Intellectual Property Rights Protection and Self-Selection into Entrepreneurship: Evidence from China*

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Abstract

This study explores the impact of intellectual property rights (IPR) protection on entrepreneurial decisions. Leveraging household survey data and the staggered rollout of Intellectual Property Rights Demonstration Cities (IPRDCs) program in China, we identify a robust, positive impact of strengthened IPR protection on the probability of individuals pursuing self-employment. In addition, we uncover that stronger IPR protection is associated with a lower threshold of individual attributes necessary for venturing into entrepreneurship. These entrepreneurial attributes include age, education, social status, and access to social networks. This study primarily investigates two plausible mechanisms that may propagate the IPRDC policy shock. First, we demonstrate that IPRDC policy leads to an improved legal environment, which can reduce the risk of intellectual property infringements, thereby shielding the profit flows accruing to ordinary business proprietors. Second, while enhanced IPR protection may not ease the financial constraints for aspiring entrepreneurs, it fosters technology progress, which in turn may reduce the barriers for business start-ups. These findings indicate that the mechanisms through which IPR protection stimulates entrepreneurial activities are substantially distinct from those of land and broader property rights protection.

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1 Introduction

The role of entrepreneurs and the dynamics underlying their occupational choices have been long considered as fundamental drivers of innovation and economic development (Banerjee and Newman, 1993). Previous studies on individual-level decisions to venture into entrepreneurship highlight that the probability of engaging in entrepreneurial activities is tightly linked to pre-existing wealth (Evans and Jovanovic, 1989; Paulson and Townsend, 2004), ability (Poschke, 2013), risk preferences (Kihlstrom and Laffont, 1979; Hombert *et al.*, 2020), demographics (Liang *et al.*, 2018) and social environment (Djankov *et al.*, 2006). Moreover, an emerging body of literature has sparked a heated debate on the importance of institutional factors, particularly the protection of land and broader property rights, in augmenting firm values (Beck *et al.*, 2005; La Porta *et al.*, 2002; Berkowitz *et al.*, 2015) and fostering entrepreneurship (Wang, 2012; Bu and Liao, 2022).

This study focuses on a much less-examined factor, the protection of intellectual property rights (IPR). Previous studies, typically leveraging firm-level data, highlight the significant impact of IPR protection on firm financing, R&D investment, and innovation output (Ang *et al.*, 2014; Fang *et al.*, 2017; among others). However, there is a void in the literature exploring its impact on the self-selection of individuals into a broad spectrum of entrepreneurial activities. These include not only R&D-related start-ups with substantial growth prospects but also small businesses launched by necessity-driven entrepreneurs, who constitute a substantial fraction of entrepreneurial activities.[1] In addition, it remains unclear whether and how the impact of IPR protection on entrepreneurial decisions, if it exists, is contingent on individual characteristics. This study seeks to address these critical questions and identify the possible channels through which the IPR policy shock may propagate.

A large body of the patent-design and endogenous growth literature has long established that IPR protection matters for innovation and growth (Nordhaus, 1969; Klemperer, 1990; Helpman, 1993; among others).[2] In theory, a system characterized by weak IPR protection is inherently more susceptible to infringements and imitation activities, which may foster an environment where copied or imitated goods can flood the market, exerting a downward pressure on prices. This decline in prices, in turn, significantly erodes the potential profits reaped from innovative activities or the downstream rents that emerge from the commercialization of such innovations.[3]

In this study, we propose a theoretical model to demonstrate the linkages between IPR protection and entrepreneurship. Augmenting a simple R&D growth framework of the Romer (1990) type with heterogeneous entrepreneurial attributes, we show that stronger IPR protec-

[1] Leveraging data from the Global Entrepreneurship Monitor (GEM), Poschke (2013) finds that, on average, entrepreneurs who start businesses "out of necessity" account for 14.4% of entrepreneurial activities in industrialized countries. This fraction escalates dramatically in transition economies, averaging 29.9%, and becomes even more pronounced in poorer countries (i.e., 39.1% in Argentina and 46.7% in Brazil).

[2] Please refer to Chu (2022) for a comprehensive survey.

[3] Helpman (1993) models patent protection as a parameter that governs the exogenous probability of an imitation process. This methodology is adopted by Kwan and Lai (2003) and many subsequent studies.

tion can promote entrepreneurial activities through lowering the threshold for entrepreneurship. Intuitively, since strengthening IPR protection tends to enhance firm values (which finds empirical support in Hsu *et al.*, 2013), it can induce individuals who previously fell below the entrepreneurial threshold to pursue their business ideas. We hypothesize that this key model implication may extend to entrepreneurs not directly involved in R&D activities.[4] This is predicated on the fact that strengthening IPR not only offers enhanced protection for patents, but it also reduces the risk of trademark and copyright infringements, thereby shielding the profit flows accruing to ordinary business proprietors.

To empirically examine the impact of IPR protection on entrepreneurship, we confine our analysis to the context of China, and exploit the individual-level data from the China Family Panel Studies (CFPS), which covers about 14,000 households each year in 25 provinces. In particular, this study leverages the staggered introduction of Intellectual Property Rights Demonstration Cities (IPRDCs), a program aimed at enhancing the IPR governance capacities, as a plausibly exogenous policy shock. This program is well suited for our empirical practice, given that the selection of IPRDCs is not limited to economically prosperous areas; it also includes relatively small prefecture-level cities in less developed provinces. This quasi-natural experiment among 54 Chinese cities from 2012 to 2018 allows us to use the difference-in-differences (DiD) methodology to identify the causal effect of IPR protection on entrepreneurial activities.[5]

We document a strong positive effect of strengthened IPR protection on entrepreneurship across the board. Our baseline regression, which controls for individual and city-level characteristics, along with multiple layers of fixed effects, suggests that the probability of becoming an entrepreneur among individuals in the treatment group on average increases by 2.7% more than their counterparts in the control group. This estimated effect is significant at the 1% level and retains its robustness even when excluding provincial capital cities or instances where a district-level area of the city receives a subsequent IPRDC designation following its initial designation. To mitigate the concerns over potential bias in staggered DiD estimators originating from the variation in treatment timing (Goodman-Bacon, 2021), we adopt the methodology proposed by Sun and Abraham (2021) to obtain the Interaction-Weighted estimator. This refined estimation approach maintains the consistency of our findings. In addition, exploiting firm entry data at the city level, we find that the introduction of IPRDCs exerts a significantly positive effect on the entry of high-tech and non-high-tech firms. This further confirms the positive impact of IPR protection on entrepreneurial activities across a broad spectrum of sectors. A further exploration of firm entry by ownership type reveals that the increases in new registrations are concentrated among privately owned firms post the introduction of IPRDCs.

In this study, we find that the effect of IPR protection on the likelihood of entrepreneurship

[4] We make this conjecture because our simple theoretical model excludes non-R&D-related entrepreneurs.

[5] Although the designation of these demonstration cities may not be entirely exogenously determined, empirical evidence supporting the assumption of parallel trends in entrepreneurial activities between the two groups prior to the introduction of IPRDCs alleviates this concern.

is critically dependent on educational background and age, both of which can be interpreted as proxies for individual ability. On the one hand, our findings indicate that, following the adoption of the IPRDC policy, the probability of entrepreneurship for individuals with medium educational attainment (junior and senior high school) and higher educational attainment (above senior high school) in the treatment group increases, on average, by 4.9% and 3.4%, respectively, more than their counterparts in the control group. On the other hand, we use 35 years as an age cutoff and find that the introduction of IPRDCs elevates the probability of younger individuals (age $<$ 35) becoming entrepreneurs by an average of 4.8%, while the impact on their more experienced counterparts (age $\geq$ 35) is 1.8%. These findings point to the possibility that enhanced IPR protection may promote entrepreneurship through attracting individuals who previously fell marginally below the ability threshold to venture into entrepreneurship.[6]

Moreover, our analysis suggests that entrepreneurial decisions in response to stronger IPR protection hinges on individual income. The empirical evidence in Poschke (2013) indicates that high-income individuals are less likely to become entrepreneurs who, as Moskowitz and Vissing-Jørgensen (2002) suggest, bear high risks. Upon examining the potential heterogeneous effect of IPR protection among different income groups, we find that individuals who fall into the middle and upper income brackets (i.e., 33.33%–66.66%, and 66.66%–100%) in IPRDCs are significantly more likely to embark on entrepreneurial ventures compared to their counterparts in non-IPRDCs.

Inspired by Djankov *et al.* (2006), we also examine the potential impact of social environment on self-employment decisions. We find that strengthened IPR protection significantly raises the likelihood of self-employment for individuals with and without social networks among the treatment group by averages of 6.3% and 2.1%, respectively, more than those in the control group. In particular, the increase in entrepreneurial probability among individuals with no social networks may point to a reduction in the threshold of individual attributes for entry. In addition, our findings indicate that stronger IPR protection leads to a higher probability of entrepreneurship among individuals who self-identify as having low or medium social status. In contrast, the effect on those who consider themselves of high social status is almost non-existent.

To understand these intriguing empirical findings, we primarily investigate two channels that may translate increased IPR protection into entrepreneurial decisions. First, we conjecture that the introduction of IPRDCs enhances the legal environment, which in turn reduces the likelihood of potential losses resulting from patent, trademark, and copyright infringements. This provides a stronger protection for the revenue flows accruing to ordinary business owners. From China Judgements Online, we collect data on all judicial documents involving intellectual property (IP) infringements from 2012 to 2016 in China. We find that the volume of case filings in the treatment

[6]Existing studies suggest that the relationship between ability and entrepreneurship may be U-shaped, and that individuals with low and high ability might pursue different types of entrepreneurial activities (i.e., necessity-driven versus opportunity-driven). Our findings do not contradict this literature because they indicate that the thresholds for medium and high ability entrepreneurs both decrease when IPR protection becomes stronger.

group increases on average by around 71% more than that in the control group. Meanwhile, the probability of lawsuit withdrawals and appeals after first-instance judgments in the treatment group decreases substantially by averages of 14.8% and 5.9%, respectively, compared with those in the control group. This is also accompanied by a statistically significant reduction in the time required for case trials. According to Bebchuk (1984), Priest and Klein (1984), Baye and Wright (2011), and Cao *et al.* (2023), these findings suggest a decrease in litigation costs and an improvement in judicial efficiency and quality following the introduction of IPRDCs.[7]

In addition, we posit that the effect of IPR protection on entrepreneurship can be channeled through innovation. Enhanced IPR regimes have been shown to stimulate technological innovation, as evidenced by Fang *et al.* (2017) using data from China. This technological advancement can spill over into non-R&D sectors, fostering entrepreneurship by reducing the cost of starting small businesses. A clear example of this channel is the rise of Information Technology (IT), which has precipitated the rapid growth of E-commerce platforms. These platforms allow small business owners to start online shops at lower costs compared to traditional brick-and-mortar stores. This reduction in entry cost could potentially draw individuals who were previously financially constrained to explore their business opportunities. Consequently, stronger IPR protection indirectly stimulates entrepreneurship across sectors, including those not involved in R&D.

In this paper, we find that the probability of self-financed entrepreneurs in the treatment group increases by 4.2% more than that in the control group. In contrast, IPRDCs policy seems to exert a negative effect on entrepreneurship that relies on external financing. Nonetheless, the establishment of IPRDCs does not seem to have a statistically significant impact on family debt levels. These findings lead to important implications. First, start-ups with a focus on R&D typically require substantial investment, often in the form of external funding. Therefore, stronger IPR protection may not stimulate entrepreneurial activities through relaxing the financial constraints as did enhancing the protection of property rights through land titling or housing reforms (Wang, 2012; Bu and Liao, 2022). However, it could encourage a broader base of entrepreneurs by lowering entry barriers, benefiting ordinary and even necessity entrepreneurs who are less likely to gain access to external funding. In addition, we show that several additional channels associated with the protection of land property rights, such as social trust and risk preferences, are unlikely to be provided by IPR protection.

This study contributes to several strands of the economics and finance literature. First, this paper relates to the literature emphasizing the effect of institutional factors on entrepreneurship. Fogel *et al.* (2008) argue for the necessity of long-term transaction trust in entrepreneurial activities, underpinning the need for a stable and efficient enforcement of property rights. The extant literature provides consistent evidence that legal institutions safeguarding property rights enhance firm values and growth (Beck *et al.*, 2005; La Porta *et al.*, 2002; Berkowitz *et al.*, 2015).

[7]Please refer to Weatherall and Webster (2014) for a detailed survey.

Lin *et al.* (2010) also show that the strengthening of broader property rights enforcement promotes corporate innovation.[8] This paper complements these studies by specifically focusing on the protection of IPR and the self-selection into entrepreneurship. Additionally, a growing literature examines the nexus between land/housing assets and entrepreneurial activities (Corradin and Popov, 2015; Schmalz *et al.*, 2017; Han *et al.*, 2020; among others). Wang (2012) scrutinizes the housing reforms in China, uncovering a pronounced positive effect of property rights protection on entrepreneurship. Bu and Liao (2022) find that land titling reform in China spurs rural entrepreneurial activities. Given that land and housing can serve as collateral for financial endeavors, these studies highlight how the reinforcement of land property rights can alleviate financial constraints, thereby nurturing entrepreneurial ventures. Our study complements these insights by showing that the role of IPR protection may be substantially different from that of land property rights. Instead of enabling individuals to better capitalize on their real estates, IPR protection can fuel technological innovation and alleviate the financial constraint by lowering the cost of business start-ups.

