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Influence of IPRs and Competition Policy on the Development of Entrepreneurship across Countries

Kun Fu

Bocconi University
Department of Management and Technology
kun.fu@phd.unibocconi.it

Kun Liu

Wayne State University
Department of Management & Information Systems Management
k.liu@wayne.edu

Abstract

Institutions, as the rules of the game, influence the emergence and development of entrepreneurship in important ways. Most of the existing studies have investigated entrepreneurship within a given institutional environment without considering the variations of institutions in different national contexts. In this paper we study the impact of two economic institutions that are particularly relevant to entrepreneurship ? the intellectual property rights (IPRs) and the enforcement of the competition policy, as well as their interaction effects on the development of entrepreneurship especially those dealing with technological innovations. We propose that IPRs is positively associated with entrepreneurial activity and this effect is contingent upon the enforcement level of competition policy. The hypotheses are examined within a framework of pooling a cross-section of 60 countries during the periods between 2002 and 2007. The findings show surprisingly that strengthened IPR protection adversely affects the entry of entrepreneurs adopting new technology and this relationship is attenuated by the increasing enforcement of competition policy.

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Influence of Intellectual Property Rights and Competition Policy on the Development of Entrepreneurship across Countries

ABSTRACT

Institutions, as the rules of the game, influence the emergence and development of entrepreneurship in important ways. Most of the existing studies have investigated entrepreneurship within a given institutional environment without considering the variations of institutions in different national contexts. In this paper we study the impact of two economic institutions that are particularly relevant to entrepreneurship — the intellectual property rights (IPRs) and the enforcement of the competition policy, as well as their interaction effects on the development of entrepreneurship especially those dealing with technological innovations. We propose that IPRs is positively associated with entrepreneurial activity and this effect is contingent upon the enforcement level of competition policy. The hypotheses are examined within a framework of pooling a cross-section of 60 countries during the periods between 2002 and 2007. The findings show surprisingly that strengthened IPR protection adversely affects the entry of entrepreneurs adopting new technology and this relationship is attenuated by the increasing enforcement of competition policy.

Keywords: Entrepreneurship, Institutions and IPRs

INTRODUCTION

Entrepreneurship has long been viewed as an engine that drives economic development, employment creation, and innovation. Institutions as the rules of the game influence the emergence and development of entrepreneurship in important ways (North, 1990; Baumol, 1996). A greater understanding of institutional differences will aid entrepreneurs, researchers, potential investors, and government policy makers trying to revitalize their economies (Busenitz, Gomez, and Spencer, 2000). Scholars have studied how patent rights (Nelson, 1982) and societal norms (Busenitz & Lau, 1996) affect the level of entrepreneurship within an economy. Most of the studies, however, investigate entrepreneurship within a given institutional environment without considering the variations of institutions in different national contexts (Davidsson and Wiklund, 2001). With a few exceptions, several cross-nation empirical studies have discovered that the institutions such as culture (Mueller & Thomas, 1997), intellectual property rights (Autio and Acs, 2010), bankruptcy law (Peng, Yamakawa and Lee, 2009) and economic freedom (Harbi and Anderson, 2010) influence the motivation and cost of entrepreneurship significantly.

Two economic institutions are particularly relevant to the development of entrepreneurship —intellectual property rights (IPRs) and competition policy. IPRs offer inventors temporary monopoly rights over intellectual properties and provide entrepreneurs with incentive to innovate. Therefore, whether a country allows entrepreneurs to appropriate value from their new ideas through IPRs and how well IPRs are protected create significantly different incentives for individuals engaging in the entrepreneurial activity (Hoskisson, Covin, Volberda and Johnson, 2011). Effective competition policy instead lowers entry barriers by preventing monopolization in favor of a competitive market, which increases entrepreneurial opportunities and encourage the entry of the entrepreneurial firms.

The current study aims to address the following research questions. What is the impact of intellectual property protection on the emergence of early-stage entrepreneurs, particularly those dealing with technological innovation activities and to which extent does the enforcement of competition policy affect this relationship? We define in this paper the early-stage entrepreneur as a working age-adult who is either actively trying to start a new entrepreneurial firm, or who is currently acting as

the owner-manager of a new entrepreneurial firm. The technology entrepreneur is defined as an individual involved in early-stage entrepreneurial activity that claims to use new technology in the production of goods or services. Technology entrepreneurs are particularly relevant in this context because intellectual property is the key asset possessed by this type of firm and the importance and economic value of this asset is subject to the establishment and enforcement of the IPR regime. We propose that IPR protection is positively associated with entrepreneurial activity and this effect is contingent upon the enforcement level of competition policy. Specifically, stronger IPR protection encourages the entry of technology entrepreneurship. The enforcement of competition policy complement IPRs in that increasing the level of enforcement of competition policy will intensify the positive relationship between IPRs and the technology entrepreneurship.

We test the hypotheses using annual data from the Global Entrepreneurship Monitor during the period of 2002 and 2007 on various measures of entrepreneurship. Data from the World Bank, the Heritage Foundation and the IMD World Competitiveness Yearbook are used to construct the key explanatory and control variables. The findings show surprisingly that instead of encouraging, stronger IPRs adversely affect those entrepreneurs who introduce new technology among other early-stage entrepreneurs. As we expected, IPRs and competition policy complement each other and the negative impact of IPRs on technology entrepreneurs is attenuated by stronger enforcement of competition policy.

We make the following contributions. First, as a cross-nation empirical research, the current study specifically focuses on the variations of institutions such as IPRs and competition policy and examines how different institutions in different national contexts would affect the entrepreneurial activities. Second, we add to the existing studies that mainly look at the entrepreneurs with high growth aspiration by providing the evidence of institutional impact on the entrepreneurs introducing new technologies, which constitute another important group of economic agents contributing substantially to the economic performance of a country. Third and most importantly, we highlight the interaction between two institutions—IPR and competition law. Our findings suggest that institutions work as an ecosystem and they jointly determine entrepreneurial activities in countries. Such interdependence and interaction provide important implications for research and policy makers.

