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Second-Tier Stock Exchanges and Growth of Entrepreneurship

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Abstract. We examine the role of second-tier stock exchanges in an entrepreneurial context from a global perspective. We construct a country-industry-year panel of global venture capitalist (VC)-invested startups, and find a significant increase in entrepreneurial activity following the launch of such markets. A causal interpretation is supported by additional tests for staggered difference-in-differences regressions and interacted regressions based on industry-specific dependence on second-tier stock exchanges. We propose a VC exit mechanism that receives empirical support: the launch of second-tier stock exchanges positively predicts (i) VC investment in startups, (ii) VCs' valuation of startups, (iii) startups' patenting records, (iv) startups' initial public offering (IPO) likelihood, and (v) startups' IPO valuation. We find that more startups are created in countries with more VC investment after the launch of such markets. We also find that the effect of second-tier stock exchanges on entrepreneurial ventures increases with financial resources, human capital, and intellectual property protection.

History: Accepted by Matt Marx, entrepreneurship and innovation.

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Keywords: entrepreneurship • second-tier stock exchanges • inventors • innovation • intellectual property

1. Introduction

There is a growing consensus that active stock markets play a central role in driving economic growth by spurring innovation and entrepreneurial activity (King and Levine 1993, Brown et al. 2009, Kerr and Nanda 2015, Mace 2023).[1] Over the last several decades, policy makers globally have strived to create second-tier exchanges, such as NASDAQ in the United States and the Alternative Investment Market (AIM) in the United Kingdom, which are less restrictive in listing requirements and target young and entrepreneurial firms (Vismara et al. 2012, Bernstein et al. 2020). Although these markets have existed for several decades, there is limited research regarding their impact on entrepreneurial growth. In this paper, we fill this gap and provide evidence on this increasingly important issue and the underlying mechanism from a global perspective.

We propose that second-tier exchanges facilitate entrepreneurial activity by increasing the likelihood of initial public offerings (IPOs) for startups and thus offering better exit opportunities for venture capitalists (VCs). Such an increased IPO likelihood will encourage VCs (and their investors) to provide more funding for entrepreneurial firms (Gompers et al. 2008, Ozmel et al. 2013), which leads to faster economic growth and technological development.

For the purposes of our research, we expand the data of 91 unique second-tier exchanges in Bernstein et al. (2020) from 45 countries in 1990–2013 to 159 countries in 1990–2020. During our extended period, 101 new second-tier exchanges in 55 countries were created, and 17 unique second-tier exchanges were closed. We then collect all portfolio company founding information from the Pitchbook Global Venture Capital database and use the number of newly founded firms to measure a country-industry's entrepreneurial activity. As a supplementary proxy, we also use the number of new patent-filing firms (Farre-Mensa et al. 2020, Ewens and

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Marx 2024). We do not include the United States in our main sample to prevent reporting bias.

We use the country-level establishment of second-tier exchanges to implement a staggered difference-in-differences (DiD) analysis by creating a group of counterfactuals to determine how entrepreneurial ventures would have developed without such markets. Our DiD analysis shows a significant increase in local entrepreneurial activity after the launch of second-tier exchanges. On average, industries in countries that establish such markets experience a 40% increase in the number of startups, relative to that of other industries in nontreated countries.

Although we acknowledge that it is challenging to claim a causal interpretation of our results, we implement several tests to *mitigate* endogeneity concerns. First, we show that, prior to treatment, treated and control countries exhibit similar levels of entrepreneurial activity and macroeconomic conditions. Second, we implement the synthetic DiD of Arkhangelsky et al. (2021) and the counterfactual estimators of Liu et al. (2024) to show that our DiD estimates are robust to possible pretreatment trends, which further supports the parallel trends assumption. Third, we also consider the stacked DiD method proposed by Cengiz et al. (2019) and the imputation strategy proposed by Borusyak et al. (2024) to correct for heterogeneous treatment effects.

To further strengthen a causal interpretation of our DiD results, we adopt the methodology of Rajan and Zingales (1998) by estimating each industry's dependence on second-tier exchanges ex ante, based on NASDAQ-listed IPOs' industry distribution in the past. Using these estimations, we show that postlaunch entrepreneurial growth is disproportionally higher in industries that are more dependent on second-tier exchanges.

