e.g. business support, incubation, infrastructure development) than individual rent-seeking (Sobel, 2008). Meanwhile, lower levels of government revenue may create risks and lead to a weaker state capacity: "While much research in political economy points out the benefits of 'limited government', political scientists have long emphasized the problems created in many less-developed nations by 'weak states', which lack the power to tax and regulate the economy and to withstand the political and social challenges from non-state actors" (Acemoglu, 2005: 1199).

Another strand of literature related to government spending suggests that it can have both positive and negative effects on the level of economic development (Tanzi, 1992; Joshi et al., 2014; Estrin et al. 2013; La Porta & Shleifer, 2014). The literature related to the welfare state and entrepreneurship suggests a large government sector has a negative impact on entrepreneurship (Koellinger & Minniti,

2009; Estrin et al. 2013). Meanwhile, social norms of compliance also improve and resources accumulate when members of society receive government services in return for tax payments (Moore, 2007; Brautigam et al., 2008). The insurance effect is likely to be stronger in developing countries, as the state will need to create a 'safety net' due to high market risks and crises related to inefficient institutions and support entrepreneurial entry (Sobel, 2008). Larger governments aim to tax high–growth productive entrepreneurs, which may also decrease the rate of returns of productive activities. Over-regulation and large government size associated with high tax rates will negatively affect growth aspirations and the quality of entrepreneurship. Based on these we hypothesize that:

Hypothesis 5a: The positive effects of government size on the quantity of entrepreneurship will be stronger for developing countries than developed countries.
Hypothesis 5b: The negative effects of government size on the quality of entrepreneurship will be stronger for developed countries than developing countries.

Government Programs and Support

Government involvement in the private sector is not new, and governments have been active in managing and promoting programs to generate entrepreneurship across countries. Verheul et al. (2002) suggested that governments influence both the supply and demand sides of entrepreneurship. Scholars have found that there are several government policies in developed countries that have influenced the supply side of entrepreneurship (Cumming et al., 2017; Cooper, 2003; Lerner & Kegler, 2000). For example, the United States Congress enacted the Small Business Innovation Research (SBIR) program in 1982 in order to increase American competitiveness. The legislation mandated funding for innovative small businesses (Cooper, 2003; Lerner & Kegler, 2000, Lerner, 1999; Gilbert et al., 2004). Many European governments have instituted venture capital for new high-tech firms (Cumming et al., 2017; Cumming & Johan, 2013). Government programs can serve the same purpose as entrepreneurs situated in the developing countries. We therefore hypothesize:

Hypothesis 6a: The positive effect of government programs on the quantity of entrepreneurship is stronger in developing countries than in developed countries.
Hypothesis 6a: Government programs have positive effect on the quality of entrepreneurship in both developing and developed countries.

Data and Methodology

Data and Sample

We constructed our sample by matching data from the following sources over 2005-2015 at the country level: the World Development Indicators, the Doing Business Database, the Global Entrepreneurship Monitor (GEM), the Index of Economic Freedom (IEF), the World Economic Forum (WEF), and the World Intellectual Property Organization (WIPO). Our sample included both developed and developing countries for an in-depth view of any trends or variance around the world (Thai & Turkina, 2013). The dataset is an unbalanced panel which covers 70 countries over the period 2005-2015, and includes 23 countries which were observed for less than 10 years and 3 countries which were observed for less than 5 years. Our final sample included 626 observations of the variables of interest where data is available. All institutional data is reported in Table 1. The variables vary across and within countries over time with a time series variation over 2005-2015. This enables us to test for relationships between various institutional dimensions and entrepreneurial activity.

Considering the few missing observations, researchers often use averaged indicators to predict the role of institutions in entrepreneurial activity. This is incorrect, as it may produce different results so that causality could not be claimed. Following Cumming et al. (2014) and Cumming and Li (2013), we opt for panel data estimation which includes measures of changes in labor, fiscal and bankruptcy regulation over time (2005-2015). It also has variables measuring the availability of capital, skills, entrepreneurial cognition and government programs over time, and allows us to make inferences about the relationship between the above institutional dimensions and entrepreneurial activity conditional on various levels of economic development. Changes in data over time enable us to capture changes in institutions and their impact on entrepreneurial activity (Stenholm et al. 2013). A number of control variables from various sources (GEM, doingbusiness.org) are available with measurement changes over the period 2005-2015.

Given the longitudinal nature of our sample, Table 1 provides the descriptive statistics, means and separates standard deviation within (over time) and between (over countries) variation. For example, an average amount of taxes payable as a share of commercial profits is 63.57. However, the variance

in the tax rate between countries is between 34.33 and 96.72, while the variance within (overtime period 2005-15) is between 46.61 and 85.83.

TABLE 1 ABOUT HERE

Dependent Variables

Our dependent variables include measures of the quantity and quality of entrepreneurship. The quantity of entrepreneurship in a country is measured by its 'new business ownership rate'. The new business ownership rate is the percentage of the population aged 18-64 who are owners of a new business, i.e. those who own and manage a start-up that has paid salaries, wages or any other payments to the owners for a period between 3 and 42 months (McMullen et al., 2008; Reynolds et al., 2002). This indicator is taken directly from GEM.

To test the hypotheses related to the quality of entrepreneurship we constructed measures for productive and unproductive entrepreneurship. This is a novel approach building on the recent quality of entrepreneurship review by Mohammadi Khyareh (2017), as new variables were used to construct productive and unproductive entrepreneurship. We used measures available in the World Economic Forum (WEF Global Competitiveness Report), GEM and WIPO data over 2005-2015, drawing on principles of productive and unproductive entrepreneurial behavior (Baumol, 1990, 1993). We drew from the existing literature (Sobel, 2008; Mohammadi Khyareh, 2017) and created a net entrepreneurial productivity (NEP) index for 74 countries following Sobel's (2008) approach but using six new proxies. These proxies capture entrepreneurial behavior and the environment in a country which may affect the choice between productive and unproductive entrepreneurship (see Table 2). In order to compute a single index number, we employed the Borda Count Index classification system that normalizes all variables over the same range and weighs them equally. The NEP is calculated as the difference between unproductive and productive entrepreneurship scores for each year over the period 2005-2015. Productive entrepreneurial activity is measured by combining the total (resident plus non-resident) patent applications in the country; the percentage of firms involved in total entrepreneurship activity (TEA) that introduce a product new to the market (GEM) and the percentage

of firms involved in TEA which aim to creating at least 6 jobs over the next 5 years (GEM) (Estrin et al. 2013). Unproductive entrepreneurship is based on the studies by Sobel and Garrett (2002) and Sobel (2008) using the WEF and GEM. Unproductive entrepreneurship is measured by averaging three different measures: the unethical behavior of firms (inverse of ethical behavior) (WEF), the extent that crime imposes costs on business (inverse of no cost to high cost) (WEF), and necessity driven TEA, which is defined as a percentage involved in TEA because they had no other option for work (McMullen et al., 2008).

A positive NEP score means the country is characterized by more productive than unproductive entrepreneurial behavior. Meanwhile a NEP score of zero reflects the same position (rank) for productive and unproductive entrepreneurship, which means productive and unproductive behavior is almost equal (Table 2). A negative NEP score means the country is characterized by more unproductive than productive entrepreneurial behavior (Table 2). The countries ranked as having the top five NEP scores are Denmark, Singapore, Luxembourg, Sweden and Australia. These five countries have the most productive entrepreneurship in comparison with their levels of unproductive entrepreneurship. The five countries ranking the lowest are Philippines, Jamaica, Bulgaria, Pakistan and Bangladesh. These countries have the highest levels of unproductive entrepreneurship relative to productive entrepreneurship.

TABLE 2 ABOUT HERE

Independent Variables

Table 1 lists the independent variables used in this study. The *financial development* of a country is used to test our H1 and is measured by the extent to which banks provide domestic credit to the private sector (La Porta et al., 2002) from the World Development Indicator database. We added two new variables to account for the availability of alternative sources of funding for entrepreneurs following Cumming and Zhang (2016), such as venture capital availability (WEF, Global Competitiveness report). We also controlled for emerging sources of entrepreneurial finance, such as financing through

the local equity market available in the WEF Report. This is a novel indicator used for equity financing in this study. The availability of entrepreneurial capital in the country is used to test H2 and was measured as the percentage of the 18-64 population who believe that they have developed the skills and knowledge needed to start a business (perceived capabilities). We also used the percentage of 18-64 year-olds who see good opportunities to start a firm in the area where they live (perceived opportunities), both used previously from GEM data by Stenholm et al. (2013).

The regulatory business environment is used to test our H3. Firstly, we used bankruptcy laws and the legal consequences of personal bankruptcy (strength of resolving insolvency index, recovery insolvency cost and recovery rate) (van Stel et al., 2005). Several elements of bankruptcy law were explored from developed countries (Armour & Cumming, 2006, 2008; Amorós et al., 2009). Secondly, we used *labor regulations* which reflect various aspects of a country's labor market and are available over time as a labor freedom component (McMullen et al., 2008).

Thirdly, we used fiscal regulation as changes in *corporate tax rate* which measures the statutory tax rate (% of commercial profits). These are used to determine a business's tax payable amount, and were previously used by Da Rin et al. (2011) as well as Doingbusiness.org. Although labor and fiscal regulations have been used previously, bankruptcy regulations have to be included within the same regulatory framework (Fun & White, 2003; Armour & Cumming, 2008) to exploit the full magnitude of the relationship. A country's corruption level is used to test our H4 and is measured by individual's perceptions about the use of public office for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests (Rose-Ackerman, 2007; Kaufman et al. 2010; Belitski et al 2016).

Government spending is used to test H5 and was measured by the general government's final consumption expenditure as a percentage of GDP. To make the interpretation easier, we follow Reynolds (2010) in transforming the Heritage Foundation measure of government expense to obtain the original ratio of government expense to GDP. The government entrepreneurship programs

indicator was collected from GEM to test H6 (Estrin et al. 2013). It uses a 1-5 point scale to evaluate the presence and quality of programs directly assisting SMEs at all levels of government (national, regional and municipal).

Control Variables

We have included several control variables. The working-age population of a country is measured by the percentage of the total population aged from 15 to 64 which was taken from World Development Indicator (WDI). Studies have shown that certain age groups are more likely to engage in entrepreneurship than others (Reynolds et al., 1999). The unemployment level of each country was measured by the share of the labor force that is without work but available for and seeking employment (Audretsch & Thurik, 2000). The trade openness of a country was measured by total trade, which includes the sum of exports and imports of goods and services measured as a share of the gross domestic product (McMullen et al., 2008). Access to natural resources was measured by the income generated from the mineral rents (% of GDP) taken from the World Bank (Harford & Klein, 2005; Sachs & Warner, 1995). The gross enrolment in tertiary education (%) is an important control for human capital, and is expressed as a percentage of the total population regardless of age (Schultz, 1959; Mincer, 1974). To measure the rule of law enforcement and bankruptcy laws on entrepreneurship we included: the number of procedures required to register property, the number of days required to enforce a contract, insolvency costs (% of estate) and recovery rates (cents on the dollar). This data came from Doingbusiness.org, and enabled us to build on important studies which demonstrate the significant impact that personal bankruptcy and pre-bankruptcy indebtedness has on entrepreneurship (Armour and Cumming, 2006, 2008). To measure the role of alternative equity financing on the quality and quantity of entrepreneurship, we added an ordinary variable - companies raise money by issuing shares and/or bonds on the capital market from 1 to 7 (equity) (Cumming & Johan, 2013).