We structure this paper as follows. We begin by reviewing briefly the literature that studies the institutional determinants of entrepreneurial activity with a focus on the link between IPRs and competition policy and the development of entrepreneurship. Then, we develop theoretical arguments leading to the hypotheses. We follow the hypotheses with a discussion of our sample, methods, empirical models, and results. We conclude the paper with implications of our findings and suggestions for future research.

THEORY AND HYPOTHESES

Entrepreneurship and Institutional Context

Institutions are the rules of the game (North, 1990; Powell and DiMaggio, 1991). They guide the behavior of individuals and facilitate interactions between economic agents through defining the structure for exchange that influences uncertainties and transaction costs, hence the reward or incentive system in the economy and the feasibility and profitability of engaging in certain economic activities (Baumol, 1996; Gagliardi, 2008). The quality of institutions significantly influences the economic outcomes of the individual or organization's undertakings. Entrepreneurs, as a specific type of economic agent, are affected by their institutional setting. Institutions lay out the foundation for an ecosystem within which opportunities and threats emerge for entrepreneurs.

An emerging group of empirical studies have built upon this theoretical framework and been focusing on the role of institution in determining the development of entrepreneurship. Autio and Acs (2010) claim that strategic entrepreneurial behaviors cannot be fully understood without giving attention to the context in which those behaviors are observed. Applying real options logic, they show that a country's IPR regime affect the effect of an individual's human and financial capital on entrepreneurial growth aspirations. Lee, Yamakawa, Peng and Barney (2010) posit that entrepreneurs and firms strategically respond to the formal institutions of a society and they find that entrepreneur-friendly bankruptcy laws are significantly correlated with the level of entrepreneurship development as measured by the rate of new firm entry. Using national patent and self-employment data, Harbi and Anderson (2010) find that institutional environment influences entrepreneurship and innovations

differently—several institutional factors of economic freedom encourage self-employment but discourage innovation.

Intellectual Property Rights and Entrepreneurship

Entrepreneurship involves the discovery, evaluation, and exploitation of opportunities to introduce new goods and services, ways of organizing markets, production processes, and handling materials through efforts that previously had not been exercised (Venkataraman, 1997; Shane and Venkataraman, 2000). Creation and recognition of opportunities is one of the most important prerequisites of entrepreneurial activity. Entrepreneurship takes a wide variety of forms by engaging in various opportunity-discovery and exploitation activities mentioned above and acting as knowledge creators and knowledge users.

Knowledge as a public good is non-rivalrous and non-exhaustible in that the consumption of knowledge by one does not preclude the accessibility of others to the same knowledge. Knowledge can be consumed by many people at once, without reducing the value, quantity or utility and it can also be reproduced with almost marginal cost. However, to produce any kind of knowledge, an economic agent (e.g. individual, firms, and research institutions) has to make investment of various types (e.g. human, financial, technological and organizational resources) and at different levels of intensity, which normally represent a sizable cost of the agent. Without effective mechanisms to exclude others from using their innovations as free riders due to the public goods nature of knowledge, economic agents would have difficulties to recoup the investment. Lack of protection for the intellectual properties lowers their incentive to invest in and develop new knowledge in the first place.

IPRs grant certain time-limited rights to creators so that they can have temporary monopoly over those intellectual properties (WIPO, 2004). IPRs protect the owners of the IP by excluding the rivals from accessing and utilizing their creations without authorization. Increasing the strength of IPR protection therefore provides firms and individuals (including potential entrepreneurs who may or may not engage in the commercialization process) with incentives to invest and produce more new knowledge and subsequently more potential entrepreneurial opportunities. In the meantime, the exclusive right of the IP owner has another option of IPR application in

practice, which is the possibility of selling or licensing his right through knowledge market where technology suppliers and user exchange needs with each other. This increases the accessibility to certain knowledge for potential entrepreneurs (knowledge users) who are planning to bring the market new products or services based fully or partially on this knowledge, which they might not be able to access and explore otherwise.

Small businesses and entrepreneurial firms have shown great potential to bring forward innovation and technological changes (Acs and Audretsch, 2005). They are regarded as technology entrepreneurs that are defined in the current study as working-aged individuals who claim to adopt new technology in the production of goods or services while starting or running new firms. Intellectual property is one of the key assets associated with this type of firms and the technological importance and economic significance of this asset is subject to the changes of a country's IPR regime. Strong IPR protection promotes the dedication to new technological knowledge production and diffusion, which in turn increase the level of knowledge stock, technological capacity, knowledge transfers and spillovers in the whole economy (Audretsch and Acs, 1994). Overall, this drives the emergence of more technological opportunities and provides potential entrepreneurs with more possibilities to take part in the entrepreneurial activities through exploring these emerging opportunities. Based on the above argument we propose that:

Hypothesis 1 (H1): The strength of IPR protection is positively associated with the probability of an individual engaging in the technology entrepreneurship.

Competition Policy and Entrepreneurship

Competition policy is a set of policies that promote competition in local and national markets, as well as legislations (e.g. competition law), judicial decisions and regulations specifically aimed at preventing anti-competitive business practices and unnecessary government interventions, avoiding concentration and abuse of market power (Dube, 2008). There are basically two ways to look at and study competition policy in the literature: one concerns the existence of certain kinds of laws and regulations whereas the other view focuses on the enforcement of these laws

(Nicholson, 2004). An appropriate law and policy in place thus is not sufficient unless it is an effective one, with appropriate guidelines and enforcement power (Rey, 1997). Here we are interested in the actual enforcement the competition policy.