In the second part of this paper, we implement several tests to examine a VC exit mechanism: VCs observe better exit opportunities through increased IPO likelihood and thus increase their investment in startups, leading to higher entrepreneurial activity. Our startup-level analyses suggest that more startups are likely to receive VC funding; conditional on funding, they receive significantly more VC investment and have a higher valuation in such investment after second-tier exchanges are launched. In addition, startups founded after the launch of such markets are more likely to produce patents, to exit via IPO, and to have higher valuations from the public market. At the aggregate level, we find that more startups are created in countries that experience more VC investment after the launch of second-tier exchanges; this observation confirms that increases in entrepreneurial activity are attributable specifically to more VC financing. Our mechanism tests not only confirm the causal interpretation of our DiD analyses, but also provide microevidence for the effect of such markets.

In the third part of this paper, we examine how the role of second-tier exchanges varies by different institutional settings. We consider several macroeconomic factors, and find that the positive effect of such markets is more pronounced in countries with lower unemployment rates, lower short-term interest rates, and higher money supplies.[2] We further consider intellectual property-related factors, and show that such a positive effect increases with patent protection indexes, the fraction of R&D personnel, and the rule of law. These results suggest that financial resources, human capital, and intellectual property protection all help second-tier exchanges promote entrepreneurship.

Finally, we discuss potential alternative explanations for our findings. The first one is the "lemons" problem in second-tier exchanges, which is ruled out by our finding that startups become more valuable (to both VC and IPO investors) and more innovative (in terms of patenting activity) after the launch of such markets. In addition, we do not find significant changes in the protection of minority investors, the control of corruption, government effectiveness, and regulation quality around the introduction of such markets. Second, we implement a placebo test by using U.S. Patent and Trademark Office (USPTO) trademark data to measure entrepreneurial activity (Conti and Guzman 2023). We do not find this trademark-based measure of entrepreneurship to be related to the creation of second-tier exchanges. This finding helps rule out the concern that our results may simply reflect an overall economic boom period rather than a surge of VC-invested startups. Finally, to address the concern that other confounding pro-entrepreneurship policies may drive our results, we additionally control for bundled policies for startups in a given country; when we do so, our main estimates remain unchanged.

Our paper contributes to several strands of the literature. First, it adds to prior studies that examine the effect of second-tier exchanges. Bernstein et al. (2020) show that newly created second-tier exchanges attract a significant share of global IPO market activity, and that these IPOs tend to be more successful in countries with stronger shareholder protection. We complement their findings by examining how entrepreneurial activity can be attributed to the creation of such markets. In particular, we use startup-level data as microevidence for the mechanism that VCs increase startup funding and valuations because of better exit opportunities.

This paper also adds to research that explores the driving forces of regional entrepreneurial activity. Prior studies have examined the roles of VCs, angel investors, crowdfunding, and government funding, as well as incubators and accelerators.[3] We offer abundant evidence that second-tier exchanges positively impact

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local entrepreneurship, which supports related policy initiatives of many governments (especially those in emerging economies). Our results on how other macroeconomic and infrastructure factors complement such markets to help promote entrepreneurship also offer policy implications.

Finally, this paper offers unique and timely evidence to support earlier findings on the interaction between financial markets and entrepreneurial activity (King and Levine 1993, Brown et al. 2009). More broadly, it also extends the literature on how financial development contributes to economic growth (Rajan and Zingales 1998). Different from prior studies that consider aggregate financial development (e.g., Rajan and Zingales 1998), our paper focuses on a specific financing channel: the second-tier exchange. On the other hand, our investigation of VC-backed startups also deviates from prior research on how aggregate innovation is influenced by financial markets (Hall and Lerner 2010, Hsu et al. 2014, Kerr and Nanda 2015).

2. Institutional Background and Hypothesis Development

Research supports that access to public equity markets plays a critical role in innovation and entrepreneurial activity, as such access lets investors diversify their risk and price growth options (Pagano et al. 1998, Brown et al. 2009, Hsu et al. 2014). In addition, the model of Allen and Gale (1999) implies that, because young industries feature heterogeneous technologies, public equity markets comprised of investors with heterogeneous beliefs can fund a greater variety of technologies.

As public equity markets develop, a country's main board usually is more accepting of firms with a sufficient track record of operations, profitability, and a minimum of accounting-based assets. Although such restrictive listing requirements help to protect outside investors, they are unfriendly to high-growth, entrepreneurial companies that are typically unprofitable at the time of IPOs and have assets that are more intangible and hard to assess (see Bernstein et al. 2020 for a detailed discussion). The creation of second-tier exchanges is often characterized by less restrictive listing requirements, and often aims to help young and small companies raise equity funding from the public. As reported in Table IA1 of the internet appendix, we show that firms listed in second-tier exchanges have smaller market capitalization, receive fewer IPO proceeds, and are more likely to be high-tech industry firms compared with those firms listed on main boards.