To capture the regulatory changes in the country's entrepreneurship policy, we added a binary variable of entrepreneurship reform in a country in a year (Klepper et al., 2006). A country's level of economic development was measured by creating a binary variable 'rich', which equals one in countries with a GDP per capita in 2010 USD constant prices greater or equal 25,000 USD and is zero otherwise.. Table 3 shows the correlation coefficients between the variables used in this study.

TABLE 3 ABOUT HERE

Model

To test our hypotheses, we use random and fixed effects panel estimation to combine the country and time effects (Cumming et al., 2014). This enables us to control for unobserved heterogeneity across countries and time in one model. We follow Wallace and Hussain (1969) and Baltagi (2008), among others, by estimating the regression model given by (1) with two-way error component disturbances (2). λ_i denotes the unobservable country effect (Baltagi, 2008), λ_t denotes the unobservable time effect and e_{it} is the remainder stochastic disturbance term. Note that λ_t is country-invariant and accounts for any time-specific effect not included in the regression. For example, it could account for government program intervention year effects that disrupt entrepreneurship and drive more quality of business. λ_i is time invariant and accounts for any country-specific effects, such as culture and informal institutional frameworks. In vector form, our panel data estimation is written as:

$$y_{it} = f(\beta x_{it,} \Theta z_{it,} a_{it}, \mu_{it}) \quad i=1,..., N; \quad t=1,...,T \qquad (1)$$

$$u_{it}=\lambda_i + \lambda_t + e_{it} \qquad (2)$$

where y_{it} is either quality or quantity of entrepreneurship in a given country *i* at time *t*. β and Θ are parameters to be estimated, x_{it} is a vector of independent explanatory variables and z_{it} is a vector of exogenous control variables; a_{it} presents interaction of economic development with a number of institutional variables at time *t* by country *i*. These include entrepreneurial capital, financial development, regulation, corruption and government size and support. As mentioned above, the error

term u_{it} consists of unobserved country and time specific effects and the remainder disturbance.e_{it} independent and identically distributed.

Our choice to use both fixed effects (FE) and random effects (RE) rather than choosing between them was driven by the limitations of FE as discussed by Baltagi (2008). First, estimating $(N-1)$ will introduce extra parameters, which may aggravate the problem of multicollinearity among the regressors. Second, an FE estimator cannot estimate the effect of any time-invariant variable (a country which has remained in a developing or developed group over the estimation period). Time-invariant variables are wiped out by the *Q* transformations, the deviations from means transformation.

It is also important to compare and contrast FE and RE estimations, as they use different assumptions on two-way error terms when drawing policy. RE estimations model only one additional parameter instead of (N-1) by making greater assumptions, which makes it more efficient yet vulnerable to bias (Baltagi, 2008). In contrast, the fixed effects model allows for the endogeneity of *all* the regressors with these country effects. We test t endogeneity in the model (1) using the Durbin-Wu-Hausman test (augmented regression test) for endogeneity in Appendix B (Davidson & MacKinnon, 1993). FE and RE are an 'all or nothing' choice of homogeneity of the regressors and country effects (Baltagi, 2008). These over-identification restrictions are also testable using a Hausman-type test (see Table 4). The results of the augmented regression test and joint significance of the residuals F-test do not provide empirical evidence of endogeneity in the model (1).

To address the concern of multicollinearity, we used a variance inflation factor (VIF) in both models with quality and quantity of entrepreneurship as dependent variables. Although several variables have high scores (e.g. time to enforce contracts (45), population in logs (40), equity finance (35)) which are higher than the 'rule of thumb' (Kutner et al., 2004), the average VIF for each model[1] is 11 which is close to the advised boundary of 5-10.

[1] Please refer to robustness check section for further details

To reflect the size of the effect and control for the possible nonlinear relationship between a variety of institutional contexts and the quantity and quality of entrepreneurship, we note that the significance and size of beta coefficients might not always reflect the nature of the relationship. We therefore calculated post-estimated predictive margins for each institutional dimension using the results of the FE regression (columns 7 and 8, Table 4) with the quantity and quality of entrepreneurship as the dependent variable (Figure 1). The margins are a tool to explain a relationship when the direction of the relationship may be nonlinear, rending the net effect is statistically insignificant. The predictive margins enable us to visualize how a change in each of the six institutional dimensions contributes to a marginal change in the quantity and quality of entrepreneurship across a distribution of each institutional dimension and between developing and developed countries. Building on Williams (2012) and Rising (2012), the beta coefficients in Table 4 provide averaged results of model estimation and are limited in capturing non-linear effects. For example, a one-unit change in institutional dimension may result in a disproportional change in entrepreneurship activity at different levels of institutional dimension, which cannot be captured by the beta coefficient. Figure 1 illustrates the margins of responses for specified values of covariates. It uses 95% confidence intervals to measure the boundaries of the effect of various institutional contexts on entrepreneurship.

TABLE 4 ABOUT HERE

FIGURE 1 ABOUT HERE

Results and Discussion

We interpret our findings and conclusions related to our hypotheses using the predictive margins shown in Figure 1. These were calculated based on the results of FE estimations (coefficients in base effects and interaction effects) with the quantity and quality of entrepreneurship (Table 4) as the dependent variables. Table 4 includes both basic models for RE (column 1-2) and FE (column 3-4) and models with interaction terms (column 5-6) for RE estimation and (column 7-8) for

FE estimation. The signs of the coefficients and confidence intervals between RE and FE estimation are similar, although the significance of the coefficients is stronger when estimated with FE. The Hausman test also supports the use of FE. The results had a stronger statistical significance for the relationship between entrepreneurship and venture capital (VC), corruption, government support programs, entrepreneurial reform and procedures to register property.

The post-estimation predictive margins presented in Figure 1 were calculated based on columns 7-8 (Table 4). We used the 'margins' command in a statistical software STATA 15 to compute the standard errors of the means. The marginsplot command was used afterward as it gives a good view of the shape of the relationship and its economic significance (Williams, 2012). It illustrates the strength and direction of the relationship as well as changes in the marginal effect between each of the six institutional dimensions and entrepreneurship activity and between developing and developed countries. For example, predictive margins allow us to phrase a question such as 'What would be the quality of entrepreneurship activity as a domestic credit to private sector (% GDP) moves from 10 to 50 for a developing (developed) country?' It also allows us to make efficient comparisons between developed and developing countries to directly test our hypotheses, as well as measure the economic size of the effect of each change in institutional dimension.

Our H1a and H1b are supported; the availability of domestic credit (Figure 1A) and VC finance (Figure 1B) are positively related to the quantity and quality of entrepreneurship, and the effect is stronger for developing countries. We used equity financing as a control variable for financial development in a country. We examined the difference in the effects of debt financing (domestic credit to the private sector by banks, % GDP) and VC capital availability on the quality and quantity of entrepreneurship. We did so by producing the post-estimation t-test on the beta coefficients of debt financing and VC availability. The p-values of the t-test which assumed VC and debt financing effects are equal in both quantity and quality of entrepreneurship are reported below Table 4 as 't-test for β debt financing = β capital financing (p-value)'. The coefficient is positive and significant for both the

quality and quantity of entrepreneurship, but the size of the effect differs. The p-values of the t-test which states that betas are equal are greater than 5% for the quantity of entrepreneurship and lower than 5% for the quality of entrepreneurship.

These findings provide important insights (see Figure 1). Firstly, the availability of VC capital compared to debt financing increases the quality of entrepreneurship for both developed and developing countries. At the highest level of debt financing, the expected NEP score is 10 for developing countries and zero effect for developed countries. Meanwhile, at the highest level of VC financing the expected NEP score is 25 for developing countries and 20 for developed countries. Secondly, there is no difference between availability of debt and VC financing for the quantity of entrepreneurship between developed and developing countries. This finding is similar to Cole's et al. (2016) results: a stronger and positive effect of VCs on the quality of entrepreneurship vs. the effects of bank finance on the quality, which is statistically weak (see the t-test beneath Table 4). It is also likely that bank finance is more common in developed countries, resulting in a greater effect in the developed country context (Cumming & Zhang, 2016; Johan & Zhang, 2016). The results also suggest that developed countries allocate more financial resources to entrepreneurial activity than their developing country counterparts. This helps to generate higher levels of entrepreneurship, in terms of both quantity and quality.

In H2, we predicted that entrepreneurial capital would be positively associated with both the quality and quantity of entrepreneurship and the effect would be stronger for developing countries. We found support for H2a, which posits that entrepreneurial skills (Figure 1C) and opportunities (Figure 1D) significantly increase the quantity of entrepreneurship. However, we found mixed results for H2b. Unlike the effect of entrepreneurial skills in developing countries, there is an inverted U-shape relationship between entrepreneurial skills and quality of entrepreneurship in developed countries. The predictive margins suggest that a higher degree of entrepreneurial capital increases the quality of

entrepreneurship, and then reverses direction so that the effects become negative (right column, Figure 1C).

The results suggest that entrepreneurial cognition and high-quality skills become a resource for incumbent firms. In this instance, individuals are likely to consider the opportunity costs of engaging in entrepreneurial activity compared to a wage-paying job. When we include the interaction effect of economic development, we find partial support for our H2b. We also find that the effect of entrepreneurial capital moderated by economic development on the quantity of entrepreneurship is positive. The positive effect of entrepreneurial capital on the quality of entrepreneurship holds mostly for the existence and recognition of opportunity and to a lesser extent for entrepreneurial skills. Our results are partly consistent with prior findings for entrepreneurship cognition across developed and developing countries (Stenholm et al., 2013; Korosteleva & Belitski, 2015) and suggest that while recognition and opportunity for exploitation are more important they depend largely on the context.

We found support for H3a: the effects of improvements in fiscal, labor and bankruptcy regulations have a stronger impact on the quantity of entrepreneurship in developing countries (Fig. 1E-G) extending Armour & Cumming's (2008) evidence for developing countries. Interestingly, at a low corporate tax rate we observe a positive effect on the quantity of entrepreneurship for both developed and developing countries, suggesting that barriers are conducive to increasing the number of businesses (Djankov et al. 2002).

However, when the tax rate exceeds 60% of commercial profits, the quantity of entrepreneurship drops to zero for developed countries. When the tax exceeds 120% the quantity of entrepreneurship drops to zero for developing countries. This illustrates the higher resilience of firms in developing countries to changes in financial burden, which in some instances could be explained by the presence of a larger informal sector than in developed countries (Figure 1E). Additionally, we explored and found support for an inverted U-shape effect of tax rates on the quality of entrepreneurship for developed countries (Da Rin et al., 2011). The positive effect of the tax rate becomes negative once it

exceeds 60% of commercial profits. In developed countries, a high corporate tax environment discourages individuals from becoming involved in entrepreneurial activity. Meanwhile the lower flexibility and lower opportunity costs for entrepreneurs in developing countries leads to a low variance in entrepreneurial activity.

The effect of labor market regulations on the quantity of entrepreneurship supports H3a (Figure 1F). Labor market-related regulations are generally controlled by the government in developing countries and are positively related to a higher quantity of entrepreneurship. This effect could be explained by public interest forces (Pigou, 1938), and suggests that regulation is generally devised to provide labor market protection and benefits to the public at large while labor market regulations are implemented to correct for market failures and improve public welfare (Pigou, 1938).