Competition is essential to innovations and entrepreneurship. Competition policy alters the level of competition in the market place and influences the emergence of entrepreneurship in several ways. Through ensuring the availability of multiple suppliers of goods, services and technologies that could effectively compete against each other the effective enforcement of competition policy creates pro-competitive environment wherein larger incumbent firms are prevented from abusing their market powers to exploit smaller competitors and consumers, removes barriers of entry so that new firms could gain their access to the markets and fosters competition in order to boost innovation and accelerate technological progress. These measures, if well enforced, could all provide an entrepreneur-friendly environment wherein potential entrepreneurs could acquire and explore new technological opportunities through establishing new ventures. Therefore, failing to enforce competition policy and provide healthy business environment could harm entrepreneurship since potential entrepreneurs will be placed at a disadvantaged position, where the available opportunities are limited and the hazard of failure are high.

The same principles of competition policy apply to the areas (e.g. licensing agreement of IP, in particular patents, technology transfer and other IP pooling arrangements) in which IPRs may be used to charge excessive prices, prevent access to protected technologies and restrict competition between technologies that are economic substitutes for one another. The enforcement of competition policies therefore complement IPR protection and promote the emergence of technology entrepreneurship. Specifically, at a given level of IPR protection, fair and pro-competitive licensing terms (e.g. compulsory license) under competitive market assured by the strong enforcement of competition regulations increase the access of potential entrepreneurs (knowledge users) to new technologies and encourage the technology adoption on the one hand. Well-functioning competition policy, on the other hand, makes it more difficult for big incumbent firms to acquire new, small and promising firms (e.g. technology ventures). Under this circumstance, potential entrepreneurs could gain more space to explore new opportunity and develop new ventures with limited detrimental impacts from the market power of big dominating

firms. Meanwhile, the option of assigning or licensing patent for the knowledge creators under stricter competition regulations could be less profitable than it is under the weak enforcement of competition policy as more bargaining power is shifted to the knowledge users. Therefore, there will be a higher chance that potential entrepreneurs (knowledge creators) will commercialize their ideas through entering the market where there are more opportunities and higher probability they could compete with and even defeat existing established firms. We therefore propose that:

Hypothesis 2 (H2): Enforcement of competition policy moderates the positive relationship between IPRs and technology entrepreneurship such that the stronger the enforcement of competition policy, the stronger this relationship.

METHODS

Data and Sample

We test our hypotheses using annual survey data from the Adult Population Survey (APS) of Global Entrepreneurship Monitor (GEM) on various measures of entrepreneurship from 2002 to 2007. GEM systematically researches entrepreneurial behavior around the world. It defines entrepreneurs as "adults in the process of setting up a business they will (partly) own and / or currently owning and managing an operating young business." Based on the stage, profits and salary payments of the business, the nascent entrepreneur, baby business and established business are regarded as three main classes of the entrepreneurship.

We examine in this study the first two types of entrepreneurship, which together is also called the "early-stage entrepreneur" or the "total entrepreneurial activity" (TEA). TEA is defined as the working adult-age individual (18 - 64) who is either actively trying to start a new entrepreneurial firm, or who is currently acting as owner-manager of a new entrepreneurial firm. Initial database contains 802,318 individuals from 18 to 64 years old in 60 countries. This data is summarized in Table 1, in which we report the total number of observations (i.e. the individuals who have participated in the survey), the early-stage entrepreneur as the share of total participants in each country over the 7 years and the technology entrepreneurs that we are particularly interested in. Technology entrepreneurship is a sub-category of TEA that claims to

adopt new technologies in the production of the goods or services. Table 1 presents the scale of technology entrepreneurs as share of the total early-stage entrepreneurs in each country over the observation period. We can tell from this table that the rate of early-stage and technology entrepreneurship varies widely across countries. On average, there are about 6.7% of total observations claiming to be involved in the early-stage entrepreneurial activity, 12.14% of which claim to adopt new technologies.

Insert Table 1 about here

Data from the World Bank, the Heritage Foundation and the World Competitiveness Report are used to construct the key explanatory and control variables. IPR protection measure comes from the index of property rights from the Economic Freedom database of the Heritage Foundation. The Heritage Foundation has tracked the march of economic freedom in 183 countries around the world with 10 influential Index of Economic Freedom and has been commonly used by many scholars (Acemoglu and Johnson 2005; Aidis, et al. 2007; Autio and Acs, 2010). Effectiveness of competition policy indicator is drawn from the World Competitive Yearbook. This report constructs the indicator based on a survey of business leaders, which were asked to rate, on a scale from 1 (lowest value) to 10 (highest value), whether antimonopoly policy promotes competition. It is one of the most comprehensive indicators available in terms of countries included and time periods covered. It has been used in many studies (e.g. Nicholson, 2004; 2008; Kronthaler, 2007).

Variables and Measures

Dependent variable. *Technology Entrepreneur* is defined as an individual involved in *early-stage entrepreneurial activity* (i.e. an working-age adult who is starting a new business or currently an owner-manager of a new business that has paid salaries, wages, or any other payments to the owners not more than 42 months) that claims to use (will use or is currently using) new technology in the production of the goods or services. A technology is considered new if it was not available more than a year ago. It is coded as a dummy variable and it equals to1 if a person is a technology entrepreneur and takes value 0 otherwise.

Independent variables. *Intellectual Property Rights* is defined as the degree to which a country protects private property rights and the degree to which its government enforces those laws and regulations. The IPR protection variable combines various aspects of the degree to which private property is protected in a given country, intellectual property rights are respected, and citizens are protected against expropriation of their properties (Autio and Acs, 2010). The index scales from 10 (lowest value) to 100 (highest value). The more certain the legal protection of property, the higher a country's score is.