This paper adds to the literature examining the impact of IPR protection. While theoretical exposition of the relationship between IPR protection and economic growth (Acs and Sanders, 2012) questions the conventional wisdom that stronger IPR protection is always favorable, empirical evidence often suggests that enhanced IPR protection is conducive to innovation (Chen and Puttitanun, 2005) and economic growth (Branstetter *et al.*, 2006; Allred and Park, 2007).[9] Focusing on China's economy, Ang *et al.* (2014) uncover that regional variation in local IPR protection in China affects firms' financing choices, R&D investment and patenting activities. Fang *et al.* (2017) indicate that the promoting effect of IPR protection on innovation output varies with firm ownership. Hsu *et al.* (2013) find a reduction in piracy and an increase in firm value following the strengthening of local IPR protection. We complement these intriguing studies by scrutinizing how IPR protection in China translates into individual entrepreneurial decisions.

This study also speaks to the literature on the relationship between demographics and entrepreneurship. Acemoglu *et al.* (2014) posit that creativity may diminish as inventors and managers age, which provides a rationale for the long established observation that the probability of venturing into entrepreneurship is highest during young-middle age (Evans and Leighton, 1990; Mondragón-Vélez, 2009). Liang *et al.* (2018) find that countries with younger populations tend to have more entrepreneurial activities, and that the entrepreneurship rates of the middle aged are particularly sensitive to variations in demographic structure. Moreover, Aksoy *et al.* (2019) suggest that the trend of population aging and low fertility rate can predictably lead to a decline in investment and output growth. We contribute to this discussion by showing that the institutional factor, namely IPR protection, can shape individual entrepreneurial decisions, attracting

[8] Estrin *et al.* (2013) find that growth-aspiring entrepreneurs can benefit simultaneously from strong and weak property rights enforcement, albeit they are hindered by government corruption.

[9] Some other studies, such as Gould and Gruben (1996), show that the empirical relationship between IPR protection and growth is inverted U-shaped.

both younger and older individuals to engage in entrepreneurial activities.

Finally, our study connects to the literature on occupational choice. Earlier studies largely support a positive correlation between wealth and the probability of entrepreneurship (Evans and Jovanovic, 1989; Cagetti and De Nardi, 2006; among others). However, Hurst and Lusardi (2004) present a counter-narrative, suggesting that for most of the population, the probability of becoming an entrepreneur is not significantly affected by wealth, except within the wealthiest top decile. Mondragón-Vélez (2009) suggests that the relationship seems inverted-U shaped when stratified by age and educational levels. We contribute to this literature by presenting evidence that stronger IPR protection promotes entrepreneurship through inducing individuals in the middle and upper income brackets to engage in entrepreneurial activities. Another strand of literature discusses the impact of individual ability. Poschke (2013) proposes an occupational choice model and suggests a U-shaped relationship between the probability of entrepreneurship and variables such as age and education. Abstracting from the discussion on the potential non-linear relationship, we show that enhanced IPR protection, which reduces the risk of IP infringements, can encourage low and high ability individuals for entrepreneurship.

The remainder of the paper is organized as follows. Section 2 presents our theoretical framework and develops the main testing hypotheses. Section 3 describes the data, variable definition, descriptive statistics, and empirical specification. Section 4 reports the empirical results and explores the transmission mechanisms. Finally, Section 5 concludes this paper.

2 Motivating Theory

In this section, we extend the variety-expansion model of Romer (1990) to formulate our hypotheses for empirical testing. Inspired by Jaimovich and Rebelo (2017) and Arawatari *et al.* (2018), we assume that there is a large representative household composed of heterogeneous agents who differ in entrepreneurial attributes. This model features individuals' occupational choice as in Lucas (1978). Particularly, we aim to demonstrate that strengthening IPR protection, measured by larger patent breadth (as in Goh and Olivier, 2002), can promote entrepreneurial activities and reduce the minimum attribute threshold that is necessary for entrepreneurship. For a simple demonstration, however, this model excludes non-R&D-related entrepreneurs. We posit that the major model implication may still be applicable to ordinary businesses that are not involved in R&D.

2.1 Theoretical Model

Final good. We assume that the economy produces a unique final good for consumption. The final good is produced competitively by a mass of identical firms, which employ labor l_t and a

continuum of intermediate inputs $x_t(i)$. The production technology is given by

$$Y_t = l_t^{\alpha} \int_0^{N_t} [x_t(i)]^{1-\alpha} di, \tag{1}$$

where N_t is the number of input varieties, and $\alpha \in (0,1)$ is the elasticity of demand for intermediate goods. Solving the profit-maximizing problem yields the inverse demand functions for l_t and $x_t(i)$:

$$p_t(i) = (1-\alpha)\left(\frac{l_t}{x_t(i)}\right)^{\alpha}, \tag{2}$$

$$w_t = \alpha \int_0^{N_t} \left(\frac{l_t}{x_t(i)}\right)^{\alpha-1} di, \tag{3}$$

where $p_t(i)$ and w_t are the price of $x_t(i)$ and the wage rate, respectively. Note that they are denominated in units of the final good, which is chosen as the numeraire.

Intermediate goods. Agents who create a new innovation through R&D are assumed to own permanent patents on the production of intermediate goods. We assume that the production technology across all industries is identical. Each firm $i \in [0, N_t]$ behaves as the monopolistic producer in its own industry. Producing one unit of intermediate goods requires η units of final good. The profit-maximization problem is expressed as $\pi_t(i) = [p_t(i) - \eta]x_t(i)$. Solving this problem, combined with (2), yields the optimal price of intermediate good i, given by $p_t(i) = \eta/(1-\alpha)$.

In an economy with perfect patent protection, the monopolists are able to charge an unconstrained price markup ($(1-\alpha)^{-1}$) over the marginal cost of production η. If patent protection is incomplete, they are threatened by the entry of imitators. The weaker the patent protection, the lower the (technical or legal) cost of imitation. In this sense, monopolistic firms are only allowed to charge a limited price to exclude the competition of imitators.[10] We follow Gilbert and Shapiro (1990) and Goh and Olivier (2002) to parameterize patent breadth by the maximum price that the monopolistic manufacturing firms can charge. Thus, firms' optimal price is given by

$$p_t(i) = \mu\eta \tag{4}$$

where $\mu \in [1, 1/(1-\alpha)]$ is price markup over per unit cost of production. Given (4), the profit-maximizing quantity of intermediate goods and the flow of profit are identical across industries such that

$$x_t = (1-\alpha)^{\frac{1}{\alpha}} \eta^{-\frac{1}{\alpha}} \mu^{-\frac{1}{\alpha}} l_t, \tag{5}$$

$$\pi_t = (1-\alpha)^{\frac{1}{\alpha}} \eta^{\frac{\alpha-1}{\alpha}} (\mu - 1)\mu^{-\frac{1}{\alpha}} l_t, \tag{6}$$

[10] We concentrate on the equilibrium in which when prices of monopolists and imitators are identical, there is no production by competitive firms.

where π_t is an increasing function of patent breadth for $1 \leq \mu \leq 1/(1-\alpha)$. Substituting (5) into (3) yields the equilibrium wage rate such that

$$w_t = \alpha N_t (1-\alpha)^{\frac{1-\alpha}{\alpha}} \mu^{\frac{\alpha-1}{\alpha}} \eta^{\frac{\alpha-1}{\alpha}}. \tag{7}$$

Households. The economy is populated by a representative "large" household, consisting of L agents with heterogeneous entrepreneurial attributes $a \in [\underline{a}, \bar{a}]$, where $\underline{a}$ and $\bar{a}$ are the minimum and maximum of a. In our model, a can potentially capture a broad set of ability-related factors (such as intellectual aptitude, experience, access to social networks and so forth). In addition, a follows a cumulative distribution $F(a)$ that is continuously differentiable and satisfies $F(\underline{a}) = 0$ and $F(\bar{a}) = 1 (0 < \underline{a} < \bar{a})$. Agents with the same attributes are identical. The utility of the representative household is given by

$$U = \int_t^{\infty} e^{-\rho(t'-t)} \cdot \frac{(c_{t'})^{1-\sigma} - 1}{1-\sigma} dt', \tag{8}$$

where $c_{t'}$ denotes the consumption of final good per agent at time t', $\rho > 0$ is the subjective discount rate, and $\sigma > 0$ is the inverse of the elasticity of intertemporal substitution.

Each agent faces an occupational choice on whether to become a worker or an entrepreneur. Denote by $I_t(a)$ the occupational choice of an agent with attribute a. $I_t(a)$ takes the value of 1 if an agent decides to become a worker, and 0 otherwise. The payoff of being a worker is the wage income w_t. Should the agent become an entrepreneur with a successful innovation, she would own intermediate good firms and earn a profit $\pi_t(i)$ from each firm. Hence, the representative household receives a total amount of $\int_0^{N_t} \pi_t(i) di$ profits. The flow budget constraint of the representative household is

$$\dot{b}_t = r_t b_t + \int_{\underline{a}}^{\bar{a}} w_t I_t(a) L dF(a) + \int_0^{N_t} \pi_t(i) di - c_t L, \tag{9}$$

where b_t denotes the bond of the representative household and r_t is the interest rate.

Let $n_t(a)$ denote the number of intermediate good firms owned by a typical agent with attribute a. Thus the aggregate number of intermediate goods can be expressed as

$$N_t = \int_{\underline{a}}^{\bar{a}} n_t(a) L dF(a). \tag{10}$$

If an agent with attribute a becomes an entrepreneur and engages in R&D, within a small time interval dt, she can create an amount of $(\delta K_t a) dt$ new intermediate goods. $\delta > 0$ is the productivity parameter, and K_t captures the knowledge spillover in R&D. The law of motion for $n_t(a)$ is

$$\dot{n}_t(a) = \delta K_t a [1 - I_t(a)], \tag{11}$$

where $I_t(a) = 1$ if an agent with ability a becomes a worker at time t, and $I_t(a) = 0$ otherwise. Consequently, the number of product variety evolves according to

$$\dot{N}_t = \int_{\underline{a}}^{\bar{a}} \dot{n}_t(a) L dF(a) = \delta K_t \int_{\underline{a}}^{\bar{a}} [1 - I_t(a)] a L dF(a). \tag{12}$$

Given the flow budge constraint (9) and innovation technology (12), the representative household maximizes her utility in (8). Lemma 1 shows the household's optimal decision as follow.

Lemma 1. *The Euler equation that determines household's intertemporal consumption decision is*

$$\dot{c}_t / c_t = (r_t - \rho)/\sigma. \tag{13}$$

All intermediate good firms have the same value such that

$$v_t = \int_t^{\infty} \pi \cdot \exp\left(-\int_t^{\tau} r(s) ds\right) d\tau, \tag{14}$$

and the no-arbitrage condition in the competitive R&D sector with free entry is $r\dot{v}_t + \pi_t = r_t v_t$. *The threshold ability* a^* *that makes agents indifferent between being a worker and entrepreneur is given by*

$$w_t = v_t \delta K_t a_t^*. \tag{15}$$

Proof. See Appendix A.2. □

Equation (15) determines agents' occupational choice given their entrepreneurial attributes. The left-hand side of (15) is the opportunity cost of becoming an entrepreneur and the right-hand side is the corresponding benefit. An agents with ability higher than a_t^* becomes an entrepreneur and other "lower-ability" agents are self-selected into wage workers. Enhanced patent protection increases the profits of intermediate-good firms and, subsequently, their market values. This lowers the threshold required for agents to engage in entrepreneurship and concurrently affects the number of agents engaging in R&D activities.

2.2 Model Implications and Test Hypotheses

Conditional on the steady-state equilibrium of the model defined in Appendix A.1, we derive the major model prediction on the relationship between IPR protection and entrepreneurship. Given that only agents with an ability above a_t^* engage in innovative activity, Equation (12) can be rewritten as $\dot{N}_t = \delta K_t L \int_{a^*}^{\bar{a}} a dF(a) = \delta K_t L H(a_t^*)$, where $H(a_t^*) \equiv \int_{a_t^*}^{\bar{a}} a dF(a)$. Thus, the growth rate of N_t is given by

$$g(a_t^*) = \frac{\dot{N}_t}{N_t} = \delta L \frac{K_t}{N_t} \int_{a_t^*}^{\bar{a}} a dF(a) = \delta L H(a_t^*), \tag{16}$$

where we have assumed $K_t = N_t$ as in Grossman and Helpman (1991) and Arawatari *et al.* (2018).

Lemma 2 characterizes the impact of IPR protection on the equilibrium dynamics of threshold ability a_t^*.

Lemma 2. *The equilibrium dynamics of a_t^* are given by*

$$\frac{\dot{a}_t^*}{a_t^*} = \frac{1}{1+\sigma\Omega(a_t^*;\mu)}\left\{\Phi(\mu)a_t^*F(a_t^*) - \rho - \sigma g(a_t^*;\mu)\right\}, \tag{17}$$

where $\Phi(\mu) = \delta(1-\alpha)(\mu-1)/(\alpha\mu)$, and $\Omega(a_t^*;\mu) > 0$ is a composite variable defined in Appendix A.3.

Proof. See Appendix A.3. □

In the steady-state equilibrium, we show that a_t^* is constant and equals a^*, which is determined in (17) by imposing $\dot{a}_t^* = 0$ such that

$$\Phi(\mu)a^*F(a^*) = \rho + \sigma\delta H(a^*), \tag{18}$$

where $\Phi(\mu) = \delta(1-\alpha)(\mu-1)/(\alpha\mu)$. Differentiating Equation (18) yields that

$$\frac{da^*}{d\mu} = \frac{-\Phi'(\mu)a^*F(a^*)}{\Phi(\mu)[F(a^*)+a^*F'(a^*)] + \sigma\delta a^*F'(a^*)} < 0. \tag{19}$$

Equation (19) implies that stronger patent protection reduces the entrepreneurial threshold and encourages entrepreneurship. Intuitively, if strengthened IPR protection enhances the profit flows of innovative firms, it alters household occupational choices by increasing the expected returns from entrepreneurship. Consequently, this tends to attract workers who were marginally below the required ability level to consider entrepreneurial ventures. Moreover, given that the population size is fixed, a lower entry threshold indicates a larger number of agents being self-selected into entrepreneurship.