With regards to bankruptcy law, an increase in the strength of resolving insolvency reflects the legal consequences of personal bankruptcy. The cost and time of resolving insolvency is positively associated with new business ownership rates in developed and developing countries. The effect is stronger in developing countries supporting H3a once the index value is in the third quartile, which indicates that the relationship is non-linear (Figure 1G) (Armour & Cumming 2006, 2008). The size of the effect of bankruptcy law on entrepreneurial start-ups demonstrates that it is a crucial element of the regulatory business environment (Fan & White, 2003).

For labor market regulations, we do not find support for H3b. This is because the quality of entrepreneurship is unlikely to change between developed and developing countries under various degrees of labor market regulation. Interestingly we do find support for H3b for the bankruptcy regulation, with the effect on the quality of entrepreneurial activity being stronger for developing countries (Figure 1G). While we found mixed and unexpected results related to the effect of the regulatory environment on the quality and quantity of entrepreneurship, our findings suggest a nonlinear relationship between the magnitude of fiscal policy and labor market regulation and both types of entrepreneurship (Figure 1, right column). We find that entrepreneurs in developing countries

are likely to benefit more from the improvement of bankruptcy laws than entrepreneurs in developed countries (Fan & White, 2003). This indicates that changes in the quality of institutions are able to bring developing economies closer to the production frontier relative to developed countries. It is likely that bankruptcy laws provide greater legal support for entrepreneurs in developing countries where informal institutions would otherwise regulate the insolvency (Estrin & Mickiewicz, 2011).

Hypotheses H4a and H4b are supported (Fig. 1H) by showing corruption acts as grease' than sand for the wheel of business (Méon & Sekkat, 2005; Méon & Weill, 2010), with the effect being stronger for developing countries (Mohammadi Khyareh, 2017). In developed countries with higher-quality institutions, corruption works as an additional tax (Belitski et al. 2016) and has a negative impact on entry when the corruption is in its fourth quintile (>1.5 see Fig. 1H). We find the relationship between corruption and the quality of entrepreneurship for both developed and developing countries follows an inverted U-shape. Low corruption creates financial incentives and increases the rate of return for entrepreneurs who are likely to bolster the productive type of entrepreneurial activity (Baumol, 1990; Sobel, 2008). Corruption influences entrepreneurial decision-making differently in different institutional environments, with a sharp fall in the quality of entrepreneurship in the second quartile of corruption (>-0.5 see Fig.1H). Meanwhile the quality of entrepreneurship remains unaffected in the developing country context, which supports H4b.

We found support for H5a. The supply-side of entrepreneurship (Sobel, 2008) is enhanced by greater government support (Figure 1J). An increase in government size in developed countries is likely to create additional support and resources for high-quality labor, which is likely to exploit opportunities for productive entrepreneurship (Baumol, 1990, Sobel, 2008). At the same time, an increase in government size increases tax revenues from productive entrepreneurship (see Fig 1J) (Estrin & Mickiewicz, 2011; Estrin et al., 2013).

Finally, our H6a and 6b are supported as we found government programs have a positive effect on the quantity of entrepreneurship, with the effect being stronger in developing countries as a supply-

side effect of government (Sobel, 2008) (Figure 1K). At the same time, high-quality government programs are able to filter unproductive entrepreneurship and attract productive entrepreneurs by creating a system of incentives (Sobel, 2008). These incentives are likely to facilitate innovation and the growth aspirations of individuals, increasing the quality of entrepreneurship. Productive entrepreneurs in developing and developed countries may benefit equally from the quality program (which is the third quartile in Fig. 1K) supporting H6b, where such programs aim to provide quality training while shielding entrepreneurs from dealing with corrupt authorities and weak institutions (Sobel, 2008).

Robustness check

To calculate the productive and unproductive entrepreneurship scores we averaged several variables. As a robustness check, we ran a principal component analysis and retained only the first factor with an eigenvalue greater than the productive and unproductive entrepreneurship scores. Once the factor was retained for both the productive and unproductive entrepreneurship scores we correlated it with the scores, which were calculated using the averaging technique. The correlation coefficient between the productive entrepreneurship score and the retained factor from the factor analysis was 0.98. The correlation coefficient between the unproductive entrepreneurship score and the retained factor from the factor analysis was 0.96. We therefore adopted a simpler procedure and used the productive and unproductive entrepreneurship scores calculated using averages of normalized variables. As an example, productive entrepreneurship was calculated as the average of the total (resident plus non-resident) patent applications in the country; the percentage of firms involved in TEA that had introduced a product new to the market, and the percentage of firms involved in TEA which aimed to creating at least 6 jobs over the next 5 years.

Our second concern was that some countries in the sample may not have experienced significant changes in economic development during the period of study (Estrin et al. 2013). To address this issue, we averaged all variables around the mean over 2005-2015 and estimated the model using the OLS to

capture the general relationship. We also created predicted margins using OLS data. The signs and range of the coefficients were similar, but the standard errors were different. This demonstrates the potential bias of the OLS estimation[2].

Our third concern was the possibility of a dynamic panel data model. We performed the Arellano-Bond linear dynamic panel-data estimation on our model by adding the first and second lagged values of quality and the quantity of entrepreneurship (our dependent variable) as an independent variable in a model. Neither the first nor second lag of dependent variable in the model was statistically significant. We therefore also included the mixed effects panel data model, excluding the lagged dependent variable. The Arellano-Bond estimation robustness check clearly demonstrated that changes in the quality and quantity of entrepreneurship take place within countries over time[3].

Our fourth concern was establishing a correlation between six specific institutional dimensions and entrepreneurial activity at different levels of economic development. In addition to calculating the RE and FE based on contemporaneous time periods, we calculated the RE and FE models where all independent variables, including interaction terms, were one period (one year) lagged. This estimation used an Arellano-Bond type of instrument and enabled us to separate the relationship between our dependent and independent variables over time. This estimation also tests for the historical memory of the relationship and enables inferences about the direction of the relationship. Our one-year-lagged RE and FE estimations have 626 obs. and involve 70 countries over the period 2005-2015; signs, the significance of the coefficients and confidence intervals are similar to the results illustrated in Table 4. Predictive margins were also calculated using the lagged estimation, which confirmed the previous

[2] OLS results in table and predictive margins are not reported but are available from authors on request. Due to differences in the size of coefficients, we argue that the relationship between institutions and entrepreneurship is dynamic and changes over time, with panel data to better capture transition.

[3] We are thankful to the reviewers for suggesting the test for the dynamic of the process as we contend the ability of a country to evolve its quantity and quality of entrepreneurial activity over time, with the less historical memory of the entrepreneurial process.

findings presented in Figure 1[4]. The findings in the lagged FE model showed the effects of government size and government programs on the quality of entrepreneurship were different. This could indicate that government programs and support intended to improve the quality of entrepreneurship is short-sighted and the impact of these programs and government control over the economy is likely to dissipate quickly.

Our fifth concern was multicollinearity in the model captured by the average VIF. An average VIF of about 11 is high, and individual VIFs of more than 35 indicated serious multicollinearity issues. Although neither of these variables were related to our research hypotheses, an additional robustness check was performed. We restricted model (1) in Table 4 to a reduced model which included all variables from model (1) except for three control variables: contract regulation, population and equity capital (financial development). The results of the estimation are available from the authors upon request. Once we excluded contract regulation, population and equity capital, our average VIF dropped significantly and remained between an interval of 2.20 and 9.04. The size and direction of coefficients and confidence intervals related to our research hypotheses has not changed in the reduced model, with the quality and quantity of entrepreneurship as dependent variables which remain within a 5% deviation from the original model coefficients. A number of observations, countries, and significance of F-tests have not changed either. We also requested the computation of the uncentered variance inflation factors. This option is often used to detect the collinearity of the regressors with the constant, which confirmed our results shown in Table 4.

Conclusion

Policymakers and scholars have promoted entrepreneurship as a source of economic development, and many countries have adopted policies intended to promote entrepreneurship. Despite this, not all countries enjoy an equally-positive 'domino effect' of the entrepreneurship. The results of this study suggest that the relationship between institutions and entrepreneurship is more nuanced. For example,

[4] Both the RE and FE estimations with one year lagged independent and control variables are available from the authors upon request.

the relationship may exhibit a non-linear pattern, or differ across countries with different levels of economic development and for the quality and quantity of entrepreneurship (Cumming & Li, 2013).

This study built on Baumol's theory to examine the size and strength of the relationship between each of six institutional dimensions and the quality and quantity of entrepreneurship at different levels of economic development (Baumol, 1990; Sobel, 2008; Djankov et al. 2002; Cumming & Li, 2013).

Secondly, this study combined North's (1990) institutional theory, Williamson's (2000) institutional hierarchy approach, Whitley's (1999) NBS perspective and Baumol's (1990) theory, and applied it to the economic development perspective (Rodrik et al., 2004; Wennekers et al., 2005). This theoretical synthesis demonstrates that the role of some institutions have become critical to the quality of entrepreneurship, in particular for developing countries. Such institutions include debt and VC availability (Cumming & Zhang, 2016; Cole et al., 2016), bankruptcy law (Armour & Cumming, 2006, 2008) and government programs to support entrepreneurship (Cumming et al., 2017; Cumming & Johan, 2013), Although the prior literature has demonstrated that the size and strength of the relationship between institutions and entrepreneurship varies with the country's economic development, there has been little research into which institutions have the most significant impact on the quality and quantity of entrepreneurship and why. The empirical evidence found in this paper suggests that an improvement in institutional quality has a greater effect on the quantity and quality of entrepreneurship in developing economies than in developed economies. A type of institutional framework becomes an important boundary condition for the quality and quantity of entrepreneurial activity (Holcombe, 2000).

This paper makes a methodological contribution by merging data from various sources within an international context to establish and test the relationship between heterogeneous institutional dimensions and types of entrepreneurial activity. Drawing on Cumming and Li (2013) but unlike Sobel (2008), we use panel data which enables the consistent and robust estimation of the stated

relationship over time. We created a new measure of entrepreneurship quality which adds to the originality of this study. Our explanatory variables reflect institutional dimensions either for the first time (equity financing, bankruptcy laws and government programs) or as a novel application within the existing literature on institutions and entrepreneurship (corruption, government size, tax policy and labor regulation).

The results are both unexpected and intriguing. They confirm and extend Baumol's theory within the international context and over time, while also proving some of the recent findings for the US (Cole et al., 2016) and other developed (Armour & Cumming, 2006, 2008) and developing countries (Mohammadi Khyareh, 2017) on the role of specific institutions in the international context. This model and methodology could be applied to countries at different levels of economic development and with different entrepreneurial profiles. It can also be generalized.

Limitations and Future Research Directions

This study has several limitations which should be addressed in future research. Firstly, our findings are limited to 70 countries at different levels of economic development. We used unbalanced data with an unequal number of observations during 2005-2015, which we leveraged by performing FE and RE estimations as well as by using lagged independent variables. Additional combinations of country, institutional and business profiles could be used to construct a net productivity score. More work on cross-country comparisons and data collection should be done. Future research could also experiment with various proxies for productive and unproductive entrepreneurial behavior.

Secondly, it is unlikely to assume that linear relationships could continue at the same rate for an indefinite time and improve the quantity and quality of entrepreneurship equally. This study tested for nonlinear effects with predictive margins along the range of variation in independent and dependent variables. However, it is important to address non-linear effects explicitly with the new data, including cross-country and multilevel region-country effects. Our results on corruption, government size,

taxation and business opportunities which were found nonlinear call for further research and careful policy design.