Enforcement of Competition Policy is defined as how business leaders perceive competition law. We use data from the IMD World Competitive Yearbook (WCY). This report constructs the indicator based on the Executive Opinion Survey, which were asked to rate, on a scale from 1 (lowest value) to 10 (highest value), whether competition legislation is efficient in preventing unfair competition. The higher value indicates higher level of enforcement of competition policy and more effectively the policy could promote market competition.

Control variables. We include the following variables that could potentially affect the development of entrepreneurship as controls in the model.

Some of the key socio-demographic features of entrepreneurs are controlled. We control the age of an individual as studies have suggested that middle-aged persons are more likely to start a business (Reynolds et. al., 1999; Minniet et. al., 2005). Entrepreneurial activity is found to vary significantly with gender. Being a male is more likely to drive up the rates of entrepreneurship (Grilo and Thurik, 2005; Estrin and Mickiewicz, 2009). It is coded as a dummy variable and takes value 1 if the individual interviewed is male and 0 otherwise. Research shows that individuals with higher educational attainment are more likely to start a business (Minnitti et al. 2005). Education is coded as a dummy variable takes value 1 if the individual interviewed has a graduate experience and 0 otherwise (i.e. primary, secondary, post secondary). **Income level** influences individual's perceived opportunity cost and income expectation positively (Smith and Powell, 1990; Autio and Acs, 2010). Household income is classified into 3 categories: lower 1/3, middle 1/3 and higher 1/3. We set dummy variables to each category with lower 1/3 as reference group.

Perceptions, attitudes and skills of entrepreneurs are also taken into account as controls in our analysis. **Knowledge and skills** is coded as a dummy variable and takes value 1 if the individual interviewed believes to have the required skills and knowledge to start a business and 0 otherwise. Opportunity perception is coded as a dummy variable and takes value 1 if the individual interviewed sees good opportunities to start a business in the next 6 months and 0 otherwise (Naudé, Amorós and Cristi, 2011). Fear of Failure is coded as a dummy variable and takes value 1 if the individual interviewed indicates that fear of failure would prevent them from setting up a business and 0 otherwise. **Acquaintance with other entrepreneurs** is coded as a dummy variable and takes value 1 if the individual interviewed knows other person who started a business in the past 2 years and 0 otherwise. The cultural views or acceptability of entrepreneurship in a particular nation is believed to positively related with the probability of early-stage entrepreneurial activity (Naudé, et.al, 2011). We control **social support** and set dummy variable equal to 1 when people believes that starting a business is considered as a good career choice, 0 otherwise.

Based on the World Development Indicators from the World Bank, we also include some macro economic factors proven to be associated with the development of entrepreneurship. Country's growth rate positively associated with the entry of new firms (Kawai and Urata, 2002). Thus, we control for the **growth rate of GDP** measured as annual percentage growth rate of GDP at market prices based on constant local currency. It is lagged one year and log transferred. We control for the **interest rate** in a given year measured by the lending interest rate adjusted for inflation as measured by the GDP deflator to capture the variance and stability of a country's financing infrastructure (Goderis and Loannidou, 2008). **Population** of a country that reflect the size of the market is controlled and measured by counting all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country of asylum. It is suggested that higher levels of unemployment increase the chances of self-employment. Thus we include **unemployment** measured as the share of the labor force that is without work but available for and seeking employment as another control. All variables discussed

above are log transformed. Finally, we control for **transition economies**¹ which are the countries dealing with transformation from a centrally planned economy to a free market economy (Feige, 1994) because of their idiosyncratic economic history (Autio and Acs, 2010).

Econometric Models

In the Hypothesis 1, we are interested in the impact of IPR protection on individual's decision engaging in the technology entrepreneurship. In the Hypothesis 2, we examine the moderating role of competition policy enforcement in the relationship between IPR protection and individual's decision to be a technology entrepreneur. The dependent variable is binary indicating whether or not the person surveyed is a technology entrepreneur.

We have to tackle here a sample selection issue in the econometric analysis as an individual that will adopt new technology can only be observed for those people who first decided to become an early-stage entrepreneur. This is a self-selection process in which the choice to be an early-stage entrepreneur in the first place might not be random but influenced by some factors that at the same time drive individuals to adopt new technology and become technology entrepreneurs. The two choices discussed above are not independent from each other and not taking the selection into account will bias the estimates (Heckman, 1979). The two-stage Heckman selection model is adopted for handling this sample selection issue.

To facilitate model identification, the selection model and outcome model in two stages should have at least one variable different, meaning that we should include at least one variable in the selection equation (i.e. being a early-stage entrepreneur) that is not associated with the choice of adopting new technology, therefore, can be excluded from the outcome equation (i.e. being a technology entrepreneur). Drawing upon existing literature showing that the increased likelihood of an individual entering entrepreneurship if he belongs to a more entrepreneurial social group as they may

¹ The following countries in GEM survey are listed as transition economies (the IMF, 2000; the World Bank, 2002; 2009): China, Croatia, Czech Republic, Hungary, Latvia, Poland, Romania, Russia, Slovenia and Serbia.

enhance their perceptions of entrepreneurs' social status as well as their learning experiences (Nanda and Sorensen, 2010; Giannetti and Simonov, 2009), we decide to include the personal acquaintance of other entrepreneurs as a determinant that is more relevant for an individual's selection to become an early-stage entrepreneur than for his selection of adopting new technology.

RESULTS

Table 2 and Table 3 present the descriptive statistic such as means, standard deviations and the correlations for all variables included in our models. We check variance inflation factors (VIFs) of the independent variables included in the models. VIF measures how much the variance of an estimated regression coefficient is increased because of collinearity. In the outcome equation, the mean value of VIFs is 1.92 which is less than 6 and the maximum value of VIF is 4.41 which is smaller than 10. In the selection equation the values are 1.65 and 4.27. Overall, this analysis suggests little problem of multicollinearity ².