Although our theoretical framework exclusively focuses on innovative firms, we conjecture that the implications of reinforcing IPR protection could be relevant to ordinary entrepreneurs for two main reasons. First, the occupation choice channel may extend to non-R&D-related entrepreneurship. Enhanced IPR protection not only secures patents but also mitigates the risk of trademark and copyright infringements, thus preserving the economic gains of standard business owners holding various types of intellectual properties. An illustrative example is that of self-employed content creators who produce a wide range of materials, from educational tutorials to entertainment videos, on social media platforms. Without sufficient IPR protection, these entrepreneurs are vulnerable to unauthorized duplication or misuse of their content. Strengthening IPR protection can better shield these content creators, ensuring the originality of their video content, channel visits, and revenue flows.

Second, enhanced IPR protection is associated with increased innovation, as demonstrated in Fang *et al.* (2017) using data from China. Technological progress often leads to positive spillovers in non-R&D sectors, which possibly stimulate (lower-quality) entrepreneurship. A notable example is the rapid development of IT, which has significantly propelled the growth of E-commerce platforms. These digital marketplaces enable entrepreneurs to launch online stores with substantially less capital than required for traditional retail outlets. Another illustration is the rapid expansion of food delivery platforms in China, which permits restaurants focused on delivery to operate with reduced spatial and staffing requirements, compared with those providing dine-in services. This reduction in start-up costs is likely to incentivize individuals, including those with comparatively modest abilities, to pursue self-employment.[11]

Integrating our theoretical predictions with the aforementioned conjectures, we formulate the key refutable test hypotheses of this study as follows.

Hypothesis 1. *Stronger IPR protection has an overall positive effect on entrepreneurial activities across the board.*

Hypothesis 2. *Stronger IPR protection can reduce the threshold for entrepreneurial activities.*

3 Empirical Strategy and Data Description

3.1 Background of IPRDCs in China

Even though the overall strength of IPR protection in China is under heated debate, existing literature indicates that IPR protection within China exhibits noticeable local variation (Ang *et al.*, 2014).[12] In 2011, the National Intellectual Property Administration of China initiated the "National Intellectual Property Pilot and Demonstration City (Urban Area) Evaluation Method." This initiative led to the selection of the first and second batches of National IPRDCs in 2012 and 2013. The key objective of this program was to strengthen IPR governance and protection, starting from pilot cities across diverse regions and incrementally diffusing these enhancements into neighboring urban areas. This initiative is central to the broader effort to reinforce China's national IPR strategy, aiming to improve government leadership, establish efficient IPR systems, and refine service management. Furthermore, the IPRDC program emphasizes the role of the local government in allocating additional resources to IPR protection and improving the effectiveness of law enforcement. Cities undertaking the demonstration task must incorporate their work

[11] However, it is equally possible that technological progress can generate a retarding effect on certain types of entrepreneurship. For instance, exploring the entry of Uber X, Burtch *et al.* (2018) suggest that gig-economy platforms depress entrepreneurial activities with relatively low quality.

[12] Maskus (2000) and Wang (2004) characterize China as maintaining lower standards in IPR protection. In contrast, Ang *et al.* (2014) suggest that IPR protection in China is not necessarily significantly weaker than that of advanced economies, a perspective supported by the Ginarte-Park index (Ginarte and Park, 1997; Park, 2008). It should be noted, however, that the Ginarte-Park index may not adequately reflect the actual enforcement of patent laws.

on intellectual property into the annual government performance assessment report. It seeks to stimulate regional development by channeling investment into innovation, providing financial and legal support, and standardizing evaluation procedures for IP infringement dispute cases to stimulate the growth of innovative enterprises.

This novel program of IPRDCs possesses several important features. First, the process of demonstration city selection hinges on the self-directed application of local governments and the subsequent approval by central authorities. Second, cities that secure entry into this program are offered the opportunity to enact policies that are highly customized to align with their unique regional attributes and comparative advantages. This approach can potentially mitigate the pitfalls associated with a one-policy-fits-all application, promoting a tailored strategy that is more likely to yield positive outcomes on the enhancement of IPR protection.

Table 1 presents the list of cities selected into this IPRDC program by 2018 and Figure 1 depicts the geographic distribution. It is worth noting that the selection of IPRDCs is not only confined to economically developed regions but also includes prefecture-level cities that are either small or in less developed areas. For instance, Dongying, a modestly sized city with a population of approximately 2.08 million, was assigned the role of a demonstration city in 2012. According to Ji and Gu (2021), by 2015, Dongying had made significant achievements in IPR enhancement, including resolving over 150 patent infringement cases with a 100% closure rate, cracking down on 280 fraudulent patents, and recovering economic losses of RMB 3.74 billion for local enterprises. The city's patent applications and grants grew by 329% and 359%, respectively, relative to the figures in 2011.

In Figure 2, we present the geographic distribution of monthly new firm registrations across Chinese cities. It shows that the monthly average of newly registered firms experienced significant increases from 2010 to 2016, particularly in cities located in the northern, eastern, and central regions. With the exception of Xinjiang Province, cities in the western region generally maintained a relatively low level of new firm registrations. Combined with Figure 1, the mapping suggests that although cities in the vicinity of IPRDCs also exhibited noticeable increases in firm entries, these surges seems more pronounced within the IPRDCs themselves.

From our perspective, the staggered introduction of IPRDCs in China exhibits a salient quasi-natural experiment feature, which is conducive for the empirical identification of the impact attributable to IPR protection. While the approved list of demonstration city applications is not necessarily exogenously determined, we carefully investigate the parallel trends assumption and implement placebo tests to alleviate this concern.

3.2 Empirical Methodology

This study takes the introduction of IPRDCs as a quasi-natural experiment and exploits a staggered DiD method to identify the causal effect of enhanced IPR protection on entrepreneurial

activities. The specification of the baseline model is as follows:

$$Entrepr_{icp,t} = \alpha_i + \mu_c + \eta_{p,t} + \beta IPR_{c,t} + \gamma X_{c,t} + \phi Z_{i,t} + \varepsilon_{ic,t}. \tag{20}$$

In Equation (20), $Entrepr_{icp,t}$ denotes a binary dummy variable indicating whether an individual i in city c of province p owns her business in year t. $IPR_{c,t}$ is a dummy variable for the establishment of IPRDCs, which takes the value of 1 if city c has been designated as an IPRDC in year t, and 0 otherwise. α_i and μ_c represent individual and city fixed effects, respectively. $\eta_{p,t}$ is the province-year fixed effect, capturing the provincial characteristics which may change across years.

$X_{c,t}$ is a vector of variables accounting for city-specific characteristics. It includes the level of economic development, measured by the log of GDP per capita; the degree of openness, gauged by the percentage of foreign capital in the year as a percentage of GDP; city size, measured by the log of the total population at the end of the year; the inverse of industrial smoke (dust) emissions per unit of GDP, which captures the intensity of environmental regulation;[13] and the level of infrastructure development, proxied by the area of urban road per capita. In addition, $Z_{i,t}$ includes control variables related to individual characteristics, such as family size, per capita family income, marital status, educational level (years of schooling), health status, age, and Hukou status. We cluster standard errors $\varepsilon_{ic,t}$ at the individual level.[14]

In this study, we also extend our empirical investigation to include tests of the parallel trends assumption, robustness checks that consider heterogeneous treatment effects, a placebo test to validate our findings, and an exploration of the underlying transmission mechanisms. Specifications for these additional empirical practices are detailed in their respective subsections.

3.3 Data

In this study, the key explanatory variable is IPR, a binary indicator defined in Equation (20). Our sample contains a total of 54 cities that were incorporated into this demonstration initiative from 2012 to 2018. Our estimation procedure carefully excludes cities that have only had their district-level areas recognized as IPRDCs. The inclusion of these cities within the treatment group might lead to a potential estimation bias. Consequently, cities such as Xuancheng in Anhui Province and Jinhua in Zhejiang Province have been deliberately excluded from our analysis. In addition, there are instances where a city, subsequent to its initial designation as an IPRDC, has its district-level areas being selected as IPRDCs again in the following years. In the robustness checks, we exclude these cities and re-evaluate our empirical results to ensure the robustness of

[13] We also use air pollution emissions to capture the effect of environmental regulations, and the empirical results barely change.

[14] We also cluster the standard errors at the city level, and the results are quite similar.

our findings.[15]

The primary dataset employed in this paper is obtained from the CFPS. This dataset encompasses five waves of nationally representative survey data collected in 2010, 2012, 2014, 2016, and 2018. Each wave of the survey gathered information from roughly 14,000 households distributed among 127 cities within 25 provinces of China. The dataset is rich with details on individuals' occupational status and employment history, as well as a broad range of demographic attributes, such as educational achievement, income, marital status, and hukou status, among many others.

The determination of a household's occupational status is derived from a careful review of the survey questions, which are phrased differently across years. In the 2010 survey, the question posed is: "Which institution are you currently working for?" A response indicating "self-employed" leads us to classify the household's occupational status as entrepreneurial, and we set *Entrepre* in Equation (20) to 1. In the 2012 iteration of the survey, households affirming self-employment in response to the query "Are you self-employed?" are also categorized as entrepreneurial. For the period from 2014 to 2018, households that self-identify as self-employed (by selecting JobClassBase=2) are similarly deemed entrepreneurs.[16]

In addition to individual attributes, we collect data on city-level characteristics from the China Statistical Yearbooks. Moreover, we acquire firm registration data from the State Administration for Industry and Commerce (SAIC).[17] The dataset covers every company registered in China for the past 40 years. Detailed firm-level information includes firm's location, ownership type, legal representatives, executive profiles, registered capital, industry code, year of establishment, among others. It also continuously incorporates updates and changes to these records. We aggregate the registration of new firms at the city-level to capture firm entry within a city. We supplement our analysis with firm entry data to ensure the robustness of our empirical findings.

Variable definition and summary statistics are presented in Table 2. We see that individuals identifying themselves as self-employed accounts for 11.3% of all observations (58,861). This fraction is slightly lower than the US average entrepreneurship rate in 2009, reported by Hipple (2010). The age of surveyed households spans from 16 to 89 years, with an average age of 45.48. Of the total observations, around 30% possess urban hukou status, and the average educational attainment is 7.4 years of schooling.

4 Empirical Findings

[15]The cities to be excluded in this step include Suzhou, Wuxi, Zhenjiang in Jiangsu Province, Qingdao in Shandong Province, and Nantong in Jiangsu Province.

[16]Note that the CFPS dataset lacks specific indicators to assess the quality of entrepreneurship, implying that we cannot accurately distinguish between entrepreneurs driven by opportunity and those driven by necessity. Nonetheless, our hypothesis posits that increased IPR protection can potentially stimulate both types of entrepreneurial activities.

[17]The SAIC administers the National Enterprise Credit Information Publicity System and authorizes Tianyancha, a service provider, to offer subscription-based access to these business registration records. This dataset has been utilized in various recent studies, including Allen *et al.* (2019), Bai *et al.* (2020), Liu *et al.* (2022), among others.

4.1 Overall Effect of IPRDCs on Entrepreneurship

Our initial examination focuses on the overall impact of IPRDCs on the probability of venturing into entrepreneurship. The baseline results, documented in Columns (1) to (3) of Table 3, identify a significant increase in the likelihood of self-employment for individuals within the treatment group. Specifically, the probability of self-employment in the treatment group exhibits an average increase of 2.6% to 2.7% more than that in the control group, subsequent to the staggered rollout of IPRDCs. This substantial and positive effect is statistically significant at the 1% level and remains largely unchanged after we control for individual- and city-specific characteristics. Moreover, an estimation where robust standard errors are clustered at the prefecture-city level yields almost identical coefficient estimates.[18]

Given that household survey data is mixed of opportunity- and necessity-driven entrepreneurs, whose motivations are not directly identifiable, these findings lend support to Hypothesis 1, affirming the anticipated positive relationship between strengthening IPR protection and entrepreneurial activities across the board. In addition, the magnitude of the estimated impact of IPRDCs is considerable and warrants attention. While not necessarily directly comparable, the observed average treatment effect on entrepreneurial probability induced by IPRDCs seems more considerable than that of housing reforms in China as documented in Wang (2012), and is on par with the impact of high-speed railway development as reported by Ma *et al.* (2021).

To ensure the robustness of our primary empirical findings, we undertake a series of robustness checks. First, our dataset includes cases where, following a city's initial designation as an IPRDC, its district-level regions are subsequently chosen as IPRDCs again in later years. Incorporating these cities may lead to a potential estimation bias. Therefore, we exclude these cities and re-estimate our baseline regression. The results reported in Column (1) of Table 4 indicate that the estimated effect of IPR protection on entrepreneurship remains unchanged. Second, given the systematic advantages in development levels and government support that provincial capital cities may possess over non-capital cities within the Chinese provinces, we run an estimation that omits provincial capitals. As shown in Column (2), the average treatment effect of IPR on the probability of entrepreneurship is 2.3%, which remains statistically significant at the 1% level. In Column (3), we present the Interaction-Weighted estimator in Sun and Abraham (2021) and show that the estimation results remain robust.[19]

In addition, we construct an alternative dependent variable *StatusChange*, whose value in year t equals 1 if an individual used to be a wage worker in year $t-1$ and becomes self-employed in year t. It takes the value of 0 for all other circumstances. This variable is used to capture the dynamic changes in occupation status from wage employment to firm ownership. A re-estimation of Equation (20) using *StatusChange* reveals that the introduction of IPRDCs is associated with an

[18] Since the outcomes are broadly similar to those presented in Column (3) of Table 3, we omit these results for brevity.