Thirdly, subsequent studies should focus on measuring the extent and possible changes in direction of the effect between institutions and entrepreneurship in explaining the role which formal and informal institutions play for various types of entrepreneurship. Future research will also pay attention to informal institutions within countries as these are harder to change than formal institutions. It is worth understanding whether changes in formal institutions initiated by productive entrepreneurs can also have a positive spillover on informal institutions through increased trust in the government and the entrepreneurial ecosystem.

Fourthly, while we matched country data from several sources we were unable to include data from other sources around the world to measure entrepreneurship (Cumming et al 2014). This is a limitation as the quality of entrepreneurship, as well as inferences regarding the impact of entrepreneurship, may differ depending on the source of the data examined. Subsequent research would make an important contribution to the literature by testingtfor the validity of Cumming's et al. (2014) findings by examining the relationship between economic development, entrepreneurship types and various institutional dimensions.

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Table 1
Definition of variables and sources

Variables	Definition	Variance	Data	Panel sample =626 obs.			
				Mean	S.D	Min	Max
Quantity	*New business ownership rate as %* 18-64 population who are owners of a new business between 3 and 42 months	Between	GEM	5.36	3.70	1.51	17.03
		Within			1.47	-1.79	13.26
Quality	Net entrepreneurship productivity (NEP) score calculated as the difference between unproductive and productive entrepreneurial scores (Sobel, 2008) using the Borda count avg. scale 1–74	Between	GEM WIPO, WEF	-2.44	25.17	-49.03	47.07
		Within			5.83	-26.25	14.18
Credit (H1)	Domestic credit to private sector by banks (% GDP) refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks).	Between	WDI	65.05	40.33	9.15	182.72
		Within			8.82	17.13	103.31
Venture capital (H1)	In your country, how easy is it for start-up entrepreneurs with innovative but risky projects to obtain equity funding? [1 = extremely difficult; 7 = extremely easy]	Between	WEF	2.93	0.67	1.79	4.42
		Within			0.22	1.89	4.29
Equity	In your country, to what extent can companies raise money by issuing shares and/or bonds on the capital market? [1 = not at all; 7 = to great extent]	Between	WEF	3.77	0.76	2.11	5.13
		Within			0.24	2.31	4.45
Capital 1 (H2)	Percentage of 18-64 population who believe they have the required skills and knowledge to start a business	Between	GEM	50.88	14.92	13.21	84.78
		Within			4.35	26.19	67.91
Capital 2 (H2)	Percentage of 18-64 who see good opportunities to start a firm in the area where they live	Between	GEM	41.09	15.81	8.38	85.03
		Within			6.55	14.32	60.70
Tax Rate (H3)	The amount of taxes and mandatory contributions payable by businesses after accounting for allowable deductions and exemptions as a share of commercial profits.	Between	DB	63.57	14.80	34.33	96.72
		Within			4.48	46.61	85.83
Labor regulation (H3)	The labor freedom (inverse) considers various aspects of the legal and regulatory framework of a country's labor market ranges from zero= less or no regulation to 100=over regulations	Between	EFI	42.11	16.99	11.30	111.56
		Within			4.62	25.73	67.95
Insolvency index (H3)	Strength of insolvency framework index [1= extremely difficult; 100 = extremely efficient]	Between	DB	59.62	21.09	0.00	93.75
		Within			1.01	57.35	82.35
Corruption level (H4)	Corruption measure captures perceptions of the extent to which public power is exercised for private gain Index ranges from [-2.5= no corruption to 2.5=high corruption].	Between	WGI	-0.31	1.00	-2.43	1.10
		Within			0.12	-0.94	0.16
Spending (H5)	The level of government expenditures including consumption and transfers (a percentage of GDP).	Between	EFI	16.06	4.96	2.80	26.00
		Within			1.16	11.24	21.84
Programs (H6)	The presence and quality of programs directly assisting the SMEs at all levels of government (national, regional municipal) (scale 1 to 5)	Between	GEM	2.56	0.43	1.78	3.59
		Within			0.16	1.94	3.12
Rich	Binary variable=1 for countries with GDP per capita in 2010 USD constant prices greater or equal 25,000USD; zero otherwise.	Between	WDI	0.34	0.47	0.00	1.00
		Within			0.09	-0.41	1.12
Population	Population 15-64 years as % of the total population. The population is based on the de facto population, which counts all residents regardless of legal status or citizenship. (% of total)	Between	WDI	16.84	1.64	13.15	21.01
		Within			0.04	16.57	17.01
Unemployment	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. (% of total labor force)	Between	WDI	8.32	4.79	0.39	27.49
		Within			2.08	-0.68	20.31
Trade	Trade is the sum of exports and imports of goods and services to gross domestic product of a country.	Between	WDI	91.35	61.55	24.96	388.91
		Within			10.04	52.62	142.09
Natural resources	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents (% to country GDP).	Between	WDI	8.84	12.60	0.00	50.76
		Within			4.13	-16.24	29.38
Human capital	Total enrollment in tertiary education (ISCED 5 to 8), regardless of	Between	WDI	45.51	3.87	17.51	65.52

	age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.	Within			2.20	1.00	11.60
Property	The number of procedures requires to register property, in a given country-year	Between	DB	5.83	0.71	3.83	10.27
		Within			0.46	4.97	7.28
Contracts	The number of days required to enforce a contract, in a given country-year, in logarithms	Between	DB	6.28	0.12	6.01	6.94
		Within			0.22	0.00	1.00
Reform	Binary variable of entrepreneurship reform in a country-year, 1 – if country implemented reform to stimulate entrepreneurship, zero otherwise.	Between	GEM	0.09	0.17	-0.61	0.69
		Within			12.60	0.00	50.76
Insolvency Cost	Resolving Insolvency Cost (% of estate)	Between	DB	13.28	7.49	1.00	38.00
		Within			1.28	1.83	19.83
Insolvency recovery	Resolving Insolvency recovery rate (cents on the dollar)	Between	DB	49.92	25.57	0.00	99.81
		Within			5.07	18.66	88.64

Source: calculation based on GEM – Global Entrepreneurship Monitor (GEM), WEF – World Economic Forum Global Competitiveness Report (2005-2016), DB= World Bank Doing Business Statistics; WDI= World Bank World Development Indicators; EFI= Economic Freedom Index, Heritage Foundation; WIPO=World Intellectual Property Organization; WGI= World Governance Indicator World Bank.

Table 2. Country productive and unproductive entrepreneurship scores and list of countries included in this study (sorted by NEP score)

Country	Number of obs.	Quantity	Productive score	Unproductive score	NEP score	Country	Number of obs.	Quantity	Productive score	Unproductive score	NEP score
Denmark	10	2.51	14.33	71.33	57	South Africa	10	2.59	23.67	22	-1.67
Singapore	10	3.7	20	69.67	49.67	Italy	7	1.69	37.67	34.67	-3
Luxembourg	8	2.77	22.33	71	48.67	Colombia	10	10.72	21	17	-4
Sweden	10	2.26	23.67	68.67	45	Kazakhstan	9	5.18	36	31	-5
Australia	10	5.55	16	60	44	Hungary	10	2.91	34.67	28.67	-6
Canada	2	3.79	20	62.33	42.33	Botswana	9	11.89	41.33	33.33	-8
Slovenia	10	1.96	17.33	58	40.67	Slovak Rep.	10	4.78	38.33	28.67	-9.67
Ireland	10	3.6	17.67	56.67	39	Thailand	10	12.85	49	38	-11
Israel	10	2.91	15	54	39	Trinidad and Tobago	10	6.94	44.67	32.33	-12.33
UK	10	3.14	15.33	54.33	39	Costa Rica	10	3.88	45	32	-13
Norway	2	3.59	33.33	71	37.67	Georgia	7	3.23	42.33	29	-13.33
Qatar	7	5.39	23.33	61	37.67	Peru	10	9.3	37.67	22.33	-15.33
United States	10	4.08	10.67	46.33	35.67	Argentina	10	6.38	26.67	10.67	-16
Chile	10	7.1	9.33	42	32.67	Mexico	10	3.58	43.33	27.33	-16
Estonia	9	4.84	25.33	56.33	31	India	10	5.1	56.33	38.33	-18
Netherlands	10	3.22	32.33	62	29.67	Greece	10	3.09	47.33	28.67	-18.67
Germany	10	2.02	26	54	28	Russia	10	2.05	35.33	16.67	-18.67
Japan	10	1.49	24	48.67	24.67	Egypt	9	5.11	50.33	27.33	-23
Latvia	9	3.85	20.67	44	23.33	Vietnam	8	11.79	54	31	-23
Saudi Arabia	8	2.49	43.33	61.67	18.33	Ecuador	6	10.95	37.67	13.33	-24.33
Belgium	10	1.51	44.33	62	17.67	Iran	10	4.7	45	18	-27
Czech Rep.	10	2.22	22.67	36.33	13.67	Bolivia	10	13.11	48.67	20	-28.67
Uruguay	9	4.73	29.67	42.33	12.67	Guatemala	10	8.31	50	19	-31
Portugal	10	3.29	42.33	54.33	12	Indonesia	7	12.05	68.67	36	-32.67
Barbados	4	3.74	41.33	51.67	10.33	Algeria	10	4.95	57.33	24.33	-33
Lithuania	9	5.03	35	41.33	6.33	Bosnia & Herzegov.	8	2.9	53	18	-35
Romania	10	2.53	27.67	32.67	5	Venezuela	8	4.82	45	10	-35
Poland	10	3.97	24.33	29.33	5	Nigeria	10	13.48	50	13.33	-36.67
Tunisia	10	5.52	45	48.67	3.67	Brazil	10	9.88	54.33	13	-41.33
Lebanon	6	9.71	29.67	32	2.33	Zambia	1	17.16	70	25.33	-44.67
China	10	9.37	30.67	31.67	1	Philippines	8	14.32	57	11.67	-45.33
Spain	10	2.94	46.67	46.67	0	Jamaica	10	8.08	60	14	-46
Malaysia	10	4.98	48	47	-1	Pakistan	10	2.86	56	8.67	-47.33
Turkey	10	4.29	26.33	25.33	-1	Bulgaria	6	1.51	66.33	14.67	-51.67
Croatia	10	1.87	30.67	29	-1.67	Bangladesh	10	7.07	70.33	15.67	-54.67

Source: GEM, WEF Global Competitiveness report, WIPO (2005-2015)