Given the surge of second-tier exchanges since the 1990s, we are motivated to examine their effects on entrepreneurial activity. Our literature review of the effects of second-tier exchanges suggests the following. First, prior studies that focus on one or few economies unavoidably miss potentially important market-wide institutional factors, such as shareholder protection and human capital. Second, cross-country analyses of the effects of second-tier exchanges, especially from the perspective of startup activity, are underexplored in prior research. Third, it is challenging to design identification tests to draw a causal inference on the effect of such markets. Finally, prior studies mainly focus on stock returns or profitability and rarely touch upon entrepreneurship.[4]

We hypothesize that the creation of second-tier exchanges encourages entrepreneurial activity by offering better exit opportunities for VCs. Vibrant public stock markets provide liquidity for private equity investors, enabling them to channel additional investment to new innovative projects (Gompers et al. 2008, Bernstein 2022, Phillips and Zhdanov 2024). In fact, Babina et al. (2025) document a positive relationship between IPO activity and entrepreneurship in the United States. International evidence in Jeng and Wells (2000) demonstrates the vibrancy of IPO markets as the driver for VC investment.

From the perspective of VC investment, the creation of second-tier exchanges increases the likelihood of IPO exits among VC-backed firms, thus raising potential returns that encourage VCs to invest in startups (Metrick and Yasuda 2021). Consistent with this view, Gompers et al. (2008) and Ozmel et al. (2013) show that a higher chance of successful IPO exit is associated with a stronger incentive for VC investment in startups. In addition, when startups are more capable of raising initial capital from VCs, they may create more radical innovations (Nanda and Rhodes-Kropf 2013), which could help fuel IPO markets and thus encourage more VC investment and entrepreneurial activity.

3. Data

3.1. Second-Tier Exchanges

Our sample starts with a country-year panel from 1990–2020 that includes 171 countries with relevant country characteristics available in the World Bank World Development Index data set. We collect information about second-tier exchanges from Bernstein et al. (2020), who cover newly introduced stock exchanges (both primary and second-tier) around the world between 1990 and 2013. We then manually check each exchange and update the closure time, as well as include newly opened exchanges after 2013. By extending the exchange data of Bernstein et al. (2020), we obtain 101 unique new second-tier exchanges (10 of which are in countries not in their list) in 55 countries through the end of 2020. Table IA2 in the internet appendix lists the details of the newly introduced second-tier exchanges that we add to the list of Bernstein et al. (2020). Table IA3 in the internet appendix lists all second-tier exchanges in our sample.

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A main explanatory variable in our regression analysis is an indicator variable *Second-tier Exchange*, which captures the timing of second-tier exchanges. Specifically, for countries that introduce such exchanges, *Second-tier Exchange* takes the value of one for the period after the entry year (and before the exit year, if any), and zero for the period prior to the introduction (and after the closure, if any). For example, as Korea established its KOSDAQ in 1996, the variable is set to one from 1997 onward. For countries with more than one active second-tier exchange, we use the entry year of the earliest one (e.g., 2004 for China). For countries that experience both a closure and a later reopening (e.g., the United Arab Emirates), the variable is coded as one only during the years when second-tier exchanges are active. For countries that never introduce such boards in our sample period, *Second-tier Exchange* always takes the value of zero.

3.2. Startups

We utilize comprehensive data from Pitchbook's Venture Capital Global and Other Global databases to systematically measure entrepreneurial activity globally.[5] Pitchbook covers VC-backed startups from 160 countries and provides granular information including the founding year and primary industry group classification; we use this information to construct a panel data set of international entrepreneurial activity, VC investment, and IPO information. Specifically, we quantify entrepreneurial intensity at the country-industry-year level by using the number of startups (# *Startups*) created in an industry/country/year. We assign a value of zero if the number of startups is missing for a given observation unit. We also exclude the United States from our sample to avoid the situation in which our baseline results are driven by U.S. startups because of data coverage.

We also consider a supplementary proxy for entrepreneurial activity by using the number of first-time patent applicants that reside in a given country, following Farre-Mensa et al. (2020) and Ewens and Marx (2024).[6] We use patent records from the PatentsView database, which includes all patents filed to and granted by the USPTO.[7] We next calculate the number of first-time patent applicants that apply for patents in each country-industry-year to measure entrepreneurial activity. We then assign a value of zero if there are no first-time patent applicants for a specific country-industry-year observation.