Insert Table 2 about here

Insert Table 3 about here

The results of estimating the impact of IPRs on the probability of an individual engaging in the technology entrepreneurship (H1) and the moderating role of competition policy (H2) using the Heckman selection models are presented in Table 4. The first stage is the selection model predicting the probability of an individual engaging in early-stage entrepreneurial activity. The second stage then estimate the independent effects of the explanatory and control variables on the probability of an individual to become a technology entrepreneur. Model 1 is the baseline model containing only the control variables. Model 2 estimates the main effects IPRs and

² Rule of thumb: individual VIFs are greater than 10 and the average VIF is greater than 6 are generally seen as indicative of severe multicollinearity.

competition policy on technology entrepreneurship. Model 3 is the full model containing the key independent variables, their interaction term and all control variables.

First of all, the inverse Mill's ratio in Table 4 shows statistically significant influences in all models. This result indicates that our decision to adopt the Heckman selection procedure is justified. Surprisingly, the effect of IPR protection exhibits negative (-0.17) and significant effect at the level of 0.05, indicating that a higher level of IPR protection is negatively associated with the probability of an individual engaging in the technology entrepreneurship. Hypothesis 1 is not supported therefore. The results show as well that the enforcement of competition policy exhibits positive (1.57) and significant effect at the level of 0.001 on the relationship between IPR and technology entrepreneurship. In other words, IPR protection and the enforcement of competition policy complement each other, which provides full support for Hypothesis 2.

Due to the selection procedure, we should calculate the conditional marginal effects for all estimated results. Conditional marginal effect is the marginal effect of an independent variable on the dependent variable conditional on selection and consists of two components. First, there is the direct effect of the independent variable, which is captured by the coefficient in the outcome model. Second, there is an indirect effect if the independent variable also appears in the selection equation. This is because a change in a given variable not only changes the predicted value of the dependent variable, but also the probability that an observation is actually in the sample. Thus, the marginal effect of IPR on the predicted probability of technology entrepreneurship is -0.04. It indicates that holding all other variables constant at their means, one unite increase in the IPR protection leads to the decrease of the probability of an individual engaging in the technology entrepreneurship by 4%. While everything else being equal, one unite increase in both IPR and the enforcement level of competition policy will increase the probability of an individual engaging in the technology entrepreneurship by 38%.

Insert Table 4 about here

DISCUSSION

We investigate in this study the relationship between IPRs and the development of technology entrepreneurship and the extent to which this relationship is moderated by the enforcement of competition policy across different countries.

The final results show that instead of stimulating, higher levels of IPR protection hamper the entry of entrepreneurs that adopt new technologies. This result is unexpected and the explanation could be the following. On the one hand, the inventor of patented knowledge is given a statutory right to prevent others from commercially exploiting their invention, which is frequently referred to as a monopolistic right to exclude others from making, using or selling the invention (WIPO, 2004). This gives the inventor the sole ability to commercialize their patented knowledge and recoup the costs of the innovation. On the other hand, the right to license others to exploit the invention is an important additional source of income to the inventor and sometimes can be the only source when the owner of the property right is not well situated to engage in large scale commercial exploitations (OECD, 1989).

Under stronger IPRs protection, potential entrepreneurs as patent owners (knowledge creators) are more likely to opt out from being entrepreneurs because they are usually better off to license out the patent than to commercialize it by them. This is partly due to the preferential licensing terms in favor of inventors under stronger IPR protection. Meanwhile, lacking relevant experience in downstream markets and the substantial cost of establishing complementary assets also lower their incentive of entry. There are potential entrepreneurs that are patent adopters (knowledge users). They acquire and rely on new knowledge produced by others. Under stronger IPR protection, a considerable amount of cutting-edge discoveries has been patented. Access to similar knowledge by potential technology users thus becomes limited (Choi and Phan, 2006) due to various kinds of holdup in negotiating licensing terms often with multiple innovators and producers (e.g. refusal to license, exclusive license, expensive license fee, risk of infringement). This is especially so for those early-stage technology entrepreneurs (potential users of the technology in question) as they are more financially constrained and lack well-developed patent portfolio that could influence the bargaining power in the negotiation processes.

Therefore, the entry of technology entrepreneurial firms is deterred. Moreover, innovations are often cumulative and complementary. By granting temporary monopoly right to the access of certain innovations, IPRs raise barriers for subsequent technological advancements that need to be built upon existing knowledge. This will slow down the pace and reduce the total amount of technology discoveries and entrepreneurial opportunities.

The selection model in the Heckman two-stage analysis indicates that IPRs shows positive effect on the total early-stage entrepreneurship while holding the enforcement level of competition policy at its mean value. To better understand the impact of IPRs on the entrepreneurship, we carry out ex-post ad hoc analysis on the relationship between IPRs and total early-stage entrepreneurship. The estimated results are presented in Table 5. Model 4 is the baseline model containing only control variables. Model 5 includes the main explanatory variables. Model 6 is the full model. The results show that IPRs and competition policy have the same complementary effect on total early-stage entrepreneurship as they do on the technology entrepreneurship. It's important to know that the main effect of IPRs on total early-stage entrepreneurship is positive (0.43) and significant at 0.001 level as opposed to the negative effect IPRs have on the technology entrepreneurship. Based on the above analysis, we understand that the effect of IPRs on the entrepreneurial activity clearly varies across different types of entrepreneurship. IPR protection is conducive to the overall entrepreneurs but adversely affects the entrepreneurs adopting new technologies.

Insert Table 5 about here

We also show the evidence that the interaction of enforcement of competition policy and IPR protection is positively related to the probability of an individual engaging in technology entrepreneurship. This could be understood by the fact that increasing IPR protection can be detrimental to the emergence of entrepreneurial firms adopting new technologies as we just discussed and effective enforcement of competition policy designed to prevent the undue exploitation of market power caused by IPR-

related monopoly clearly plays a substantial role in alleviating the negative effect of IPRs on technology entrepreneurship.