Table 3 Correlation table

	Quantity	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2 Quality	-0.41*	1.00																					
3 Credit	-0.26*	0.58*	1.00																				
4 Venture cap	-0.14*	0.64*	0.43*	1.00																			
5 Equity	0.01	0.30*	0.30*	0.67*	1.00																		
6 Capital 1	0.47*	-0.34*	-0.43*	-0.23*	-0.19*	1.00																	
7 Capital 2	0.42*	-0.19*	-0.33*	0.02	0.08*	0.61*	1.00																
8 Tax Rate	0.08*	-0.18*	-0.15*	-0.29*	-0.35*	0.08	-0.05	1.00															
9 Labor regulation	-0.08	0.30*	0.19*	0.31*	0.26*	-0.16*	0.03	-0.30*	1.00														
10 Corruption	0.40*	-0.84*	-0.63*	-0.61*	-0.31*	0.33*	0.20*	0.16*	-0.31*	1.00													
11 Spending	-0.46*	0.45*	0.45*	0.18*	0.00	-0.31*	-0.34*	0.09*	0.06	-0.52*	1.00												
12 Programs	-0.14*	0.55*	0.41*	0.44*	0.22*	-0.28*	-0.07	-0.08	0.24*	-0.57*	0.13*	1.00											
13 Rich	-0.45*	0.68*	0.61*	0.50*	0.30*	-0.33*	-0.27*	-0.13*	0.18*	-0.74*	0.49*	0.40*	1.00										
14 Population	0.19*	-0.33*	-0.05	-0.04	0.27*	-0.09*	0.03	0.11*	-0.03	0.36*	-0.31*	-0.15*	-0.17*	1.00									
15 Unemployment	-0.16*	-0.16*	-0.04	-0.33*	-0.22*	0.05	-0.22*	0.04	-0.16*	0.07	0.33*	-0.18*	-0.12*	-0.19*	1.00								
16 Trade	-0.12*	0.38*	0.23*	0.34*	0.09*	-0.25*	-0.23*	-0.23*	0.19*	-0.39*	0.05	0.43*	0.26*	-0.52*	-0.10*	1.00							
17 Natural resources	0.18*	-0.21*	-0.34*	-0.09*	-0.03	0.36*	0.44*	-0.06	0.04	0.36*	-0.34*	-0.16*	-0.25*	0.08	-0.13*	-0.16*	1.00						
18 Hum capital	-0.41*	0.51*	0.41*	0.13*	-0.14*	-0.36*	-0.47*	0.20*	0.11*	-0.45*	0.54*	0.11*	0.47*	-0.20*	0.05	0.07	-0.32*	1.00					
19. Property	0.16*	-0.35*	-0.29*	-0.30*	-0.12*	0.31*	0.23*	0.16*	-0.15*	0.30*	-0.24*	-0.13*	-0.22*	0.01	0.04	-0.11*	0.27*	-0.22*	1.00				
20. Contracts	0.12*	-0.31	-0.26*	-0.27*	-0.18*	0.39*	0.27*	0.20*	-0.29*	0.29*	-0.08*	-0.25*	-0.14*	-0.13*	0.13*	-0.27*	0.05	-0.22*	0.39*	1.00			
21. Reform	0.01	0.13*	0.05	0.02	-0.06	0.02	0.01	0.05	-0.11*	-0.17*	0.01	0.19*	-0.04	-0.04	-0.07	0.00	-0.07	0.01	0.08*	-0.03	1.00		
22. Insolvency Cost	0.35*	-0.34*	-0.26*	-0.15*	-0.05	0.40*	0.15*	0.03	0.18*	0.45*	-0.34*	-0.27*	-0.35*	0.07	-0.02	-0.07	0.23*	-0.27*	0.24*	0.23*	-0.09*	1.00	
23. Insolvency recovery	-0.29*	0.55*	0.55*	0.39*	0.21*	-0.40*	-0.26*	0.01	-0.31*	-0.70*	0.44*	0.50*	0.64*	-0.06	-0.06	0.15*	-0.35*	0.39*	-0.33*	-0.33*	0.02	-0.52*	1.00
24. Insolvency index	-0.28*	0.33*	0.35*	0.14*	0.07*	-0.43*	-0.51*	0.15*	-0.01	-0.41*	0.45*	0.19*	0.40*	0.07*	0.14*	-0.07*	-0.44*	0.49*	-0.22*	-0.19*	0.02	-0.19*	0.45*

Notes: * - significant at 0.05. Source: Authors' calculation based on GEM, WEF, DB, WDI, EFI, LFI, WIPO and WGI

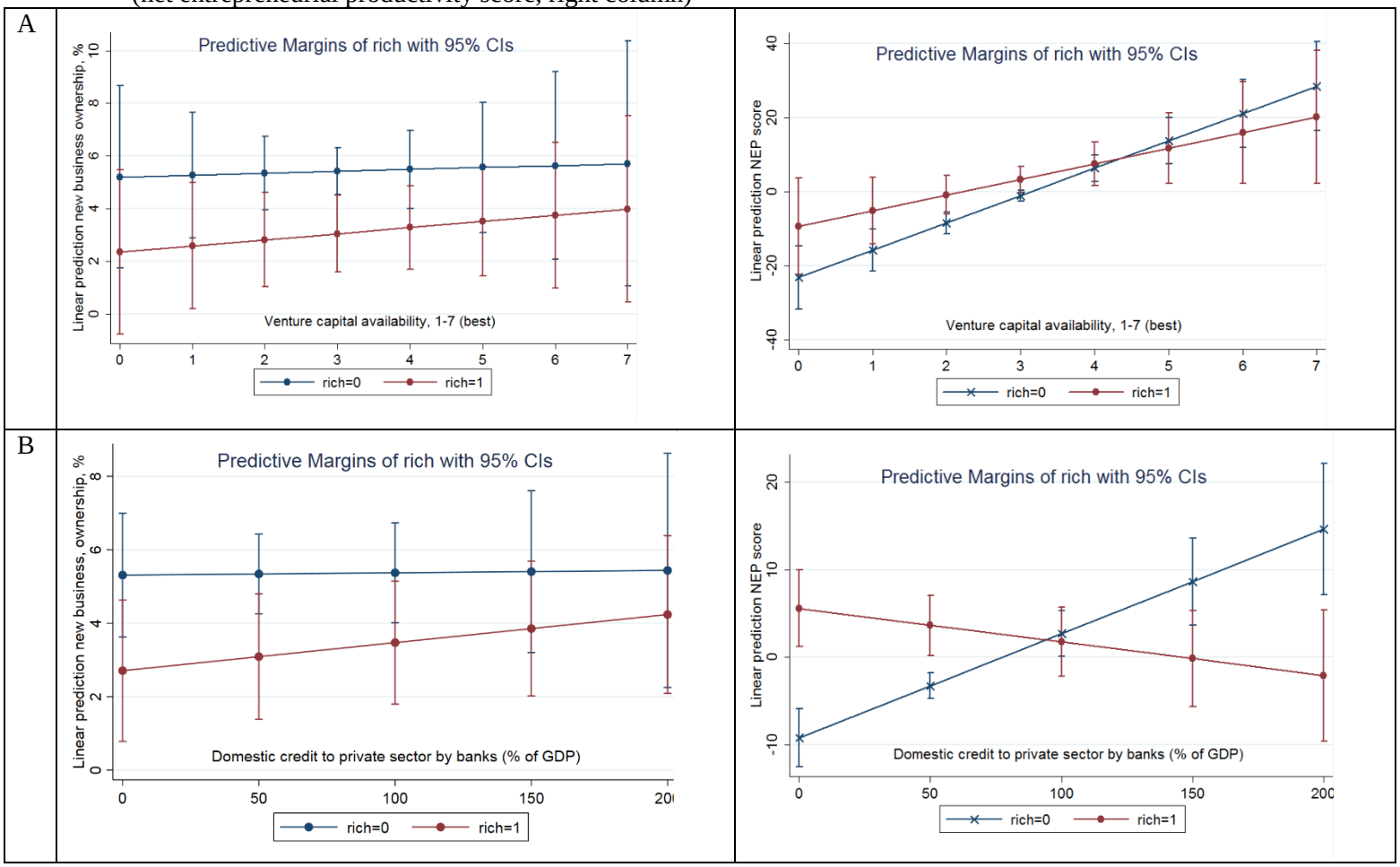
Table 4
Fixed effects (FE) and random effect (RE) estimation with interactions (DV: new business ownership rate, %, quantity and NEP score, quality).

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method	RE	RE	FE	FE	RE	RE	FE	FE
DV: entrepreneurship	quantity	quality	quantity	quality	quantity	quality	quantity	quality
Credit (H1)	0.01 (0.01)	0.08** (0.03)	-0.01 (0.01)	0.09** (0.03)	0.01 (0.01)	0.01 (0.06)	-0.01 (0.01)	0.02 (0.05)
Venture capital (H1)	0.27 (0.46)	3.32* (1.83)	0.37 (0.40)	0.32 (1.55)	-0.01 (1.08)	6.17† (3.72)	-0.13 (0.70)	0.22 (2.71)
Equity	-0.47 (0.47)	3.88* (2.11)	-1.11** (0.35)	5.94** (1.37)	-0.53† (0.35)	4.74* (2.77)	-1.02† (0.56)	9.57** (2.17)
Capital 1, skills (H2)	0.06** (0.02)	-0.07 (0.09)	0.07** (0.02)	-0.06 (0.06)	0.07** (0.03)	-0.05 (0.10)	0.08** (0.02)	-0.06 (0.07)
Capital 2 , opportunity (H2)	0.01 (0.02)	0.02 (0.06)	-0.01 (0.01)	0.02 (0.04)	-0.01 (0.02)	0.04 (0.08)	-0.01 (0.01)	0.04 (0.05)
Tax Rate (H3)	-0.01 (0.01)	-0.07 (0.05)	-0.02 (0.02)	-0.13* (0.06)	-0.01 (0.02)	-0.05† (0.03)	-0.02 (0.02)	-0.15** (0.07)
Labor regulation (H3)	0.04* (0.02)	0.07 (0.07)	0.07** (0.01)	0.08 (0.06)	0.07** (0.03)	0.06 (0.10)	0.10** (0.02)	0.06 (0.07)
Insolvency framework index (H3)	-0.00 (0.02)	0.14 (0.14)	0.02* (0.01)	0.15 (0.10)	0.01* (0.00)	0.19 (0.15)	0.01* (0.00)	0.21 (0.15)
Corruption level (H4)	0.25 (0.41)	-8.75** (2.43)	0.84 (0.53)	-4.96* (2.05)	1.03* (0.59)	-7.19* (3.26)	1.78** (0.64)	-4.86* (2.46)
Spending (H5)	-0.15* (0.08)	-0.29 (0.38)	-0.09 (0.07)	-0.50* (0.25)	-0.18* (0.09)	-0.31 (0.41)	-0.10* (0.06)	-0.58* (0.28)
Programs (H6)	0.99* (0.57)	4.54† (2.37)	0.82* (0.41)	4.94** (1.60)	1.34† (0.74)	4.54* (2.54)	0.91** (0.46)	4.83** (1.86)
Rich	-1.74** (0.50)	-1.18 (3.58)	-1.86* (0.77)	-6.78* (2.99)	1.16 (4.73)	56.29* (22.03)	14.47 (28.99)	-92.59 (112.14)
Population	0.24 (0.23)	-3.10* (1.26)	-2.80 (2.40)	16.93 (9.26)	0.10 (0.28)	-3.20* (1.35)	-3.79 (2.45)	15.81 (9.47)
Unemployment	-0.01 (0.04)	-0.11 (0.18)	-0.04 (0.04)	-0.05 (0.15)	-0.01 (0.04)	-0.23 (0.19)	-0.03 (0.04)	-0.21 (0.16)
Trade	-0.01 (0.01)	0.01 (0.02)	-0.01 (0.01)	0.02 (0.03)	-0.01 (0.01)	-0.01 (0.02)	-0.01 (0.01)	0.01 (0.03)
Natural resources	-0.02 (0.03)	0.02 (0.10)	-0.01 (0.02)	0.01 (0.07)	-0.02 (0.03)	0.02 (0.10)	-0.01 (0.02)	-0.01 (0.07)
Human capital	-0.01 (0.02)	0.10† (0.06)	0.01 (0.02)	-0.08 (0.07)	-0.01 (0.02)	0.13† (0.7)	0.01 (0.02)	0.01* (0.00)
Property	0.19 (0.13)	0.24 (0.41)	0.35** (0.10)	0.62* (0.35)	0.15 (0.13)	0.33* (0.20)	0.28** (0.10)	0.83** (0.40)
Contracts	0.09 (0.52)	1.45 (2.39)	0.50 (0.65)	4.33* (2.52)	0.30 (0.60)	0.82 (2.48)	0.55 (0.69)	4.06 (2.66)
Reform	0.43 (0.51)	3.50* (1.64)	0.80** (0.40)	3.99* (1.56)	0.60† (0.40)	4.02* (1.76)	0.96* (0.41)	4.16** (1.57)
Insolvency cost	0.09* (0.05)	-0.30* (0.18)	0.12* (0.05)	-0.44* (0.20)	0.09* (0.05)	-0.30† (0.18)	0.11* (0.05)	-0.46* (0.20)
Insolvency recovery	0.02 (0.01)	0.02 (0.07)	0.01 (0.02)	0.02 (0.06)	0.01 (0.01)	-0.01 (0.08)	-0.01 (0.02)	-0.01 (0.06)
Credit x Rich (H1)					0.01 (0.01)	0.08 (0.07)	0.02† (0.01)	0.08 (0.06)
Venture capital x Rich (H1)					0.15 (1.16)	-4.50 (4.35)	0.40 (0.84)	0.13 (3.25)
Capital 1 x Rich (H2)					-0.06* (0.03)	-0.04 (0.17)	-0.08* (0.04)	0.04 (0.16)
Capital 2 x Rich (H2)					0.03* (0.02)	-0.04 (0.11)	0.04† (0.02)	-0.08 (0.09)
Tax Rate x Rich (H3)					-0.02 (0.02)	0.02 (0.15)	-0.04 (0.04)	0.29* (0.14)
Bankruptcy law x Rich (H3)					0.01 (0.04)	-0.39 (0.25)	-0.16 (0.35)	0.99 (1.36)
Labor regulation x Rich (H3)					-0.07** (0.03)	0.02 (0.12)	-0.10** (0.03)	0.13 (0.12)
Corruption level x Rich (H4)					-1.10 (1.05)	-4.40 (5.46)	-1.54 (1.22)	-4.11 (4.71)