[19] We describe this empirical methodology in Section 4.2.

increment in the probability of wage workers transitioning into entrepreneurship by an average of 2.1% in the treatment group relative to the control group. It further confirms the effect of IPR protection on fostering entrepreneurship.

Moreover, we exploit firm registration data to validate our empirical findings from the baseline regression. We aggregate the registration information for high-tech and non-high-tech firms at the city level.[20] The empirical results are detailed in Table 5. Columns (1) and (2) reveal that the establishment of IPRDCs leads to a statistically significant increase of 0.65 high-tech firm per ten thousand capita in the treatment cities more than the control group. Meanwhile, the increase in non-high-tech firms seems remarkably strong, with an additional 15.56 newly registered firms per ten thousand capita in the treatment group relative to the control cohort post the introduction of IPRDCs. The evidence at hand reinforces the hypothesis that stronger IPR regimes stimulate a broad spectrum of entrepreneurial activities.

A closer examination of firm entry by ownership type indicates that the positive effect of IPRDCs on firm entry is concentrated among privately owned firms. According to Column (5) of Table 5, there is an average increase of 12.63 private firms per ten thousand capita more than that in the control group post the implementation of IPRDCs. In addition, private sector firms seem to crowd out the entry of state-owned enterprises. This negative effect of IPRDC policy on the entry of state-owned enterprises, as illustrated in Column (3), is -0.029 and statistically significance at the 5% level. Meanwhile, the entry of firms with foreign investment does not seem to be influenced by the implementation of IPRDCs.

Concerning the firm entry patterns among IPRDCs and their neighboring cities plotted in Figure 2, we empirically investigate the potential regional spillover effect of the IPRDC policy intervention. Following the methodology in Butts (2023), we introduce the interaction term $(1 - IPR_{c,t})S_{c,t}$ into the baseline regression, where $S_{c,t}$ denotes a binary indicator that equals 1 if a city c from the control group is within a distance d kilometers of the nearest treatment group city in year t, and 0 otherwise. We find that the coefficient estimates of $(1 - IPR_{c,t})S_{c,t}$ are statistically insignificant across three distance thresholds $d \in \{50, 100, 200\}$. This suggests that the positive effect of enhancing IPR protection on entrepreneurial activities does not appear to come at the expense of entrepreneurship in neighboring cities. We detail the empirical specification and present the results in Table B1 in Appendix B.

4.2 Parallel Trends and Placebo Test

The identification of a DiD estimator hinges on the parallel trends assumption that the trends in the outcome variable between the treatment and control groups would remain the same in absence of the IPRDC policy intervention. To assess the plausibility of this assumption, we

[20]The firm registration dataset employed incorporates all firms newly registered in China from 2010 to 2016. Higt-tech and non-high-tech firms are classified according to the 2013 "High-Technology Industry Statistical Classification Catalog." Observations are subsequently structured into a city-year panel.

estimate the following regression model:

$$Entrepr_{icp,t} = \alpha_i + \mu_c + \eta_{p,t} + \sum_{k=-4}^{3} \tau_k IPR_{c,t+k} + \gamma X_{c,t} + \phi Z_{i,t} + \varepsilon_{ic,t}. \tag{21}$$

where the variable $IPR_{c,t+k}$ represents the number of periods relative to the introduction of the IPRDC program in city c. In this paper, we select the year immediately preceding the establishment of the IPRDCs (i.e., $k = -1$) as the reference period and exclude it from Equation (21) to avoid perfect multicollinearity.

Figure 3 illustrates that, before the implementation of the IPRDC policy ($k < 0$), there was no statistically significant difference in the probability of individuals opting for self-employment between the treatment and control groups. When $k = 0$, the coefficient τ_0 turns positive and statistically significant, indicating an immediate stimulating impact on entrepreneurial activities during the onset year of the IPRDC policy enactment. This estimated effect persists for one year following the policy intervention. It then diminishes and becomes statistically insignificant from the second year onwards after the establishment of IPRDCs.

Goodman-Bacon (2021) suggests that staggered DiD estimators in two-way fixed effects models can be potentially biased in the presence of variation in treatment timing or heterogeneity across sample groups. To address this concern, we exploit the Interaction-Weighted estimator proposed by Sun and Abraham (2021), which is particularly well-suited for event-study designs. Following their methodology, we let $E_i = min\{t : D_{i,t} = 1\}$ denote the time when individual i initially receives the binary absorbing treatment, where $D_{i,t}$ is defined as a binary variable taking the value of 1 if individual i is treated in year t, and 0 otherwise. Hence, $l = t - E_i$ captures the time length that individual i has been treated. Accordingly, we estimate the following regression:

$$Entrepr_{icp,t} = \alpha_i + \lambda_t + \sum_{e} \sum_{l \neq -1} \delta_{e,l} \left(\boldsymbol{I}\{E_i = e\} \cdot D_{i,t+l} \right) + \varepsilon_{i,t}. \tag{22}$$

where $\boldsymbol{I}\{E_i = e\}$ is the binary variable indicating whether the initial treatment of individual i belongs to cohort e; and $\delta_{e,l}$ is the estimator of cohort-specific average treatment effect on treated cohort e, l periods after the initial treatment. This estimator is denoted as $CATT(e,l)$.[21] The average treatment effect can then be calculated by taking the weighted-average of $\delta_{e,l}$. As shown in Figure 4, the estimated average treatment effect remains robust after we take into account the heterogeneity in the timing of IPRDCs.

In this paper, we also conduct a placebo test. We randomly designate a comparable number of cities from the sample as IPRDCs and assign fictitious policy implementation dates to create a new treatment group. The number of treated cities is the same as that in the original sample. Based on this methodology, we re-estimate the baseline regression model and replicate the

[21] Note that this approach is based on the assumption that treatment effects are homogeneous among individuals within a given cohort, provided that the post-treatment duration is identical across individuals within that cohort.

experiment 500 times. As depicted in Figure 5, the distribution of the randomized treatment coefficients is closely centered around zero, with an overwhelming majority of p-values greater than the 0.1 threshold. Moreover, the random coefficients predominantly fall to the left of the baseline estimate (0.027). This pattern suggests that the randomization process significantly reduces both the magnitude and the significance level of the estimated policy impact, which provides further support to the robustness of our baseline results.

4.3 Heterogeneous Effects

4.3.1 Education and Age

To infer the empirical impact of IPR protection on the latent threshold of individual entrepreneurial ability, we partition the data by the educational attainment and age of households, both of which may serve as proxies for entrepreneurial aptitude. We re-estimate the baseline regression for each subsample and present the findings in Tables 6 and 7.

First, we divide individuals into three educational categories: below junior high school, junior and senior high school, and above senior high school. The estimation results, presented in Table 6, indicate that the likelihood of engaging in entrepreneurship for individuals holding a junior or senior high school diploma is, on average, 4.9% higher in IPRDCs than its counterparts in non-IPRDCs. The positive impact of IPRDC policy seems slightly less pronounced for individuals with an education level above high school. In contrast, for those with the lowest educational achievement (below junior high school), the establishment of IPRDCs does not exhibit a significant effect on entrepreneurial probability.

Second, we employ an age threshold of 35 years to examine the potential heterogeneous effects. Our findings reported in Table 7 suggest that the positive impact of IPR protection is more pronounced among the younger demographic than their older counterparts. As shown in Columns (1) and (2), the introduction of IPRDCs increases the likelihood that younger individuals (age $\leq$ 35) engage in entrepreneurship by an average of 4.8% more than those in non-IPRDCs, while the effect on older individuals (age $>$ 35) is merely 1.8%. This complements the findings in Evans and Leighton (1990) and Mondragón-Vélez (2009), which indicate a peak in the probability of entrepreneurship during young-middle age. It also echoes the findings in Liang *et al.* (2018) that countries with younger populations tend to have more entrepreneurial activities. Different from Liang *et al.* (2018), however, we show that the relationship between demographics and entrepreneurship can be shaped by changes in institutional policy regimes.

In addition, the above findings support Hypothesis 2, affirming that enhanced IPR protection can promote entrepreneurship through lowering the ability required for entrepreneurial activities. Note that the estimated coefficient on age in the baseline regression is statistically insignificant, whereas the coefficient on education is marginally negative. This might be attributed to the possible non-linear relationship between entrepreneurship and individual ability. Poschke

(2013) suggests that the entrepreneurship-ability relationship can be U-shaped. Individuals with lower ability can venture into low-quality entrepreneurial activities if this decision is driven by necessity rather than the presence of opportunity. Due to data constraints, we are unable to directly observe the motivation—whether necessity or opportunity—behind each entrepreneurial activity. It is possible that younger individuals or those with low educational attainment are more likely to engage in low-quality business ownership. However, the connection between household characteristics and the quality of entrepreneurship is not the primary focus of our study. It does not detract from the central finding that stronger IPR protection is associated with the broad reduction in entrepreneurial ability thresholds, as proxied by education and age, subsequent to the introduction of IPRDCs. This empirical phenomenon, however, stands in contrast to the effects of land titling reforms in China, as explored by Bu and Liao (2022). It may indicate that the transmission mechanisms of policy shocks stemming from IPR reforms can be substantially distinct from those associated with land property rights enhancement.

4.3.2 Income

Existing studies suggest that self-selection into entrepreneurship is dependent on wealth. The seminal work of Evans and Jovanovic (1989) presents empirical evidence that wealthier people are more likely to become entrepreneurs, highlighting the importance of capital investment and liquidity constraints to business creation. This is supported by the recent finding in Paulson and Townsend (2004) using data from Thailand. Incorporating a quadratic wage term into the regression, Poschke (2013) suggests that individuals at both extremes of the wage distribution—those with very high and very low wages—are more inclined to become entrepreneurs.

We contribute to this discussion by examining the potential heterogeneous effect of IPR protection across income groups. Households are categorized into three income groups: those within the bottom 0-33.3% bracket of earnings are defined as low-income, the middle 33.3%-66.6% as middle-income, and the top 66.6%-100% as high-income individuals. As illustrated in Table 8, we find that the stimulating effect of IPRDC policy on entrepreneurial activities is predominantly observed among middle- and high-income individuals. Specifically, for those within the middle- and upper-income brackets, the implementation of IPRDCs corresponds with an average increase of 2.6% and 3.7% in the likelihood of entrepreneurship, respectively, more than those in non-IPRDCs. Conversely, the IPRDC policy appears to exert negligible impact on the entrepreneurship of individuals with lower income.[22]

Table B2 in Appendix B reports the estimation results using an alternative grouping criterion. This categorization is based on responses from the 2010 CFPS survey to the question, "Where does

[22]This suggests that the consequences of IPR protection on entrepreneurship can be distinctly different from those arising from policy interventions focusing on infrastructure development. For instance, Ma *et al.* (2021) find that the expansion of high-speed railways in China has a comparable effect on the propensity for entrepreneurship across both high- and low-income groups.

your income stand locally?" Individuals responding with 1 or 2 are classified as low income, a response of 3 denotes middle income, while responses of 4 or 5 are categorized as high income. Employing the data on self-identified income groups, we find that the establishment of IPRDCs raises the likelihood of self-employment across all three income groups. Notably, the magnitude of the estimated coefficient is largest for the high-income group and smallest for the middle-income group.

4.3.3 Social Network and Status

The study of Djankov *et al.* (2006) emphasizes the impact of sociological factors on entrepreneurial activities in China. It finds that entrepreneurs in China are significantly more likely to have family members who are also entrepreneurs, or childhood friends who later became entrepreneurs. Leveraging the CFPS data of 2010, which examines whether respondents have relatives (including parents, siblings, or spouses) in managerial or leadership positions within organizations or institutions, we classify individuals into two cohorts based on their social connectivity: those with a social network and those without. We re-estimate the baseline regression in Equation (20) for each group independently and report the results in Table 9. Columns (1) and (2) reveal that the establishment of IPRDCs raises the likelihood of entrepreneurship by an average of 6.3% for individuals with social networks and 2.1% for those without, compared to their respective counterparts in the control group. In particular, the strong positive effect on the entrepreneurial decision among individuals lacking social networks may indicate that strengthening IPR protection could potentially lower the threshold (not necessarily ability-related) for entrepreneurial ventures.

Furthermore, our analysis extends to investigate the heterogeneous impacts among individuals of varying social status. Utilizing the 2010 CFPS dataset, we scrutinize responses to the query that asks respondents to self-assess their social status. Based on their self-classification, we distribute the respondents into three social status categories: those selecting "1 or 2" are classified as possessing low social status, those indicating "3" are considered to have medium social status; and individuals opting for "4 or 5" are categorized as having high social status.

Columns (3) to (5) in Table 9 report our empirical findings. These results suggest that the rollout of IPRDCs has a strong and positive effect on the likelihood of low and medium social status individuals engaging in entrepreneurial activities. Conversely, the entrepreneurial propensities of high social status individuals exhibit no statistically significant difference between the treatment and control groups post the IPRDC policy intervention. It indicates that the promoting effect of strengthening IPR protection on entrepreneurial decisions appears to be less pronounced or even non-existent at the higher end of the social spectrum.

4.4 Transmission Mechanisms

4.4.1 Improved Legal Environment

We conjecture that the stimulating effect of IPR protection on entrepreneurship can be transmitted through improved legal environment. Improvements along this dimension can provide more robust protection for IP holders and reduce the costs incurred from IP disputes, both of which are vital for shielding the revenue flows of entrepreneurs.

Although China had established an IP legal framework as early as 2005, which was in compliance with major international treaties, the efficiency of law enforcement has improved only gradually (Hu and Jefferson, 2009). Issues such as pervasive local judicial protectionism, complex litigation procedures, protracted trial durations, inconsistent judicial standards, and inadequate compensation levels were prevalently observed (Pan *et al.*, 2015; among others).