Although we did not hypothesize, the enforcement of competition policy has negative effect on the technology entrepreneurship. The possible explanation for this relationship may have something to do with the very specific nature of this particular type of entrepreneurship, which determines that they will not be in favor of very competitive environment. For instance, Casson (2003) argues that entrepreneurship involves the exploitation of a unique opportunity: *“if two or more entrepreneurs compete to exploit the same opportunity, then normally neither of them will obtain any reward.”* Entrepreneurship with propensity to innovate is more likely to be motivated by the potential profit generated from commercialization of the innovation, the so called “temporary monopoly profit” that depends on the competitive landscape of the new market (Binks and Vale, 1990). If a potential entrepreneur has tremendous difficulties in charging premium over the new products in which he has invested a lot, as faced in a competitive and dynamic market regulated effectively by pro-competitive policies, he would reasonably choose not to enter and compete in the market. Fazio (2010) discusses about “leapfrog innovation entrepreneurship” which are start-ups involving with “Schumpeterian creative destruction”, introducing completely new products and creating new markets. He provides the evidence that this type of entrepreneurship exist in markets characterized by low levels of competition. This seems also in line with the argument made by Chandler (1990), Fligstein (1996) and Choi and Phan (2006) asserting that less aggressive pro-competition policy encourages monopolistic rents that attract new entrants by diminishing direct competition and stabilizing industries.

CONCLUSIONS AND IMPLICATIONS

Drawing upon economics and entrepreneurship literature, we studied in this paper the impact of intellectual property rights, enforcement of the competition policy and their interaction on the development of entrepreneurial initiatives, especially those dealing with innovation activities.

We argue that entrepreneurships are heterogeneous in terms of their motivations and behaviors. Some are interested in growing bigger and faster, some prefer stay small

and just make a living out of their businesses, some are after new technologies and overseas market, so on and so forth. But they have at least one trait in common: recognizing and exploring the opportunities emerging from the economy. Opportunities with different natures have different influence on different types of entrepreneurship. IPRs, patent rights specifically, are closely related to the entrepreneurs seeking for technological opportunities. We have shown that stronger protection discouraged individuals to pursue new ventures that explore technological innovations. This is largely due to the fact that development and commercialization of technological invention is generally risky and costly and entrepreneurs are more often than not financially constrained especially at the very early-stage. Strengthening IPR protection thus the related patent protection for technological inventions generates two effects on entrepreneurs adopting new technologies. First, it gives more incentive to potential entrepreneurs (knowledge generators) generate more innovation and make it more profitable for them to license or sell the technology than to commercialize it by themselves though entering the market due to the preferential licensing terms and lack of complementary asset. Second, strong IPR protection makes it more difficult for potential entrepreneurs (knowledge users) to access new technologies due to the temporary exclusive control over IP and abusive licensing terms. Overall, the net effect of IPRs on technology entrepreneurship is negative.

We also investigated the moderating role of competition policy in the relationship between the IPRs and technology entrepreneurship. The results from this study have shown clearly these two institutions complement with each other. In a nutshell, we should not over-simplify the relationship between IPRs and competition policy. IP legislations cannot be designed and implemented in isolation from other legal disciplines, particularly competition policy. Both competition and patent policies can foster innovation, but each requires a proper balance with the other to do so. How one policy's rules are interpreted and applied can affect the other policy's effectiveness (Federal Trade Commission, 2003).

Implications of this study are twofold. First, we show that policies such as intellectual property rights and competition laws have a major impact on entrepreneurship across different national contexts. The appropriate formulation and implementation of these policies can either facilitate or impede the development of entrepreneurs, particularly

those in our study aiming to innovate. Policies become an important contextual factor in the emergence of entrepreneurship. Second and more importantly, we show that there is a significant interaction between intellectual property rights protection and competition policy. Economic policies, in order to create a nurturing environment for entrepreneurship, have to be considered as an ecosystem. The interactions and complementarities among constituent policies therefore jointly determine the future health of entrepreneurship.

There are limitations in this study. The measure of IPRs taken from the Heritage Foundation is not clear-cut. It captures the national protection of properties in general, of which intellectual property is an important part. Further researches could use other measures of IPRs such as the one from the World Competitive Report or the Trade Related Intellectual Property Rights (Hamdan–Livramento, 2009). Further studies could draw the distinction of different types of IPRs and investigate the fine-grained relationship between IPR protection and entry of various forms of entrepreneurial activity. It is also interesting to compare the differential effects of IPRs, competition policy and their interaction on the De Novo firms and the De Alio firms that are involved in innovative activities and clearly equipped with different level of resource endowment.

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Table 1 Countries and Entrepreneurship in the Sample