3.3. Country-Level Variables

We gather country-level control variables from the World Bank's World Development Index. The country controls include *GDP*, which is GDP in constant 2015 U.S. dollars (USD) in logarithm; *Population*, which is total population in logarithm; *Openness*, which is the sum of the ratio of imports and exports as a percentage of GDP; and *Inflation*, which is the rate of price change in the economy as a whole. We also consider additional control variables including the logarithmic values of total patents by residents (*Patent*, obtained from World Development Index), the market cap of stock exchanges (*MarketCapListed*, obtained from World Bank), and total IPO proceeds (*IPOProceeds*, obtained from SDC Platinum). These variables are only used in a robustness check because they only pertain to a subset of our country list.

3.4. Summary Statistics

Our final sample consists of 197,106 country-industry-year observations covering 159 countries and 42 primary industry groups during 1990–2020. Panels A and B of Table 1 provide our summary statistics at the country-year level and the country-industry-year level, respectively. An average country has 41.759 startups in a given year. This annual statistic reduces to 0.996 if we narrow down to a typical country-industry observation unit in which the industry is defined by the primary industry group in Pitchbook.

4. Main Results

4.1. Baseline Regression

Our research design features a staggered DiD test design with multiple treatment groups and multiple time periods, as employed by Bertrand and Mullainathan (2003), Imbens and Wooldridge (2009), and Atanassov (2013). We estimate the following regression for a country-industry-year panel:

$$\begin{aligned} Startups_{i,j,t} = {} & \alpha + \beta_1 Second\text{-}tier\ Exchange_{i,t} \\ & + \beta_2 Country\ characteristics_{i,t-1} \\ & + Country \times Industry\ FE_{i,j} \\ & + Industry \times Year\ FE_{j,t} + \varepsilon_{i,j,t}, \end{aligned} \quad (1)$$

in which i indexes the country, j indexes the industry (i.e., the primary industry group), and t indexes the year. The dependent variable, *Startups*, is the number of new startups in industry j in country i in year t plus one in logarithm. As detailed in Section 3.1 (and Table A.1 in the appendix for variable definitions), the variable *Second-tier Exchange* is an indicator variable that takes the value of one after the launch of a second-tier exchange in country i (and when the exchange still exists in year t), and zero otherwise. We control for country characteristics including *GDP*, *Population*, *Openness*, and *Inflation*, all of which may affect local entrepreneurial activity or the creation of second-tier exchanges (see Bernstein et al. 2020). We also include country-industry joint fixed effects (*Country* × *Industry FE*) to control for all country- or industry-specific factors (e.g., natural resources, culture). We further

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Table 1. Summary Statistics

	Mean	STD	1st Pct	Median	99th Pct
Panel A: Country-year summary statistics					
# *Startups*	41.759	172.479	0.000	1.000	774.000
Second-tier Exchange	0.182	0.386	0.000	0.000	1.000
GDP (in billions)	270.975	806.710	0.410	32.783	3,603.876
Population (in millions)	38.778	142.316	0.038	8.418	1,129.623
Openness	0.750	0.569	0.000	0.665	3.214
Inflation	0.315	3.389	−0.085	0.043	3.780
%ChangeInVCInvestment	0.705	2.999	−0.010	0.011	13.775
HighIncreaseInVCInvestment	0.476	0.512	0.000	0.000	1.000
Panel B: Country-industry-year summary statistics					
# *Startups*	0.996	9.963	0.000	0.000	19.000
Startups	0.184	0.583	0.000	0.000	2.996
Startups_asinh	0.232	0.718	0.000	0.000	3.638
Second-tier Exchange	0.182	0.386	0.000	0.000	1.000
Panel C: Firm-year summary statistics					
AnnInvestment (in millions)	0.753	0.840	0.000	0.405	2.773
I(Investment)	0.123	0.328	0.000	0.000	1.000
Valuation (in millions)	1.671	1.346	0.006	1.423	5.892
Valuation/Revenue	2.165	2.185	−2.457	1.913	8.719
I(SecondIPO)	0.007	0.083	0.000	0.000	0.000
I(IPO)	0.036	0.187	0.000	0.000	1.000
Panel D: IPO deal-level summary statistics					
Second-tier Exchange IPO	0.336	0.472	0.000	0.000	1.000
$(Valuation/Revenue)_{IPO}$	2.398	1.847	−1.126	2.065	8.531
$(Valuation/EBITA)_{IPO}$	3.305	1.167	0.876	3.185	6.257
$(Valuation/Cashflow)_{IPO}$	3.245	1.555	0.775	3.044	7.573

Notes. Our sample consists of 4,705 country-year-level observations and 197,106 country-industry-year level observations from 1990 to 2020. Panels A to C of this table present summary statistics of the full sample at respective observation units. Panel D presents summary statistics of the subsample of firms that are created after the launch of local second-tier exchanges. All dollar values are converted to constant 2015 USD. Variable definitions are provided in Table A.1 in the appendix.

include industry-year joint fixed effects (*Industry* × *Year FE*) to control for all time-varying industry factors (e.g., innovation opportunities). Given that our treatment is defined at the country level, we cluster standard errors by country. The coefficient of interest in Equation (1) is β_1, which estimates the *within-country-industry* difference between the periods before and after the introduction of a second-tier exchange relative to a similar before-after difference in a country-industry without such a market.