The initiative to establish IPRDCs seeks to enhance IPR governance and enforcement, beginning with pilot programs in selected cities across various regions and progressively extending these improvements to adjacent urban areas. A review of pertinent official documents, including the "Evaluation Methods for National Intellectual Property Pilot and Demonstration Cities (Districts)," indicates that they prescribe stringent performance appraisal criteria for local governments. These criteria not only emphasize strategic metrics for reinforcing local IPR protection efforts discussed in Section 3.1 but also include specific indicators of the practical application of judicial protection by government departments, such as the judicial protection of intellectual property, development of IP regulations, and the management of rights defense and complaint services. Consequently, it is expected that local administrations within IPRDCs will augment the judicial protection of IP, resulting in a more robust IPR protection framework.

To empirically explore this key mechanism, we collect data on judicial documents related to IP infringements from China Judgements Online (https://wenshu.court.gov.cn/) spanning the years 2010 to 2016. The cases involved various infringement disputes, including those over reproduction rights, distribution rights, performance rights, information network transmission rights, and other copyright property rights, as well as trademark rights, invention patent rights, utility model patent rights, and design patent rights disputes. Our sample was limited to judicial documents uploaded by municipal and lower-level courts since prefecture-level cities are the primary implementers of the IPRDC policy. We included only first-instance cases due to the additional complexities associated with second-instance and retrial cases.

In this study, we exploit four variables to capture the changes in legal environment along multiple dimensions. These include the volume of case filings ($CaseVol$), the withdrawal of lawsuits ($Withdrawal$), appealed lawsuits ($Appeal$), and the time required for case trials ($TrialTime$). A detailed description of these variables is provided in Table 2.[23] For $CaseVol$ at the city level,

[23]It is needed to clarify that the judicial documents uploaded by local courts can be broadly categorized into two types: verdicts, which provide judicial analysis and rulings on the substantive rights and obligations in dispute, and rulings, which resolve procedural issues during the litigation process, such as non-acceptance of civil cases, jurisdictional objections, dismissal of suits, and approvals or rejections of case withdrawals. Hence, our sample

we estimate the following regression:

$$CaseVol_{cp,t} = \mu_c + \eta_{p,t} + \tau IPR_{c,t} + \varepsilon_{c,t}, \tag{23}$$

where μ_c and $\eta_{p,t}$ denote city and province-year fixed effect, respectively. For the other three outcome variables at the disaggregate level, we estimate the following regression:

$$Y_{jcp,t} = \mu_c + \eta'_{p,t} + \gamma_{court} + \tau IPR_{c,t} + \phi H_j + \varepsilon_{jc,t}, \tag{24}$$

where $Y = \{Withdrawal, Appeal, TrialTime\}$ for case j; $\eta'_{p,t}$ is the province-date (court ruling month) fixed effect; and γ_{court} is the court fixed effect. H denotes a vector of case-level control variables. This includes dummy variables for the types of plaintiffs and defendants,[24] case type (patent, trademark or other IP disputes), and the extensiveness of judicial reasoning, quantified by the logarithm of the word count in the judgment's "The Court believes" section.[25]

As shown in Table 10, Column (1) suggests a notable increase in the volume of cases by an average of 71% in the treated cities compared to the control group after policy intervention. This surge indicates a growing demand for IP infringement litigation as a consequence of strengthened IPR protection, which is met by the legal systems of the cities enrolled in the IPRDC program. As indicated in Column (2), the enhancement of IPR protection is associated with a decreased probability of case withdrawals among IPRDCs. According to Bebchuk (1984) and Priest and Klein (1984), this trend towards litigation over pre-trial settlements suggests a reduction in litigation costs and an increase in judicial efficiency.

Furthermore, Column (3) reveals that the IPRDC policy intervention significantly reduces the probability of appeals after the first-instance judgments among the treated cities. Following the analysis of Baye and Wright (2011), this decline in appeal probability is interpreted as a sign of higher judicial quality. In addition, as suggested by Cao *et al.* (2023), the time span from filing to judgment is indicative of the judicial system's efficiency. Column (4) demonstrates that the establishment of IPRDCs successfully shortens the average trial duration.

Therefore, the evidence from Table 10 robustly supports the conjecture that the introduction of IPRDCs has enhanced the legal framework in treated cities. This improved legal environment is likely to encourage entrepreneurial activities by providing better protection for the income

encompasses both verdicts and rulings when considering the total case count and case withdrawal. When examining the appealed cases and the duration of trials, however, our sample is restricted to verdicts only.

[24]This determination is based on the character length of the plaintiff's and defendant's names, with those exceeding four characters identified as companies or organizations.

[25]The degree of detail in judicial reasoning can be indicative of both the quality of decision-making and the complexity of a case. Generally, the inclusion of more text explaining the judicial rationale behind a verdict suggests a legally stronger decision (Liu, 2018). In addition, the Supreme People's Court's "Guiding Opinions on Strengthening and Standardizing the Reasoning of Judgments" suggest that the elaboration in judgments should be proportionate to the case's social impact, trial process, and litigation stage, with enhanced reasoning for cases that are difficult, complex, or highly contentious.

streams of those opting for self-employment.

4.4.2 Technological Progress and Source of Funding

We consider the possibility that the promoting effect of IPR protection on entrepreneurial activities can be channeled through technological progress. Based on survey data from Chinese firms, Lin *et al.* (2010) demonstrate that the enhancement of property rights protection can stimulate corporate R&D activities. Fang *et al.* (2017) suggest that improved IPR protection significantly incentivizes innovation, with a more noticeable impact on private firms compared to state-owned enterprises.

In this paper, we investigate the effect of IPRDC policy on innovation output, which is measured by the number of patent grants at the city level. Our results are in line with the aforementioned empirical findings. In Table 11, Column (1) shows a statistically significant increment of 6 patents per ten thousand capita in the total count of patents granted (encompassing design, utility, and invention patents) in IPRDCs relative to non-IPRDCs post the policy enactment. Among these categories, invention patents are widely recognized as a barometer of high-quality innovation. The estimation result in Column (2) underscores that the introduction of IPRDCs raises the number of invention patent grants more than that among cities in the control group.

Our results demonstrate a notable impact of IPRDC policy on city-level innovation, which may generate potential spillover effects on entrepreneurial engagement within the private sector. A further examination of financing sources yields intriguing findings. Based on the CFPS data from 2014, 2016, and 2018, we analyze the responses to the survey question concerning the "main source of funding for one's business," which enables us to categorize the funding sources for entrepreneurial ventures. Specifically, $EntreprSF$ takes the value of 1 when a respondent indicates reliance on "personal or family funds" for entrepreneurial financing. In cases where the entrepreneur depends on external financing options (which include investments from friends and relatives, independent or equity partnerships, other investors, venture capital, commercial loans, or policy support), $EntreprNFS$ is assigned a value of 1, and 0 otherwise.

In Table 12, Column (3) indicates that the effect of IPR protection on entrepreneurship that relies on external finance is negative and statistically significant. This seems to suggest that IPR and land property rights protection work remarkably differently. Existing studies, such as Wang (2012) and Bu and Liao (2022), highlight that the promoting effect of land property rights protection on entrepreneurial activities can be channeled through the relaxation of financial constraints. In contrast, our finding suggests that the financial constraint channel is not necessarily provided by IPR protection. Column (1) shows that the family debt levels between the treatment and control groups do not exhibit any significant differences before and after the introduction of IPRDCs. However, this divergence is not entirely unexpected for two reasons. On the one hand, unlike real estate or land assets, IP is often more challenging to leverage as collateral for external

funding due to its intangible nature and the difficulty in assessing its value. On the other hand, prospective entrepreneurs are less likely to possess IP assets before commencing their business ventures. As a result, it is almost improbable that strengthened IPR protection would boost entrepreneurial activities by alleviating the financial constraints.

However, Columns (2) suggest that, post the introduction of IPRDCs, the probability of entrepreneurship relying on self-financing in the treatment group increases more than that in the control group. The estimated coefficient on IPR is both substantial in magnitude (4.2%) and statistically significant at the 1% level. This finding is particularly noteworthy as it suggests that while stronger IPR protection may not facilitate overcoming barriers to entry through easing the financial constraints, it might directly reduce barriers to entrepreneurship through promoting technological advancement. As a result, individuals without access to external funding may find self-financing an attractive and feasible option for business creation.

Since CFPS does not provide much information on the business types of entrepreneurs, we resort to firm entry data from SAIC to gain additional insights. Following China's Industrial Classification for National Economic Activities (GB/T4754-2017), we substitute the dependent variable in Equation (20) with firm entry and re-estimate the regressions for 17 different industries.[26] The empirical findings are presented in Table 13.

We find that the positive impact of IPRDC policy intervention is predominantly within the service sector, which tends to be less capital-intensive than manufacturing. Moreover, we observe that stronger IPR protection does not appear to encourage the entry of firms within the agricultural and manufacturing sectors. The remarkable increases in firm entries in industries that requires less capital or lower barriers for start-ups (such as leasing and business services, technical services, education services, computer service and software, and the cultural, physical and entertainment industries) lend support to our conjecture that technological advancements stemming from enhanced IPR protection may foster entrepreneurship by reducing barriers to entry.[27]

4.4.3 Discussion on Additional Channels

We also explore two potential channels through which the IPRDC policy might exert its impact. Fang *et al.* (2017) suggest that strengthened IPR protection signals an improvement in institutional quality. Existing studies indicate that institutional factors, such as social capital, can be instrumental in promoting entrepreneurship. For instance, Bu and Liao (2022) demonstrate

[26]Since firm entry is aggregated at the city level, individual characteristics and individual fixed effect are no longer applicable, and hence, omitted from the regression specifications.

[27]The findings that new firm entries in the food, accommodation, and retail sectors remain largely unaffected by IPRDCs are not necessarily inconsistent with our expectations. This may be attributed to the fact that major advancements in food delivery services, reservations for tickets and hotels, and E-commerce are predominantly adopted by large corporations. These industry giants deploy their new technologies on a national scale, transcending the boundaries of cities involved in the IPRDC program.

that land titling reform not only enhances social trust but also reduces risk aversion, both of which are conducive to a higher probability of rural entrepreneurial activities in China.

In order to investigate whether the IPRDC policy shock is propagated through these mechanisms, we re-estimate Equation (20) with the dependent variable replaced by indicators of social trust (*SocialTrust*) and risk preference (*RiskPref*). *SocialTrust* is a binary metric where a value of 1 is assigned if an individual agrees that "most people can be trusted," and 0 if the individual concurs that "one can never be too careful in dealing with people." *RiskPref* is a categorical variable of degree of risk aversion, taking the value of 1 if a family holds financial assets, and 0 otherwise.

Table 14 presents our estimation results, where the coefficients for IPR are not statistically significant. These lead to two implications. First, although the establishment of IPRDCs significantly advances the legal environment, it does not necessarily cultivate a social atmosphere of heightened mutual trust. Additionally, it appears that enhancing IPR protection does not modify individual risk preferences. Second, it further confirms that the mechanisms through which IPR protection influences entrepreneurial activities may be fundamentally different from those related to the protection of tangible assets such as housing and land properties. This difference could stem from the fact that intellectual property is not as widely held by the general public, coupled with the complexities involved in its valuation.

5 Conclusion

This study uncovers a robust and positive relationship between increased IPR protection and entrepreneurship across the board. Leveraging the DiD methodology, we investigate the staggered rollout of IPRDCs in China. Our findings reveal that the probability of individuals pursuing self-employment in cities with strengthened IPR protection significantly exceeds that in non-IPRDCs. This empirical evidence is consistent across a range of entrepreneurship measures at both the individual and city levels. We find that the promoting effect of IPR protection on entrepreneurial activities is concentrated among individuals in the upper income quantiles.

In addition, we identify a reduction in the ability threshold for entrepreneurship, measured by age and education. Specifically, we find that following the introduction of IPRDCs, individuals across the educational spectrum are more likely to embark on entrepreneurial ventures. The policy associated with IPRDCs also appears to elevate the likelihood of entrepreneurship among both younger and older age groups, with a notably more substantial impact on the younger cohort. These empirical findings are consistent with the predictions of our growth-theoretic model featuring heterogeneous entrepreneurial attributes.

Our analysis of potential mechanisms indicates that the impact of the IPRDC policy is likely to be transmitted through an enhanced legal framework, characterized by greater judicial efficiency and reduced costs of litigation. Furthermore, we demonstrate that stronger IPR protection

may result in a higher output of innovation, and that such technological progress can lower the barriers to business formation. This inference is supported by the observation that the rise in entrepreneurial activities is primarily concentrated among individuals who are self-financed, suggesting that those lacking external financial resources might view self-financing as a viable and appealing route to business creation following the implementation of IPRDCs.

This study carries significant implications for policy makers. First, it establishes connections between individual capabilities, entrepreneurial activity, and the institutional element of IPR protection. Building on prior studies such as Liang *et al.* (2018), which suggest that a sizeable younger population contributes to entrepreneurial activities and economic growth, our findings underscore the role of institutional factors in drawing younger individuals into entrepreneurship.

Second, our analysis distinguishes the transmission mechanisms of IPR protection from those associated with land and general property rights. Specifically, enhanced IPR protection does not appear to alleviate financial constraints for individuals, nor does it create an environment of increased social trust. Rather, it provides a more robust shield for the profits derived from the commercialization of innovative ideas, which tends to lower the barriers and thresholds for business creation. Limited by our dataset, however, we cannot conclusively determine the impact of IPR protection on the quality of entrepreneurship. We leave it an open question for future inquiry.