Country	Total Obs.	TEA		Tech. Entrepreneurship		Country	Total Obs.	TEA		Tech. Entrepreneurship	
		%	Obs.	%	Obs.			%	Obs.	%	Obs.
United States	25,543	8.87%	2,266	9.75%	221	Singapore	15,880	5.63%	894	13.09%	117
Russia	6,023	3.02%	182	7.14%	13	Thailand	7,043	17.11%	1,205	16.10%	194
South Africa	20,023	4.74%	949	21.07%	200	Japan	11,776	2.40%	283	9.54%	27
Greece	10,008	6.45%	646	27.71%	179	Korea	2,015	13.00%	262	15.27%	40
Netherlands	21,178	3.75%	794	9.07%	72	China	10,835	14.31%	1,550	16.90%	262
Belgium	18,196	3.06%	557	26.75%	149	Turkey	4,817	5.27%	254	5.12%	13
France	11,919	2.94%	350	14.57%	51	India	6,708	11.55%	775	10.32%	80
Spain	96,550	6.28%	6,066	5.06%	307	Canada	14,495	6.83%	990	9.80%	97
Hungary	11,756	4.77%	561	9.27%	52	Uganda	3,040	29.24%	889	13.05%	116
Italy	12,950	3.58%	464	15.09%	70	Portugal	3,023	7.21%	218	12.84%	28
Romania	2,046	2.54%	52	0.00%	0	Ireland	11,993	7.05%	845	9.70%	82
Switzerland	11,608	5.94%	689	12.48%	86	Iceland	12,018	10.90%	1,310	15.88%	208
Austria	4,199	4.29%	180	6.11%	11	Finland	12,030	4.34%	522	11.30%	59
UK	158,083	4.41%	6,967	9.52%	663	Latvia	5,922	5.13%	304	7.57%	23
Denmark	20,037	5.38%	1,077	8.54%	92	Serbia	2,200	6.18%	136	11.76%	16
Sweden	36,731	3.14%	1,153	13.10%	151	Croatia	12,017	4.54%	545	21.10%	115
Norway	12,969	5.96%	773	14.75%	114	Slovenia	15,089	3.97%	599	11.19%	67
Poland	4,001	6.20%	248	10.08%	25	Czech republic	2,001	6.25%	125	37.60%	47
Germany	40,724	4.92%	2,002	12.29%	246	Venezuela	5,794	23.09%	1,338	10.31%	138
Peru	6,004	34.41%	2,066	12.29%	254	Ecuador	2,010	27.06%	544	15.44%	84
Mexico	5,028	6.84%	344	9.59%	33	Uruguay	3,997	9.58%	383	9.92%	38
Argentina	12,039	12.76%	1,536	10.48%	161	Kazakhstan	2,000	9.15%	183	4.92%	9
Brazil	14,000	12.44%	1,741	3.56%	62	Puerto Rico	1,998	2.80%	56	16.07%	9
Chile	12,020	12.36%	1,486	19.58%	291	Hong Kong	8,062	4.11%	331	8.46%	28
Colombia	4,103	21.35%	876	17.58%	154	Jamaica	5,849	19.42%	1,136	19.37%	220
Malaysia	2,005	11.52%	231	9.52%	22	Taiwan	2,236	3.89%	87	28.74%	25
Australia	12,564	8.32%	1,045	11.10%	116	Jordan	2,000	19.00%	380	35.53%	135
Indonesia	2,000	19.30%	386	31.35%	121	United Arab Emirates	4,181	6.60%	276	33.33%	92
Philippines	2,000	21.25%	425	21.41%	91	Israel	5,956	5.64%	336	14.58%	49
New Zealand	6,945	12.41%	862	13.11%	113	Dominican Republic	2,081	16.05%	334	7.78%	26
Total							802,318	6.74%	54,064	12.14%	6,564

Table 2 Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Technology entrepreneur	51529	0.12	0.33	0	1
IPRs	48118	71.44	19.95	28.75	90.00
Competition policy	45917	5.74	1.22	0.00	7.88
Population	48068	111.94	261.90	0.29	1321.29
GDP growth	42655	4.50	3.06	-10.90	14.20
Interest rate	31851	7.07	9.93	-7.80	47.30
Unemployment	41084	7.86	4.28	1.20	30.50
Age	51529	38.02	11.15	18	64
Gender	51519	1.40	0.49	1	2
Education	51529	0.19	0.39	0	1
Income	30298	23515.82	31171.79	33	68100
Knows other entrepreneurs	28451	0.64	0.48	0	1
Opportunity perception	25299	0.59	0.49	0	1
Knowledge and skills	28138	0.86	0.35	0	1
Fear of failure	28201	0.23	0.42	0	1
Social support	20469	0.67	0.47	0	1
Survey year	51529	2004.85	1.70	2002	2007
Transition economy	51529	0.09	0.28	0	1

Table 3 Correlations of Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Technology entrepreneur	1.00																		
2 IPRs	-0.06	1.00																	
3 Competition policy	-0.05	0.61	1.00																
4 Population	0.04	-0.51	-0.07	1.00															
5 GDP growth	0.05	-0.52	-0.14	0.16	1.00														
6 Interest rate	-0.19	-0.02	-0.01	-0.17	-0.17	1.00													
7 Unemployment	0.06	-0.28	-0.10	0.01	-0.03	0.27	1.00												
8 Age	-0.02	0.14	0.04	-0.09	-0.11	-0.05	-0.07	1.00											
9 Age (squared)	0.02	-0.10	-0.02	0.08	0.05	0.05	0.06	-0.70	1.00										
10 Gender	0.02	0.00	0.03	0.06	-0.03	-0.03	-0.04	0.06	-0.06	1.00									
11 Education	-0.02	0.14	0.11	-0.07	-0.04	-0.06	-0.09	0.03	-0.06	-0.05	1.00								
12 Income_mid	-0.03	0.07	0.04	0.00	-0.08	-0.06	0.00	0.01	-0.03	0.00	-0.06	1.00							
13 Income_high	0.04	0.04	-0.01	-0.08	0.07	-0.08	-0.07	-0.01	-0.01	-0.14	0.26	-0.53	1.00						
14 Knows other entrepreneurs	-0.03	-0.02	-0.03	-0.03	0.05	-0.07	0.05	-0.07	0.00	-0.11	0.08	-0.01	0.13	1.00					
15 Opportunity perception	0.01	0.01	0.04	-0.07	-0.03	0.03	0.10	-0.04	0.02	-0.02	0.03	0.01	0.01	0.14	1.00				
16 Knowledge and skills	-0.02	0.05	0.00	-0.09	-0.08	0.03	0.13	0.03	-0.06	-0.10	0.05	0.01	0.06	0.14	0.20	1.00			
17 Fear of failure	0.00	-0.01	-0.04	0.02	0.02	-0.01	-0.11	0.07	-0.07	0.11	-0.07	-0.02	-0.06	-0.05	-0.07	-0.16	1.00		
18 Culture	0.03	-0.14	-0.04	0.16	0.08	0.00	-0.07	-0.01	0.01	0.03	-0.09	-0.04	-0.04	0.00	0.07	0.01	0.04	1.00	
19 Transition economy	0.03	-0.53	-0.48	0.14	0.42	-0.23	0.06	-0.07	0.04	-0.09	-0.04	-0.04	0.11	0.12	-0.08	-0.02	-0.04	-0.04	1.00