Spending x Rich (H5)					0.15 (0.12)	0.01 (0.67)	0.19 (0.16)	0.40 (0.61)
Programs x Rich (H6)					-1.15 (0.96)	-2.08 (3.47)	-0.62 (0.89)	-1.44 (3.44)
Year and country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.79 (6.45)	-8.66 (31.79)	45.49 (41.10)	-339.3** (158.65)	-4.42 (7.11)	-14.27 (10.01)	60.68 (41.92)	-323.1** (145.14)
F stat / chi-square	113.17	439.28	3.59	4.53	334.16	693.19	3.31	3.95
Sigma u	2.22	11.64	6.14	41.10	2.48	11.76	7.94	48.58
Sigma e	1.46	5.66	1.46	5.66	1.44	5.60	1.44	5.60
Rho	.69	.80	.94	.98	.74	.81	.96	.98
Theta 50	.79	.84			.81	.85		
t-test for βdebt financing=βcapital financing (p-value)	0.22	0.03	0.21	0.04	0.23	0.04	0.19	0.05
Variance inflation factors (VIF average)	2.20	5.92	8.36	9.04				

Notes: **- significant at 0.01; *- significant at 0.05; † - significant at 0.1 Standard errors are in parentheses robust to heteroscedasticity. As a robustness check, standard errors were also clustered by country. A year and country dummies are suppressed to save space. Number of countries: 70; Number of obs. 626. F Test for all u=0 is rejected, hence country fixed effects should be estimated. Hausman test reports F statistics=56 with the null is rejected. As a robustnes check the VIF average is calculated based on a reduced model (1) excluding three variables with the highest level of individual multicollinearity: equity financing, population and contracts. VIF results are within the accaptable boundaries and reduced model supports the findings of the initial model (1).
Source: authors' calculation based on GEM, WEF, DB, WDI, EFI, LFI, WIPO and WGI.

Figure 1
Quantity of entrepreneurship (new business ownership rate, %, left column) and quality of entrepreneurship (net entrepreneurial productivity score, right column)



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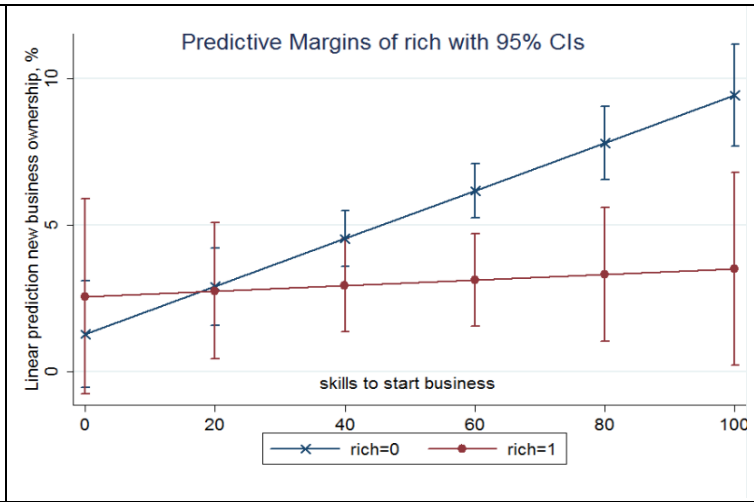
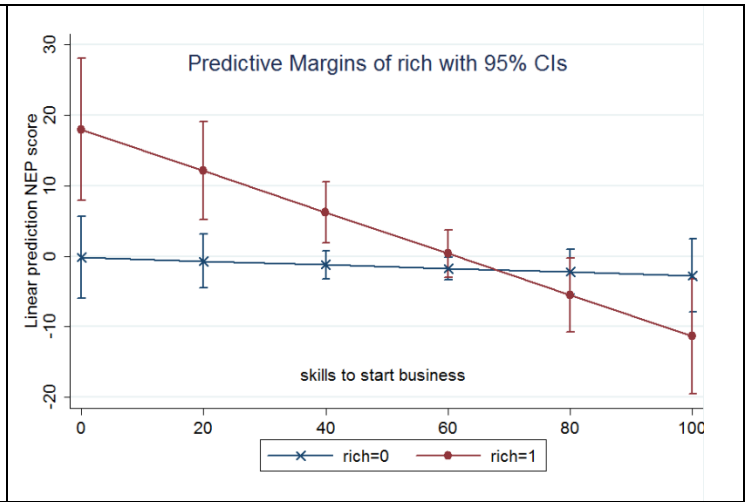
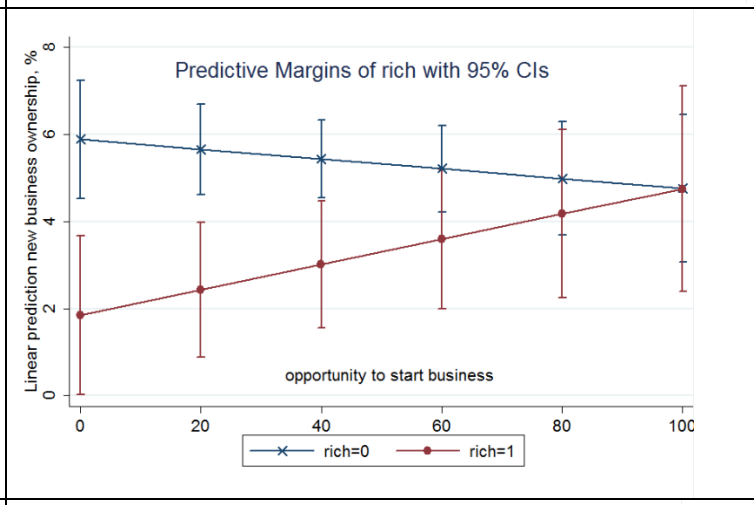
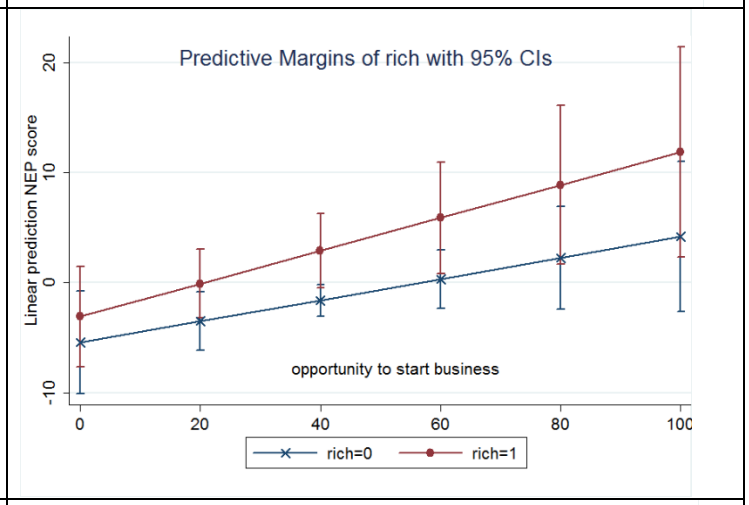

Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
0
5
10
skills to start business
0
20
40
60
80
100
rich=0
rich=1

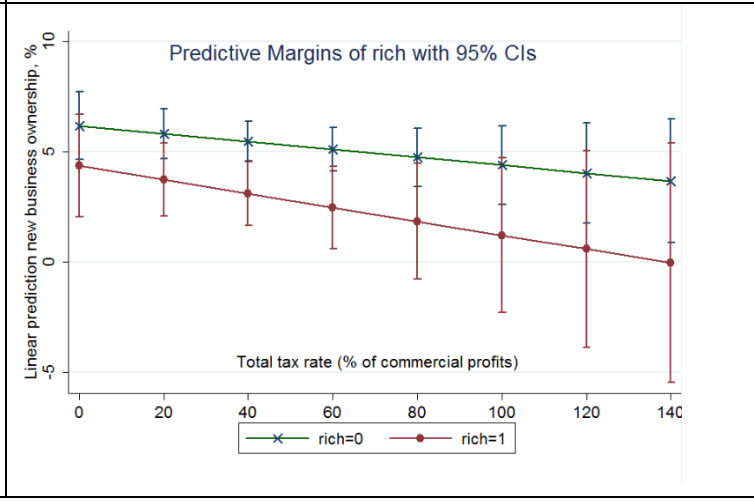

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-20
-10
0
10
20
30
skills to start business
0
20
40
60
80
100
rich=0
rich=1

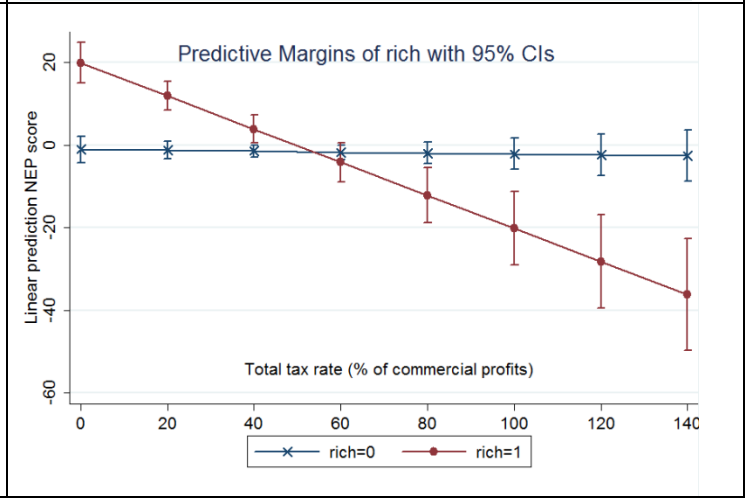
D


Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
0
2
4
6
8
opportunity to start business
0
20
40
60
80
100
rich=0
rich=1