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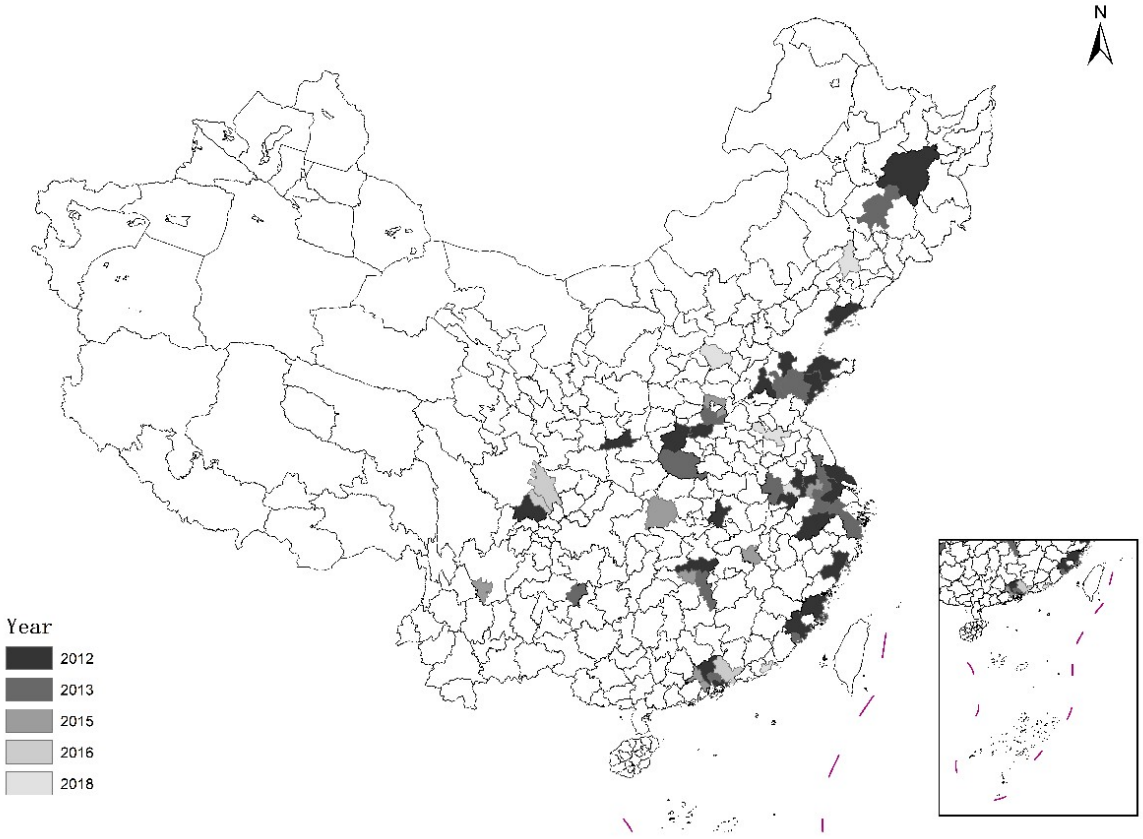
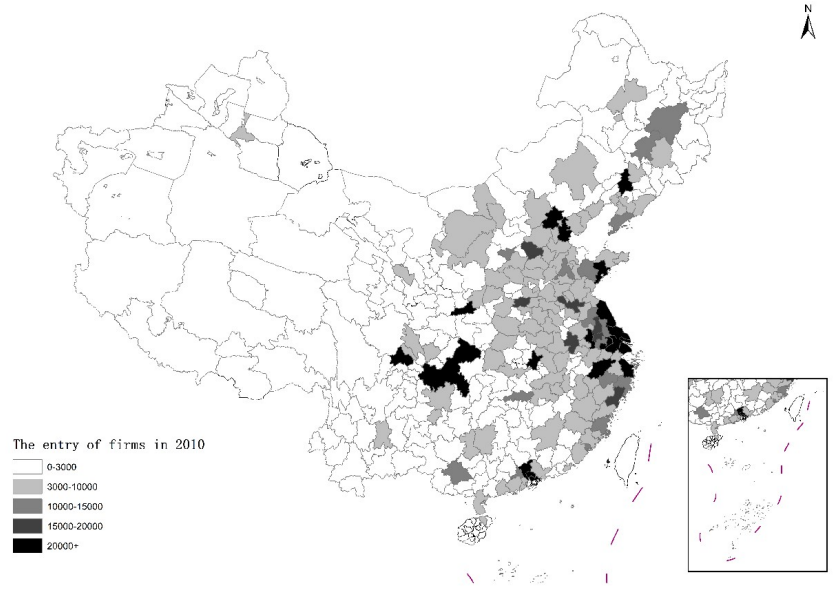
Figure 1: Geographic Distribution of IPRDCs

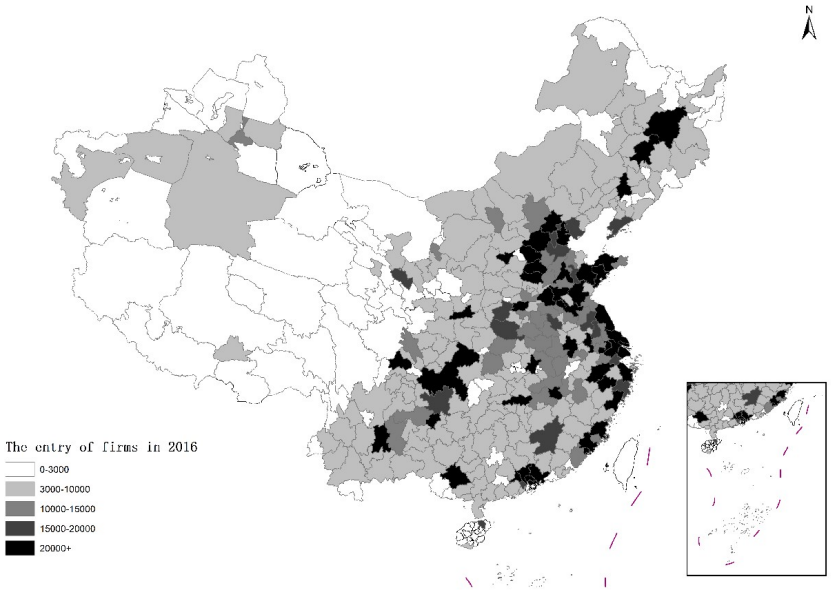


This figure presents the geographic distribution of IPRDCs from 2010 to 2016

Figure 2: Monthly New Firm Registrations by City



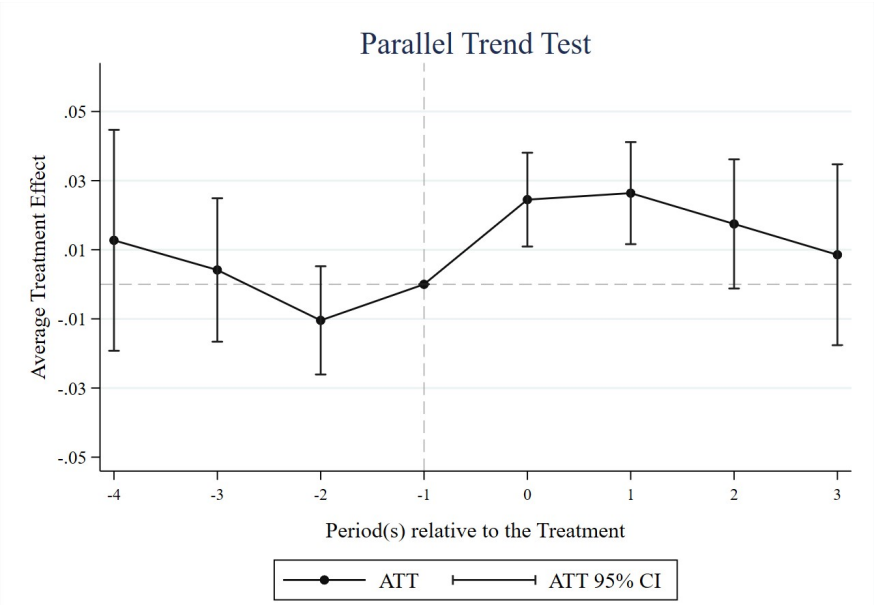
(a) Entry of Firms in 2010



(b) Entry of Firms in 2016

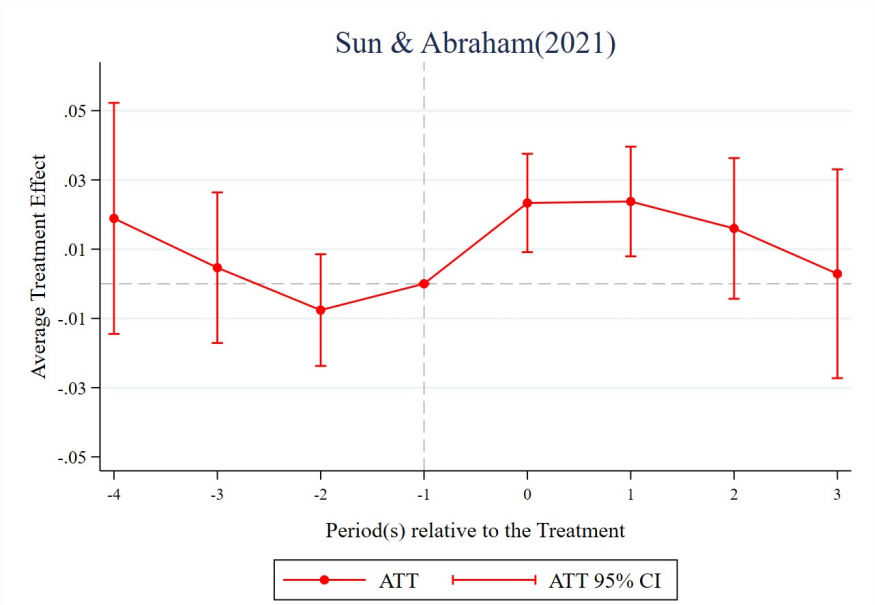
This figure depicts the geographic distribution of monthly new firm registrations among Chinese cities.

Figure 3: Parallel Trend Test



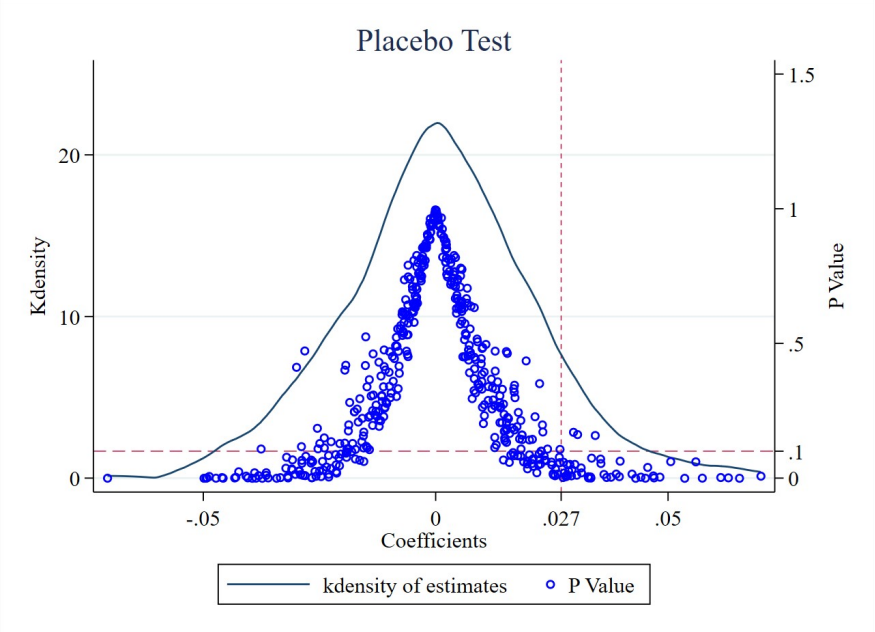
This figure depicts the difference in entrepreneurship between treated and control groups from $t-3$ to $t+4$, where $t=0$ is the onset year for IPRDCs and $t=-1$ is the reference year. The coefficient estimated from parallel trend estimation captures the difference between two groups of individuals after controlling for individual- and city-specific characteristics, along with multiple layers of fixed effects specified in Equation (21). The 95% confidence interval is shown.

Figure 4: Robust Estimation of Heterogeneous Treatment Timing



This figure depicts the difference in entrepreneurship between treated and control groups from $t-3$ to $t+4$, where $t=0$ is the onset year for IPRDCs and $t=-1$ is the reference year. The coefficients are obtained using the $CATT(e,l)$ estimator proposed by Sun and Abraham (2021). Estimated regression is specified in Equation (22). The 95% confidence interval is shown.

Figure 5: Placebo Test



This figure depicts the coefficient estimates in the placebo test based on 500 replications.

Table 1: The List of Intellectual Property Right Demostration Cities

Year	City
2012	Wuhan, Guangzhou, Shenzhen, Chengdu, Hangzhou, Jinan, Qingdao, Harbin, Nanjing, Dalian, Xi'an, Changsha, Suzhou, Nantong, Zhenjiang, Zhengzhou, Luoyang, Dongying, Yantai, Fuzhou, Quanzhou, Wenzhou, Wuhu
2013	Xiamen, Ningbo, Changchun, Dongguan, Wuxi, Zhuzhou, Taizhou, Weifang, Zibo, Hefei, Jiaxing, Nanyang, Huzhou, Xinxiang, Guiyang
2015	Changzhou, Anyang, Yichang, Xiangtan, Panzhihua, Foshan, Zhongshan, Nanchang
2016	Mianyang, Huizhou, Deyang
2018	Ma'anshan, Shantou, Shijiazhuang, Xuzhou, Shenyang

Notes: This table reports the IPRDCs at the prefecture level in our empirical analysis. Note that, however, several cities are intentionally dropped from the table. First, cities that have designated only their district areas as IPRDCs have been omitted. These include Jinhua in Zhejiang Province, and Xuancheng in Anhui Province. Second, due to the absence of city-level characteristics in the China Statistical Yearbooks, Changji in Xinjiang Province has also been excluded from our analysis. In addition, municipalities directly under the central government are omitted.