Table 4 Results of Regression Analysis Predicting Technology Entrepreneurship

	Model 1		Model 2		Model 3	
Outcome Model (Technology Entrepreneurship)	Coefficient	Conditional marginal eff.	Coefficient	Conditional marginal eff.	Coefficient	Conditional marginal eff.
Inverse Mill's ratio	-0.35**	-0.08*	-0.38***	-0.09***	-0.72***	-0.17***
IPR			-0.17*	-0.04*	-0.37**	-0.09**
Competition law	-0.28**	-0.07**	-0.16 †	-0.04 †	0.93***	0.22***
IPR x Competition law					1.57***	0.38***
Age ^a	-0.16	-0.04	-0.15	-0.04	-0.31*	-0.08*
Age (squared)	-0.25	-0.06	-0.27	-0.07	-0.63*	-0.15*
Gender (female)	0.04	0.01	0.04	0.01	0.02	0.01
Education (graduate exp.) ^a	-0.04	-0.01	-0.03	-0.01	-0.05	-0.01
Income_middle1/3 ^a	-0.03	-0.01	-0.02	0	0	0
Income_upper1/3 ^a	0.13†	0.03†	0.15*	0.04*	0.2**	0.05**
Knowledge and skills ^a	-0.06	-0.01	-0.05	-0.01	-0.05	-0.01
Opportunity perception ^a	0.07	0.02	0.07	0.02	0.07	0.02
Fear of failure ^a	-0.08	-0.02	-0.08	-0.02	-0.11†	-0.03†
GDP growth	0.3***	0.07***	0.24**	0.06**	0.26**	0.06**
year_2003 ^a	0.53	0.13	0.44	0.11	-0.07	-0.02
year_2004 ^a	0.33	0.08	0.29	0.07	0.04	0.01
year_2005 ^a	0.31***	0.08***	0.34***	0.08***	0.36***	0.09***
year_2006 ^a	0.29***	0.07***	0.29***	0.07***	0.29***	0.07***
Transition Economy ^a	-0.15†	-0.04†	-0.18*	-0.04*	-0.28**	-0.07**
_cons	-2.22***		-2.19***		-2.75***	
Selection Model (Early-stage Entrepreneurship)						
IPR			0.27***		0.27***	
Competition law			0.75***		0.75***	
IPR x Competition law			1.51***		1.51***	
Population			0.07***		0.07***	
GDP growth			0.36***		0.36***	
Interest rate			0.12***		0.12***	
Unemployment			0.11***		0.11***	
Age			-0.45***		-0.45***	
Age (squared)			-1.17***		-1.17***	
Gender (female)			-0.09***		-0.09***	
Education (graduate exp.)			0.07*		0.07*	
Income_middle1/3			0.03		0.03	
Income_upper1/3			0.12***		0.12***	
Knows other entrepreneurs			0.4***		0.4***	
Fear of failure			-0.19***		-0.19***	
Social support			0.19***		0.19***	
Year_2003			-1.4***		-1.4***	
Year_2004			-0.93***		-0.93***	
Year_2005			0.06*		0.06*	
Year_2006			-0.04		-0.04	
Transition economy			-0.31***		-0.31***	
_cons			-2.31***		-2.31***	
Wald chi2			66.75***		85.83***	
NO. of obs.			25879		25879	
Log pseudolikelihood			-1630.33		-10225.24	
Pseudo R2			0.02		0.03	

(a) Marginal effect for discrete change of dummy variable from 0 to 1.

*** p< 0.001, ** p<0.01, * p<0.05, † p<0.1

Table 5 Results of Regression Analysis Predicting Total Early-stage Entrepreneurship

Total early-stage Entrepreneurship	Model 4	Model 5	Model 6
IPR		0.43***	0.27***
Competition law	-0.09†	-0.45***	0.75***
IPR x Competition law			1.51***
Population	0.03***	0.07***	0.07***
GDP growth	0.29***	0.43***	0.36***
Interest rate	0.08***	0.1***	0.12***
Unemployment	0.16***	0.2***	0.11***
Age	-0.39***	-0.43***	-0.45***
Age (squared)	-1.16***	-1.16***	-1.17***
Gender (female)	-0.1***	-0.11***	-0.09***
Education (graduate exp.)	0.11***	0.12***	0.07*
Income_middle1/3	0.03	0.02	0.03
Income_upper1/3	0.13***	0.11***	0.12***
Knows other entrepreneurs	0.41***	0.42***	0.4***
Fear of failure	-0.19***	-0.2***	-0.19***
Social support	0.19***	0.18***	0.19***
Year_2003	-1.43***	-1.36***	-1.4***
Year_2004	-0.93***	-0.94***	-0.93***
Year_2005	0.09***	0.05†	0.06*
Year_2006	0.00	-0.08**	-0.04
Transition economy	-0.41***	-0.36***	-0.31***
_cons	-2.07***	-2.49***	-2.31***
NO. of obs.	27548	25879	25879
Wald chi2	1988.26***	1951.28***	2032.3***
Log pseudolikelihood	-11326.919	-10283.423	-10225.243
Pseudo R2	0.091	0.098	0.103

*** p< 0.001, ** p<0.01, * p<0.05, † p<0.1