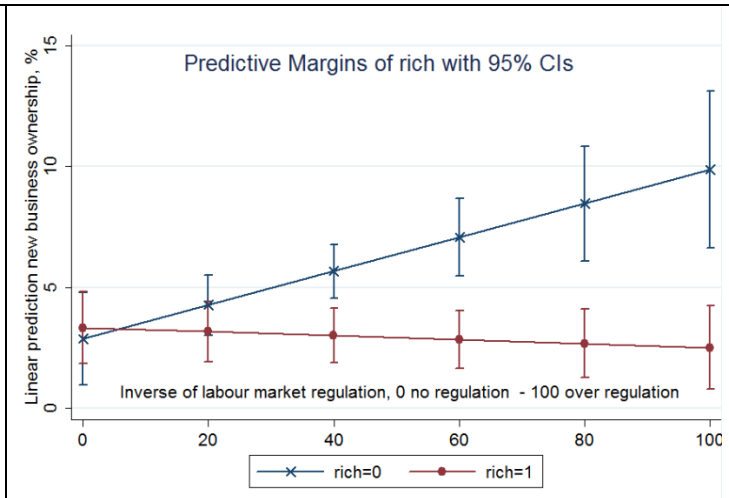

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-10
0
10
20
opportunity to start business
0
20
40
60
80
100
rich=0
rich=1

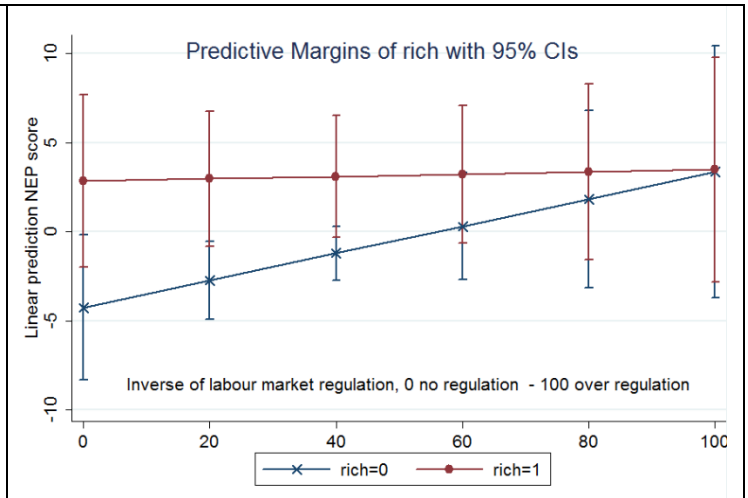
E


Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
-5
0
5
10
Total tax rate (% of commercial profits)
0
20
40
60
80
100
120
140
rich=0
rich=1

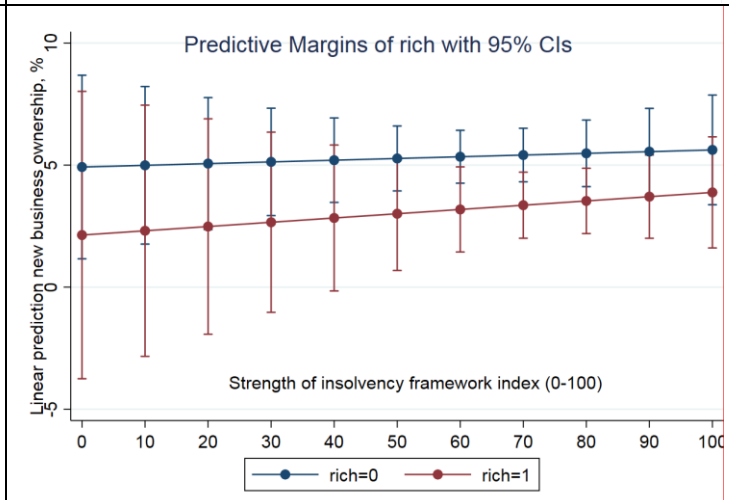

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-60
-40
-20
0
20
Total tax rate (% of commercial profits)
0
20
40
60
80
100
120
140
rich=0
rich=1

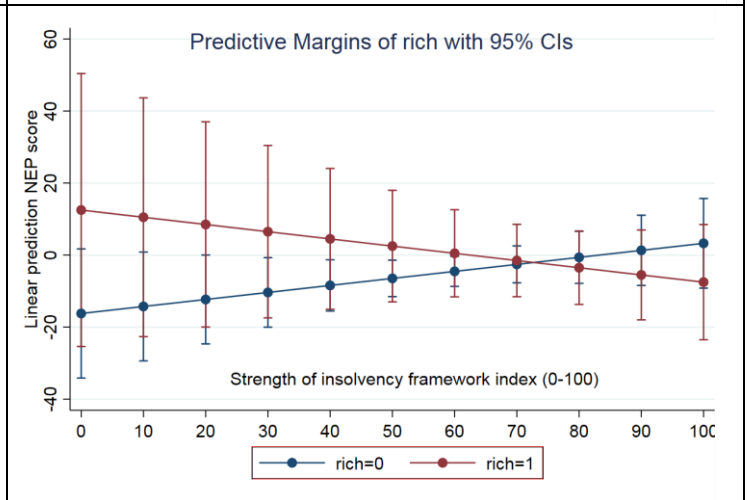
F


Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
0
5
10
15
0
20
40
60
80
100
Inverse of labour market regulation, 0 no regulation - 100 over regulation
rich=0
rich=1

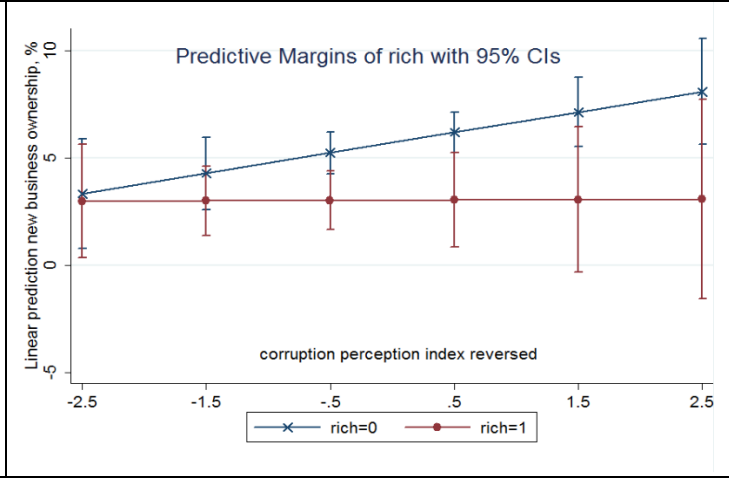

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-10
-5
0
5
10
0
20
40
60
80
100
Inverse of labour market regulation, 0 no regulation - 100 over regulation
rich=0
rich=1

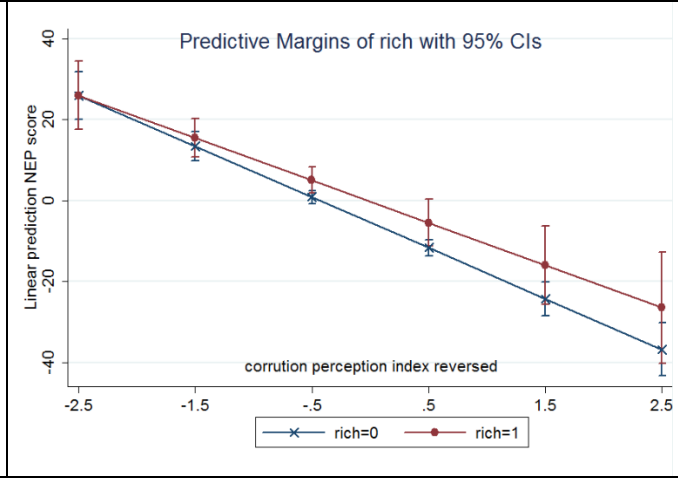
G


Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
-5
0
5
10
0
10
20
30
40
50
60
70
80
90
100
Strength of insolvency framework index (0-100)
rich=0
rich=1

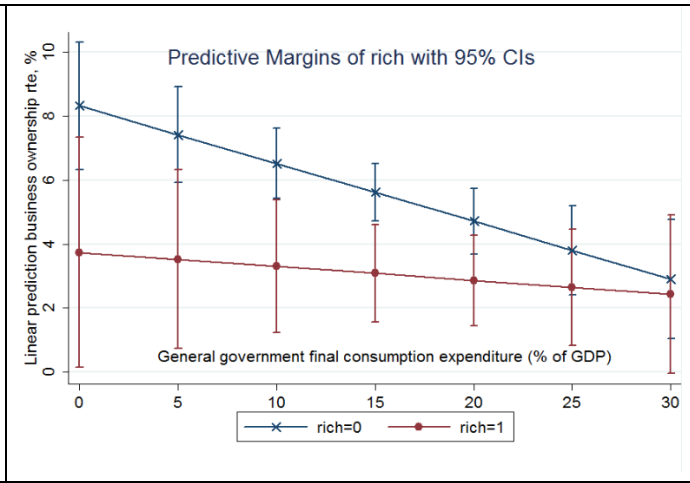

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-40
-20
0
20
40
60
0
10
20
30
40
50
60
70
80
90
100
Strength of insolvency framework index (0-100)
rich=0
rich=1

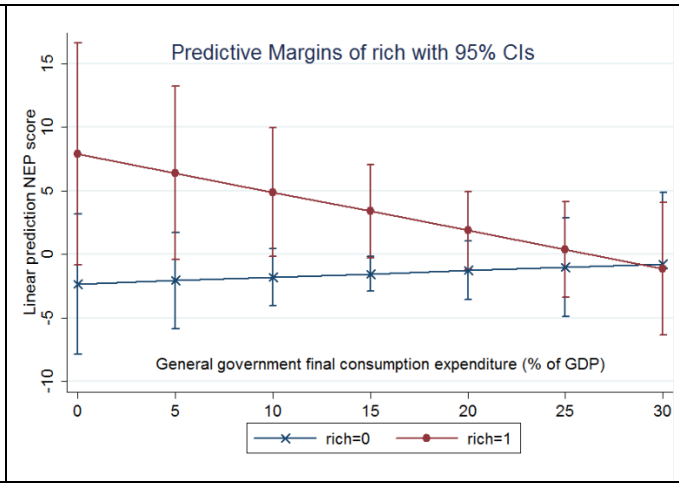
H


Predictive Margins of rich with 95% CIs
Linear prediction new business ownership, %
-5
0
5
10
-2.5
-1.5
-.5
.5
1.5
2.5
corruption perception index reversed
rich=0
rich=1

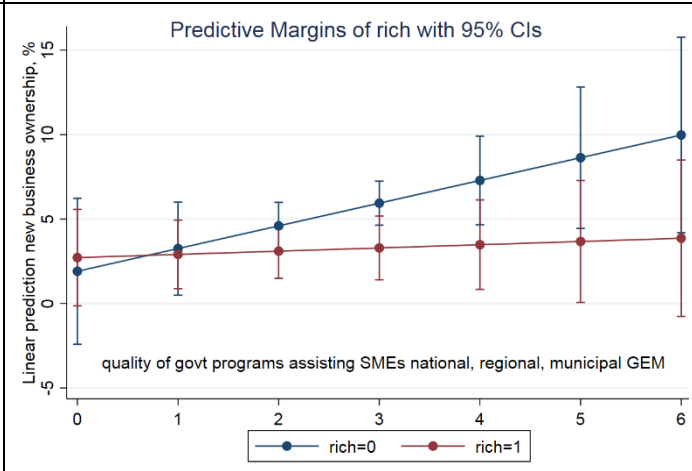

Predictive Margins of rich with 95% CIs
Linear prediction NEP score
-40
-20
0
20
40
-2.5
-1.5
-.5
.5
1.5
2.5
corrution perception index reversed
rich=0
rich=1