Table 2: Variable Definition and Summary Statistics

Variable	Variable Description	Obs.	Mean	SD	Min	Max
Individual Characteristics from CFPS						
Entrepr	A binary indicator on entrepreneurship, taking the value of 1 if an individual is identified as an entrepreneur; 0 otherwise	58,860	0.113	0.316	0	1
FamilySize	Number of family members	58,860	4.344	1.910	1	26
log(*Income*)	The logarithm of per capita household income	58,860	9.468	1.157	0	15.01
Marriage	A binary indicator on marital status, taking the value of 1 if an individual is married; 0 otherwise	58,860	0.881	0.324	0	1
Education	Years of schooling	58,860	7.391	4.612	0	18
Health	A binary indicator on health status, taking the value of 1 if an individual is healthy; 0 otherwise	58,860	0.715	0.452	0	1
HukouStatus	A binary indicator on Hukou status, taking the value of 1 if an individual has urban Hukou; 0 otherwise	58,860	0.294	0.456	0	1
Age	Age of the individual	58,860	45.58	13.51	16	89
SocialTrust	A binary indicator of social trust, taking the value of 1 if an individual responds "Yes" to the survey question "most people are trustworthy"; 0 otherwise	46,271	0.545	0.498	0	1
EntreprSF	A binary indicator on the source of finance of an entrepreneur, taking the value of 1 if an entrepreneur relies on funds from the family; 0 otherwise	29,856	0.059	0.235	0	1
EntreprNSF	A binary indicator on the source of finance of an entrepreneur, taking the value of 1 if an entrepreneur relies on funds from relatives or friends ,partnerships or equity investments by other investors, venture financing, commercial loans, policy support, and others; 0 otherwise	29,856	0.014	0.118	0	1
StatusChange	A binary indicator on the entrepreneur, taking the value of 1 if if an individual was a wage worker in year $t-1$ and becomes self-employed in year t; 0 otherwise 1 if an entrepreneur relies on funds from the family; 0 otherwise	39,904	0.046	0.210	0	1
Family Characteristics from CFPS						
RiskPref	A categorical variable of degree of risk aversion, taking the value of 1 if an family holds financial assets; and 0 otherwise	13,491	4.848	0.764	1	5
log(*Famdebt*)	The logarithm of per capita non-mortgage financial debt	24,308	1.842	3.583	0	13.71
City Characteristics						
log(*PGDP*)	The logarithm of of per capita GDP of a city	2,143	10.620	0.553	8.881	12.28
Openness	The share of foreign capital in a city's GDP	2,143	0.018	0.017	0.000	0.198
CitySize	The logarithm of the end-year total population in a city	2,143	5.914	0.628	3.466	7.298
EnvRegu	Environmental regulation intensity proxied by the inverse of industrial dust emissions divided by GDP	2,143	0.003	0.015	0.000	0.423
Infrastructure	Infrastructure development proxied by urban road area per capita	2,143	12.640	8.170	0.592	108.3
Firm Entry						
Entry	The entry of firms per 10k capita in a city	1,559	23.31	42.65	1.033	796.3
HighTech	The entry of high-tech firms per 10k capita in a city	1,559	0.65	1.378	0.012	21.31
nonHighTech	The entry of non-high-tech firms per 10k capita in a city	1,559	22.66	41.99	1.012	789.9
Patents						
Patent	The number of design, utility, and invention patent grants per 10k capita	1,892	9.600	20.13	0	280.9
InvPatent	The number of invention patent grants per 10k caipta	1,892	1.206	3.447	0	46.27
Judicial Documents						
CaseVol	The logarithm of the number of filed cases on IP infringements in a city	17,760	0.469	1.014	0	5.922
Withdrawal	A binary indicator, taking the value of 1 if the lawsuit on IP infringements is withdrawn; 0 otherwise	62,841	0.530	0.499	0	1
Appeal	A binary indicator, taking the value of 1 if the lawsuit on IP infringements after first-instance judgments is appealed; 0 otherwise	22,716	0.068	0.252	0	1
TrialTime	Time required for a case trial measured by the logarithm of the number of days	15,686	4.720	0.569	0	7.531
JudicialReasoning	The degree of judicial reasoning measured by the logarithm of the word count in the judgment's "The Court believes" section	22,847	6.945	0.692	3.219	9.459
Plaintiff	A binary indicator on plaintiff type, taking the value of 1 if the plaintiff is a corporation or organization; 0 if the plaintiff is an individual	62,940	0.892	0.310	0	1
Defendant	A binary indicator on defendant type, taking the value of 1 if the defendant is a corporation or organization; 0 if the defendant is an individual	62,940	0.756	0.320	0	1
CaseType	A categorical variable on case type, taking the value of 1 if patent dispute; 2 if trademark dispute; 3 otherwise	62,940	2.148	0.710	1	3

Table 3: Effect of IPRDCs on Entrepreneurship – Baseline

Variable	(1) *Entrepr*	(2) *Entrepr*	(3) *Entrepr*
IPR	0.026***	0.026***	0.027***
	(0.006)	(0.006)	(0.006)
FamilySize		0.002	0.002
		(0.001)	(0.001)
log(*Income*)		-0.002	-0.002
		(0.002)	(0.002)
Marriage		0.035***	0.035***
		(0.008)	(0.008)
Education		-0.002**	-0.002**
		(0.001)	(0.001)
Health		0.003	0.003
		(0.003)	(0.003)
HukouStatus		0.004	0.004
		(0.005)	(0.005)
Age		0.001	0.001
		(0.002)	(0.002)
log(*PGDP*)			0.049**
			(0.022)
Openness			-0.055
			(0.102)
CitySize			0.068
			(0.054)
EnvRegu			0.003
			(0.056)
Infrastructure			0.000
			(0.001)
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	58,860	58,860	58,860
Adjusted R^2	0.501	0.501	0.501

Notes: This table reports the effect of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Effect of IPRDCs on Entrepreneurship: Robustness Checks

Variable	(1) *Entrepr*	(2) *Entrepr*	(3) *Entrepr*	(4) *StatusChange*
IPR	0.027***	0.023***	0.021***	0.019**
	(0.007)	(0.007)	(0.007)	(0.008)
Individual Characteristics	Yes	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes
Observations	58,112	50,617	58,860	39,904
Adjusted R^2	0.500	0.508	/	0.016

Notes: This table reports the effect of IPRDCs on entrepreneurship. The dependent variable *Entrepr* is a binary indicator on entrepreneurship; *StatusChange*, which captures the dynamic changes of individual employment status, takes the value of 1 transitions from non-self-employed at time $t-1$ to self-employed at time t, and 0 otherwise. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Estimation under Column (1) excludes cities where their or district-level areas are designated as IPRDCs, whereas estimation under Column (2) excludes provincial capital cities. Estimation under Column (3) employs the Interaction-Weighted estimator in Sun and Abraham (2021). Household data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Effects of IPRDC on Firm Entry by Firm Type and Ownership

	Firm Type		Firm Ownership			
	HighTech	Non-HighTech	State-Owned	Foreign-Invested	Private-Owned	Others
Variable	(1) *HighTech*	(2) *nonHighTech*	(3) *Entry*	(4) *Entry*	(5) *Entry*	(6) *Entry*
IPR	0.654***	15.557**	-0.029**	-0.009	12.632***	3.619
	(0.223)	(7.130)	(0.015)	(0.050)	(3.974)	(3.474)
City Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,559	1,559	1,559	1,559	1,559	1,559
Adjusted R^2	0.764	0.820	0.517	0.969	0.811	0.827

Notes: This table reports the effect of IPRDCs on firm entry by firm type and ownership. *HighTech* and *nonHighTech* denote the entry of high-tech and non-high-tech firms per 10k capita at the city level, respectively. The dependent variable *Entry* is the number of newly registered firms per 10k capita within city c in year t. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. The detailed definition of all variables is provided in Table 2. All estimations include city level controls, along with city and province-year fixed effects. The sample period is 2010-2016. Robust standard errors reported in parentheses are clustered at the city level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Heterogeneous Effects of IPRDCs on Entrepreneurship: Education

	Below Junior High School	Junior and Senior High School	Above High School
Variable	(1) *Entrepr*	(2) *Entrepr*	(3) *Entrepr*
IPR	0.003	0.049***	0.034*
	(0.009)	(0.011)	(0.019)
Individual Characteristics	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	25,262	25,843	4,846
Adjusted R^2	0.497	0.506	0.480

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Heterogeneous Effects of IPRDCs on Entrepreneurship: Age

	$Age > 35$	$Age \leq 35$
Variable	(1) *Entrepr*	(2) *Entrepr*
IPR	0.018***	0.048***
	(0.007)	(0.016)
Individual Characteristics	Yes	Yes
City Characteristics	Yes	Yes
Individual FE	Yes	Yes
City FE	Yes	Yes
Province-Year FE	Yes	Yes
Observations	43,216	13,907
Adjusted R^2	0.535	0.401

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Heterogeneous Effects of IPRDCs on Entrepreneurship: Family Income

	Low Income	Medium Income	High Income
	(1)	(2)	(3)
Variable	*Entrepr*	*Entrepr*	*Entrepr*
IPR	0.007	0.026**	0.037***
	(0.011)	(0.012)	(0.013)
Individual Characteristics	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	14,636	16,743	15,179
Adjusted R^2	0.509	0.476	0.515

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. Households are divided into three income groups according to their per capita family income in 2010, benchmarked against the income levels in their cities. These groups are defined as follows: households earning within the bottom 0-33.3% are categorized as low-income, those between 33.3%-66.6% as middle-income, and the top 66.6%-100% as high-income families. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Heterogeneous Effects of IPRDCs on Entrepreneurship: Social Environment

	Social Network (SN)		Social Status (SS)		
	With SN	Without SN	Low SS	Medium SS	High SS
	(1)	(2)	(3)	(4)	(5)
Variable	*Entrepr*	*Entrepr*	*Entrepr*	*Entrepr*	*Entrepr*
IPR	0.063***	0.021***	0.030**	0.022**	0.028
	(0.024)	(0.007)	(0.013)	(0.009)	(0.018)
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	4,187	44,334	13,705	26,877	7,662
Adjusted R^2	0.466	0.509	0.488	0.515	0.491

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. An entrepreneur with relatives in managerial or leadership positions within organizations or institutions is classified as having a social network. Those without these connections are labeled as lacking a social network. Self-assessed social status is determined using the 2010 CFPS survey question. Respondents selecting "1 or 2" are classified as low social status, "3" as medium social status, and "4 or 5" as high social status. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20) The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors are reported in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Transmission Mechanism: Improved Legal Efficiency on IPR Protection

	(1)	(2)	(3)	(4)
Variable	*CaseVol*	*Withdrawal*	*Appeal*	*TrialTime*
IPR	0.709***	-0.148***	-0.059***	-0.120**
	(0.126)	(0.052)	(0.019)	(0.058)
Case Level Controls	No	Yes	Yes	Yes
Court FE	No	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Province-Date FE	Yes	Yes	Yes	Yes
Observations	17,760	62,841	22,716	15,686
Adjusted R^2	0.657	0.241	0.148	0.459

Notes: This table reports the effects of IPRDCs on measures of legal efficiency from 2010 to 2016. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. The detailed definition of all dependent variables is provided in Table 2. We include case-level controls, along with court, city and province-date (court ruling month) fixed effects. Robust standard errors reported in parentheses are clustered at the city level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 11: Effects of IPRDCs on Innovation Output

Variable	(1) *Patent*	(2) *InvPatent*
IPR	6.179***	1.599***
	(1.436)	(0.226)
City Characteristics	Yes	Yes
City FE	Yes	Yes
Province-Year FE	Yes	Yes
Observations	1,892	1,892
Adjusted R^2	0.925	0.926

Notes: This table reports the effects of IPRDCs on innovation output and entrepreneurship from 2010 to 2018. *Patent* and *InvPatent* denote the number of all patent grants and invention patent grants per 10k capita, respectively, which are aggregated at the city level. The sample period is 2010-2018. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include city-level controls, along with city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the city level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 12: Transmission Mechanism: Family Debt and Funding Source of Entrepreneurship

	Family Debt	Self-Financed Entrepreneurship	Non-Self-Financed Entrepreneurship
Variable	(1) $\log(FamDebt)$	(2) *EntreprSF*	(3) *EntreprNSF*
IPR	0.043	0.042***	-0.019**
	(0.127)	(0.012)	(0.008)
Individual Characteristics	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	24,308	29,856	29,856
Adjusted R^2	0.263	0.460	0.195

Notes: This table reports the effects of IPRDCs on households' financing condition and entrepreneurship. The source of funding is classified based on the responses to the question "What is the main source of capital for your business?" in CFPS for the years 2014, 2016, and 2018. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 13: Effect of IPRDCs on Firm Entry by Industry

Panel A						
	Farming, forestry, animal husbandry and fishery	Mining	Manufacturing	Production and supply of electric power, gas and water	Construction	Wholesale and retail trade
	(1)	(2)	(3)	(4)	(5)	(6)
Variable	*Entry*	*Entry*	*Entry*	*Entry*	*Entry*	*Entry*
IPR	-0.361	0.007	-0.225	0.026	0.848***	7.731
	(0.228)	(0.008)	(0.316)	(0.019)	(0.233)	(4.765)
Observations	1,559	1,559	1,559	1,559	1,559	1,559
Adjusted R^2	0.656	0.411	0.927	0.563	0.866	0.792
Panel B						
	Traffic, storage and mail business	Accommodation and food	Information transfer, computer service and software	Realty business	Leasing and business service	Scientific research, technical service and geologic examination
	(1)	(2)	(3)	(4)	(5)	(6)
Variable	*Entry*	*Entry*	*Entry*	*Entry*	*Entry*	*Entry*
IPR	0.234**	0.225	1.557***	0.143**	3.798***	0.896*
	(0.098)	(0.146)	(0.574)	(0.071)	(1.099)	(0.458)
Observations	1,559	1,559	1,559	1,559	1,559	1,559
Adjusted R^2	0.864	0.581	0.687	0.907	0.648	0.830
Panel C						
	Water conservancy, environment and public institution management	Neighborhood services and other service	Education	Sanitation, social security and social welfare	Cultural, physical and entertainment	
	(1)	(2)	(3)	(4)	(5)	
Variable	*Entry*	*Entry*	*Entry*	*Entry*	*Entry*	
IPR	0.038**	0.569	0.092***	0.047***	0.583**	
	(0.018)	(0.504)	(0.027)	(0.014)	(0.235)	
Observations	1,559	1,559	1,559	1,559	1,559	
Adjusted R^2	0.755	0.533	0.626	0.476	0.623	

Notes: This table reports the effect of IPRDCs on firm entry by industry. The dependent variable *Entry* is the number of newly registered firms per 10k capita within city c in year t. The value of IPR dummy variables depends on whether the city is designated as an IPRDC in year t. The detailed definition of all variables is provided in Table 2. All estimations include city level controls, along with city and province-year fixed effects. The sample period is 2010-2016. Robust standard errors reported in parentheses are clustered at the city level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 14: Additional Channels: Social Trust and Risk Preference

Variable	*SocialTrust*	*RiskPref*
IPR	0.019	0.011
	(0.014)	(0.013)
Individual Characteristics	Yes	Yes
City Characteristics	Yes	Yes
Individual FE	Yes	Yes
City FE	Yes	Yes
Province-Year FE	Yes	Yes
Observations	46,271	13,491
Adjusted R^2	0.266	0.532

Notes: This table reports the heterogeneous effects of IPRDCs on social trust the risk preferences. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. *SocialTrust* and *RiskPref* are categorical variables measuring households' social trust and degree of risk aversion (captured by the holding of financial assets), respectively. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Online Appendix

Intellectual Property Rights Protection and Self-Selection into Entrepreneurship: Evidence from China

Appendix A Technical Details on the Theoretical Model

A.1 Definition of Steady-State Equilibrium

Denote by $X_t = \int_0^{N_t} x_t(i)di$ the aggregate demand of intermediate goods. The decentralized equilibrium is defined as follow.

Definition 1. *The decentralized equilibrium consists of sequences of aggregate variables* $\{b_t, c_t, Y_t, X_t, l_t\}_{t=0}^{\infty}$, *intermediate good producing firm j's decisions* $\{x_t(i), p_t(i)\}_{t=0}^{\infty}$, *agents' choice* $\{I_t(a)\}_{t=0}^{\infty}$, *and aggregate prices* $\{p_t(i), w_t, r_t, v_t\}_{t=0}^{\infty}$, *for* $i \in [0,1]$ *such that at each instant of time, household and firms optimize their decisions and all markets clear. For example, the bond market clears such that* $b_t = 0$. *The final good market clears such that*

$$Y_t = Lc_t + \eta X_t. \tag{A.1}$$

The labor market-clearing-condition is given by

$$L = l_t + [1 - F(a_t^*)]L, \tag{A.2}$$

where $l_t = LF(a_t^*)$ *is the number of workers (the labor supply for final good production) and* $[1 - F(a_t^*)]L$ *is the number of entrepreneurs.*

Moreover, to ensure the existence of a steady state with positive growth, we impose the following assumption.

Assumption 1. $\bar{a} > \rho/\Phi(\mu)$.

Given this assumption, holding constant the patent breadth μ, the economy immediately jumps to a unique steady-state equilibrium where c_t and Y_t grow at the same rate as N_t. The proof is as follows. We can see from (17) that

$$\text{sign}\left(\frac{\dot{a}_t^*}{a_t^*}\right) = \text{sign}\left(\Phi(\mu) \cdot \underbrace{a_t^* F(a_t^*)}_{\Omega(a_t^*)} - \rho - \sigma g(a_t^*)\right). \tag{A.3}$$

First, for $a^* \in [\underline{a}, \bar{a}]$, we have from Assumption 1 that

$$\Phi(\mu) \cdot \underline{a} F(\underline{a}) = 0 < \rho \quad \text{and} \quad \Phi(\mu) \cdot \bar{a} F(\bar{a}) = \Phi(\mu) \cdot \bar{a} > \rho.$$

Moreover,

$$\frac{d[a_t^* F(a_t^*)]}{da_t^*} = F(a_t^*) + a_t^* F'(a_t^*) > 0$$

implies that $\Phi(\mu) \cdot \Omega(a_t^*) - \rho$ is a monotonically increasing function of a_t^*, with a negative lower bound and a positive upper bound. From $g(a^*) \equiv \delta L H(a_t^*)$, we have $g(\underline{a}) > 0$, $g(\overline{a}) = 0$ and $g'(a_t^*) > 0$, implying that $g(a^*)$ is a monotonically decreasing function with a positive upper bound and a negative lower bound. Therefore, there exists a unique steady-state equilibrium where a_t^* is constant at $a^*(\mu)$. Since the steady state is unstable, the economy is always in the steady state equilibrium.

A.2 Proof of Lemma 1

The household's optimization problem can be represented by the following current-value Hamiltonian:

$$CVH = \frac{(c_t)^{1-\sigma} - 1}{1-\sigma} + \mu_{1t}\left[r_t a_t + \int_{\underline{a}}^{\overline{a}} w_t I_t(a) L dF(a) + \int_0^{N_t} \pi_t(i) di - c_t L\right] + \mu_{2t}\delta K_t L \int_{\underline{a}}^{\overline{a}} a[1 - I_t(a)] dF(a), \tag{A.4}$$

where μ_{1t} and μ_{2t} are the co-state variables associated with the budget constraint (9) and innovation technology (12). The first-order conditions are given by

$$\frac{\partial CVH}{\partial c_t} = 0 \Leftrightarrow c_t^{-\sigma} = \mu_{1t} L, \tag{A.5}$$

$$\frac{\partial CVH}{\partial b_t} + \dot{\mu}_{1t} = \rho\mu_{1t} \Leftrightarrow \frac{\dot{\mu}_{1t}}{\mu_{1t}} = -r_t + \rho, \tag{A.6}$$

$$\frac{\partial CVH}{\partial N_t} + \dot{\mu}_{2t} = \rho\mu_{2t} \Leftrightarrow \mu_{1t}\pi_t(i) + \dot{\mu}_{2t} = \rho\mu_{2t}, \tag{A.7}$$

$$\frac{\partial CVH}{\partial I_t(a)} = 0 \Leftrightarrow \mu_{1t} w_t = \mu_{2t}\delta K_t a. \tag{A.8}$$

Taking the log of (A.5) and differentiating the resulting equation with respect to time, together with (A.6), yield the Euler equation in (13). Moreover, define $v_t = \mu_{2t}/\mu_{1t}$, then taking the log of this equation and differentiating with respect to time yield $\dot{v}_t = \dot{\mu}_{2t}\mu_{1t} + \dot{\mu}_{1t}\mu_{2t}$. Substituting this expression into (A.7), together with (A.6), yields

$$\dot{v}_t + \pi_t = r_t v_t, \tag{A.9}$$

where the condition $\pi_t(i) = \pi_t$ has been applied. Integrating (A.9) yields the value of an intermediate good firm in (14). In addition, using $v_t = \mu_{2t}/\mu_{1t}$ to reduce (A.8) yields (15).

A.3 Proof of Lemma 2

Given $x_t(i) = x_t$ in (5), from (3) we have $w_t l_t/\alpha = Y_t$. Substituting this expression, (5) and (7) into the final good market clearing condition (A.1) yields

$$\begin{aligned}
&\frac{w_t l_t}{\alpha} = Lc_t + \eta x_t N_t \\
\Leftrightarrow &N_t(1-\alpha)^{\frac{1-\alpha}{\alpha}}\mu^{\frac{1-\alpha}{\alpha}}\eta^{\frac{\alpha-1}{\alpha}} l_t = \frac{l_t}{F(a_t^*)}c_t + \eta N_t(1-\alpha)^{\frac{1}{1-\alpha}}\mu^{-\frac{1}{\alpha}}\eta^{-\frac{1}{\alpha}} l_t \\
\Leftrightarrow &\frac{c_t}{N_t} = (1-\alpha)^{\frac{1-\alpha}{\alpha}}\eta^{\frac{\alpha-1}{\alpha}}\mu^{-\frac{1}{\alpha}}(\mu-1+\alpha)F(a_t^*)
\end{aligned} \tag{A.10}$$

Define $\hat{c}_t \equiv c_t/N_t$. Taking the log of (A.10) and differentiating the resulting equation with respect to time yield

$$\frac{\dot{\hat{c}}_t}{\hat{c}_t} = \Omega(a_t^*;\mu)\cdot\frac{\dot{a}_t^*}{a_t^*}, \tag{A.11}$$

where

$$\Omega(a_t^*;\mu) = a_t^*\frac{F'(a_t^*)}{F(a_t^*)} > 0.$$

Moreover, taking the log of $\hat{c}_t$ and differentiating it with respect to time, together with the Euler equation, give rise to

$$\frac{\dot{\hat{c}}_t}{\hat{c}_t} = \frac{r_t-\rho}{\sigma} - g(a_t^*;\mu). \tag{A.12}$$

To express r_t as a function of a_t^*, we first use (A.9) to rewrite $r_t = \dot{v}_t/v_t + \pi_t/v_t$. Next, to derive $\dot{v}_t/v_t$, we substitute the condition $K_t = N_t$ and (7) into (15) having

$$v_t = \frac{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}\mu^{\frac{\alpha-1}{\alpha}}\eta^{\frac{\alpha-1}{\alpha}}}{\delta a_t^*}, \tag{A.13}$$

which implies

$$\frac{\dot{v}_t}{v_t} = \frac{\dot{a}_t^*}{a_t^*}. \tag{A.14}$$

Thus, combining (6) and (A.13) with (A.14) yields

$$\begin{aligned}
r_t &= \frac{\dot{a}_t^*}{a_t^*} + \frac{\pi_t}{v_t} = \lambda + \frac{\dot{a}_t^*}{a_t^*} + \frac{\pi_t}{v_t} \\
&= \frac{\dot{a}_t^*}{a_t^*} + \frac{F(a_t^*)(1-\alpha)^{\frac{1}{\alpha}}(\mu-1)\mu^{-\frac{1}{\alpha}}\eta^{\frac{\alpha-1}{\alpha}}}{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}\mu^{\frac{\alpha-1}{\alpha}}\eta^{\frac{\alpha-1}{\alpha}}/(\delta a_t^*)} \\
&= \Phi(\mu)a_t^*F(a_t^*).
\end{aligned} \tag{A.15}$$

Plugging (A.15) and (A.11) into (A.12) eventually gives rise to the equilibrium dynamic equation of a_t^* as in (17).

Appendix B Supplementary Tables

Table B1: Regional Spillover Effect

	Within 50 KM	Within 100 KM	Within 200 KM
	(1)	(2)	(3)
Variable	*Entrepr*	*Entrepr*	*Entrepr*
IPR	0.028***	0.029***	0.032***
	(0.007)	(0.008)	(0.009)
$(1-IPR)S$	0.012	0.005	0.005
	(0.014)	(0.007)	(0.006)
Individual Characteristics	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	58,860	58,860	58,860
Adjusted R^2	0.501	0.501	0.501

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. Following the methodology in Butts (2023), we estimate the following regression:

$$Entrepr_{icp,t} = \alpha_i + \mu_c + \eta_{p,t} + \beta IPR_{c,t} + \xi(1 - IPR_{c,t})S_{c,t} + \gamma X_{c,t} + \phi Z_{i,t} + \varepsilon_{ic,t}.$$

The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of IPR dummy variables depends on whether the city is designated as an IPRDC in year t. $S_{c,t}$ is an indicator variable, which is defined as follows: first, conditional on a distance threshold $d \in \{50, 100, 200\}$, if the distance between city c and its nearest city from the treatment group in year t is less than d kilometers (KM), then $S_{c,t}$ is assigned a value of 1, otherwise it is 0; second, if city c in year t is in the same province as a city that has been designated as an IPRDC, then $S_{c,t}$ is assigned a value of 1, otherwise it is 0. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table B2: Heterogeneous Effects of IPRDCs on Entrepreneurship: Self-Identified Income Group

	Low Income	Medium Income	High Income
	(1)	(2)	(3)
Variable	*Entrepr*	*Entrepr*	*Entrepr*
IPR	0.031***	0.021*	0.068**
	(0.010)	(0.011)	(0.032)
Individual Characteristics	Yes	Yes	Yes
City Characteristics	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	25,262	25,843	4,846
Adjusted R^2	0.497	0.506	0.480

Notes: This table reports the heterogeneous effects of IPRDCs on the probability of entrepreneurship. The data is from 5 waves of CFPS survey in 2010, 2012, 2014, 2016, and 2018. The sample is classfied into three groups based on individuals' responses to the question "Where does your income stand locally?" from the 2010 CFPS survey. Those who respond with a 1 or 2 are categorized as having low income, a response of 3 indicates middle personal income, and responses of 4 or 5 are classified as high income. The dependent variable *Entrepr* is a binary indicator on entrepreneurship. The value of *IPR* dummy variables depends on whether the city is designated as an IPRDC in year t. Control variables for individual and city characteristics are specified in Equation (20). The detailed definition of all variables is provided in Table 2. We include individual, city and province-year fixed effects. Robust standard errors reported in parentheses are clustered at the individual level. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.