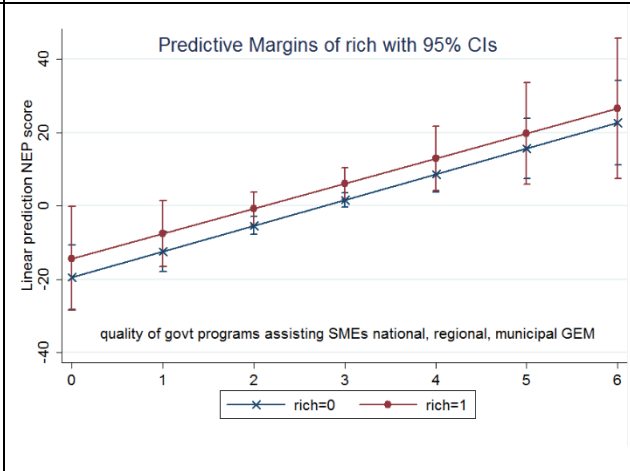
J





K





Source: authors' calculation based on GEM – Global Entrepreneurship Monitor (GEM), WEF – World Economic Forum Global Competitiveness Report (2005-2016), DB= World Bank Doing Business Statistics; WDI= World Bank World Development Indicators; EFI= Economic Freedom Index, Heritage Foundation; LFI=Labor Freedom Index, Heritage Foundation; WIPO=World Intellectual Property Organization; WGI= World Governance Indicator World Bank.

Appendix A: Computation of Net Entrepreneurship Productivity (NEP) score explained

We followed Sobel's (2008) procedure to compute the quality of entrepreneurship indicator known as NEP score. First, we calculated NEP score by calculating difference between unproductive and productive entrepreneurship scores.

Second, we employed the Borda Count Index classification system that normalizes a set of variables over the same range which is associated with the number of entities (countries) of analysis. Each variable which was included in the calculation of productive and unproductive entrepreneurship score was normalized between one and 74 as the number of countries in our sample is 74. Have we had a larger sample, the range of ranking would be larger as well. The possible range for each of three variables for productive entrepreneurship and each of three variables for unproductive entrepreneurship varies between 1 to 74.

Third, to calculate productive entrepreneurship score we use: the total (resident plus non-resident) patent applications in the country; the percentage of firms involved in TEA that introduces a product new to the market (GEM) and the percentage firms involved in TEA which aims at creating at least 6 jobs over the next 5 years (GEM) (Estrin et al. 2013).

Fourth, to calculate unproductive entrepreneurship score we use: unethical behavior of firms (inverse of ethical behavior) (WEF), the extent that crime imposes cost on business (inverse of no cost to high cost) (WEF), and necessity driven TEA defined as a percentage involved in TEA because they had no other option for work (McMullen et al., 2008). For example, the variable "the total (resident plus non-resident) patent applications in the country" which is used in calculating productive entrepreneurship score varies between 1 and 74. Once we get each variable ranked we can calculate unproductive and productive entrepreneurship scores as the simple averages of three components. Thus, unproductive and productive entrepreneurship scores would range from 1 to 74 as well.

In the example of a Table, A1 provided below calculates NEP score for India in the year 2012. India's patent applications in the country is ranked 62 out of 74, for % of firms aiming to create 6 jobs

over the next 5 years is ranked 70 out of 74 and for % firms which introduced new to market product is ranked 37 out of 74. Then we calculate productive entrepreneurship score as (62+70+37)/3=56.4. Using similar approach an unproductive entrepreneurship score is calculated for India: (37+42+36)/3=38.3. Now we can calculate NEP which is the difference between column H and D in Table A1= (38.3-56.3) = - 18.0.

NEP score is the difference between two (unproductive and productive entrepreneurship scores) its range could be from -73 (1-74) to 74 (74-0). However, it is unlikely that one country score 74 in productive and first in unproductive with a final score 74. The range for NEP has both negative and positive values between -74 to +74.

Table A1: Example of calculation of NEP score for the list of countries in the year 2012.

Country	Patent applications in country	aiming to create 6 jobs over the next 5 years	introduced new to market product	Productive entrepreneurship score	Inverse of ethical behavior of firms	crime imposes cost on business	entrepreneurship activity due necessity	Unproductive entrepreneurship score	NEP score
	A	B	C	D= (A+B+C)/3	E	F	G	H= (E+F+G)/3	K=H-D
Greece	45.0	66.0	31.0	47.3	11.0	35.0	40.0	28.7	-18.7
India	62.0	70.0	37.0	56.3	37.0	42.0	36.0	38.3	-18.0
Israel	6.0	19.0	20.0	15.0	56.0	57.0	49.0	54.0	39.0
Japan	1.0	15.0	56.0	24.0	63.0	44.0	39.0	48.7	24.7
Jordan	44.0	37.0	42.0	41.0	48.0	69.0	44.0	53.7	12.7
Luxembourg	14.0	50.0	3.0	22.3	68.0	72.0	73.0	71.0	48.7
Sweden	13.0	36.0	22.0	23.7	74.0	62.0	70.0	68.7	45.0
United Arab Emirates	22.0	4.0	34.0	20.0	64.0	73.0	63.0	66.7	46.7
United Kingdom	10.0	31.0	5.0	15.3	65.0	39.0	59.0	54.3	39.0
United States	3.0	16.0	13.0	10.7	57.0	28.0	54.0	46.3	35.7

Source: GEM, WIPO, WEF

Appendix B: Durbin-Wu-Hausman Test (Augmented regression test) for Endogeneity

Scholars raise concerns of possible endogeneity problem of the regulatory environment being endogenous to entrepreneurial activity (Ardagna and Lusardi, 2010; Dreher and Gassebner, 2013). For example, changes in entrepreneurial activity as a response to policy change.

The Durbin–Wu–Hausman test (augmented regression test) using the software Stata 14 enables us to empirically test endogeneity between regulatory environment and variables and quality and quantity

of entrepreneurship (Davidson & MacKinnon, 1993). The first step (Table B.1) we use GLS estimation to predict residuals using instruments such as: property rights and fiscal freedom country indicators over 2005-2015 from International Economic Forum and foreign direct investment (% of GDP) and GDP per capita (constant 2010 US$) using World Bank World Development Indicators (2005-2015). We use controls for country and year fixed effects.

The second step includes adding predicted residuals from the first stage in the model (1) for the variables included in Table 4 in the main body. Table B.2 below tests model 1 with four predicted residuals. Finally, we test the joint significance of all residuals of regulatory environment variables using F-test after RE and FE estimation for quantity and quality of entrepreneurship. For the quantity of entrepreneurship, the null is not rejected illustrating absence of endogeneity in the final model (1). For the quality of entrepreneurship, the null is rejected at 10% significance level, but not rejected at 5% significance level. We conclude that the estimation of the model (1) using Table 4 is unbiased with a weak evidence of endogeneity between regulatory environment and entrepreneurial activity. It is a business environment which is likely to affect the decision-making of entrepreneurs.

Table B.1: Augmented Regression Test (Step 1): GLS Estimation and Residual Prediction

Dependent variable	Tax rate	Labour market regulation	Insolvency index	Government programs
Specifications	(1)	(2)	(3)	(4)
Property rights	0.05 (0.09)	-0.13** (0.04)	-0.01 (0.00)	0.01 (0.00)
Fiscal freedom	-0.33** (0.10)	-0.08 (0.06)	-0.01 (0.00)	-0.01** (0.00)
Foreign direct investment	-0.04 (0.03)	0.01** (0.00)	0.01 (0.00)	0.01 (0.00)
GDP per capita (constant 2010 US$), logarithms	0.01 (0.00)	-0.01 (0.00)	0.00 (0.00)	0.01** (0.00)
Constant	28.71 † (16.60)	78.14** (11.78)	43.41** (0.87)	2.553** (0.12)
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N. obs.	626	626	626	626
R2	.76	.88	.95	.87
RMSE	18.41	5.66	.97	.16
F stat	556.11	452.16	402.67	639.77

Notes: **- significant at 0.01; *- significant at 0.05; † - significant at 0.1 Standard errors are in parentheses robust to heteroscedasticity. Year and country dummies are suppressed to save space. Number of countries: 70.
Source: authors' calculation based on GEM, WEF, DB, WDI, EFI, LFI, WIPO and WGI.

Table B.2: Augmented Regression Test (Step 2): Fixed effects (FE) and random effect (RE) estimation of model (1) using variables reported in Table 4 with predicted residuals of four regulatory environment variables from step 1. (DV: new business ownership rate, %, quantity and NEP score, quality of entrepreneurship).

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method	RE	RE	FE	FE	RE	RE	FE	FE
DV: entrepreneurship	quantity	quality	quantity	quality	quantity	quality	quantity	quality
Model	Baseline				Interactions with independent variables			
Tax Rate residual from Step 1	0.01 (0.03)	-0.05 (0.11)	-0.08 (0.10)	0.29 (0.40)	0.01 (0.03)	-0.10 (0.11)	-0.17 (0.11)	0.71 (0.48)
Labor regulation residual from Step 1	0.10** (0.04)	0.26† (0.15)	0.03 (0.25)	1.08 (0.98)	0.09 (0.06)	0.37† (0.20)	-0.227 (0.27)	2.59* (1.05)
Insolvency index residual from Step 1	3.11† (1.89)	4.52 (5.26)	8.26 (9.79)	-5.57 (37.68)	3.50 (2.54)	5.70 (5.43)	19.91† (12.70)	-50.77 (40.98)
Programs residual from Step 1	-0.71 (1.09)	-8.46 (5.91)	-3.74 (4.52)	-27.26 (17.39)	-1.42 (1.14)	-6.84 (6.12)	-6.65 (4.51)	-30.34 (17.27)
Controls	-1.78 (6.28)	-19.21 (38.20)	34.45 (45.41)	-226.2 (174.74)	-2.08 (6.69)	-17.79 (38.55)	29.17 (46.52)	-214.0 (178.12)
Year and country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F stat / chi-square	164.26	626.89	.18	.22	384.23	945.81	.22	.27
Sigma u	2.04	11.37	6.14	38.74	2.29	11.75	11.31	56.36
Sigma e	1.46	5.63	1.46	5.63	1.44	5.51	1.44	5.51
Rho	.66	.80	.94	.97	.71	.81	.98	.97
Theta 50	.77	.84			.80	.85		
F Test u=0			18.66	24.20			18.25	22.22
F Test for residuals= 0 (p-value)					0.20	0.11	0.12	0.09

Notes: **- significant at 0.01; *- significant at 0.05; † - significant at 0.1 Standard errors are in parentheses robust to heteroscedasticity. All variables in the Table B.2 except of predicted residuals of four regulatory environment variables were suppressed to save space.
Number of countries: 70; Number of obs. 626. F Test for all u=0 is rejected, hence country fixed effects should be estimated. Source: authors' calculation based on GEM, WEF, DB, WDI, EFI, LFI, WIPO and WGI.