We tabulate our baseline results in Table 2. We first observe that *Second-tier Exchange* is positively related to the creation of startups. In column (1), which is based on a simplified version of Equation (1), we include *Second-tier Exchange* as the only independent variable (to prevent the "bad control" issue). The coefficient estimate on *Second-tier Exchange* is 0.511 and significant at the 1% level, suggesting that a country-industry's entrepreneurial activity significantly increases after the launch of second-tier exchanges. In column (2), we include country-industry joint fixed effects as well as industry-year joint fixed effects. The DiD estimate of 0.209 is statistically significant at the 1% level. When compared with the control group (industries in countries without second-tier exchanges), the treated group (industries in countries that have such markets) increases its number of new startups by 46.5% per year.[8]

In column (3) of Table 2, we control for the four country-level covariates that may be correlated with the introduction and success of second-tier exchanges. The coefficient on *Second-tier Exchange* is 0.197 and is significant at the 1% level. Because column (3) offers the most stringent control of country characteristics and fixed effects, we use it as our baseline regression hereafter. Collectively, our results in Table 2 consistently show that local entrepreneurial activity increases significantly after such markets are introduced.

4.2. Robustness Checks

In this section, we conduct a comprehensive series of robustness tests related to different definitions of entrepreneurial activity, more control variables, and nonabsorbing treatment states. When we do so, our baseline results remain robust.

4.2.1. Alternative Definition of Entrepreneurial Activity. When we use the number of first-time patent applicants as an alternative proxy of entrepreneurial

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Table 2. Second-Tier Exchanges and Entrepreneurial Activity

Dependent: *Startups*	(1)	(2)	(3)
Second-tier Exchange	0.511***	0.209***	0.197***
	(0.079)	(0.069)	(0.066)
GDP			0.062
			(0.097)
Population			−0.356***
			(0.112)
Openness			0.050
			(0.031)
Inflation			0.002**
			(0.001)
Constant	0.091***	0.146***	0.544*
	(0.013)	(0.013)	(0.313)
Country × Industry FE	N	Y	Y
Industry × Year FE	N	Y	Y
Observations	197,106	197,064	197,064
Adjusted R^2	0.114	0.714	0.719

Notes. This table reports DiD tests that examine the effect of introducing second-tier exchanges on local entrepreneurial activity. Over the sample period of 1990–2020, we have 197,106 country-industry-year level observations. The dependent variable is *Startups*, which is the number of newly established startups in a given country-industry-year unit plus one in logarithm. The key independent variable of interest is the indicator variable *Second-tier Exchange*. For countries that introduce the entrepreneurial board, *Second-tier Exchange* takes the value of one for the period after the introduction (and before the exit year, if any), and zero for the period prior to the introduction (and after the closure, if any). For countries that never introduce second-tier exchanges in our sample period, *Second-tier Exchange* always takes the value of zero. Country controls include *GDP*, which is the natural logarithm of GDP converted to constant 2015 U.S. dollars; *Population*, which is the natural logarithm of total population based on the de facto definition of population; *Openness*, which is the sum of the ratio of imports and exports as a percentage of GDP; and *Inflation*, which is the rate of price change in the economy as a whole. Variable definitions are provided in Table A.1 in the appendix. *Country × Industry FE* denotes country-industry joint fixed effects, and *Industry × Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

activity, we obtain consistent results, which we report in Table IA4 of the internet appendix. Specifically, the definition of startups in panel A refers to patent applicants that are first-time applicants in column (1) and to first-time applicants that have applied for fewer than 3, 5, and 10 patents in year t in columns (2) to (4), respectively. The first-time applicant's industry is defined by the USPTO's three-digit subsection code. As shown in panel A of Table IA4, the coefficients on *Second-tier Exchange* are positive and significant at the 5% level for all alternative proxies of entrepreneurial activity, indicating that our definition of startups is robust to alternative specifications based on first-time patent assignees. For example, the coefficient estimate on *Second-tier Exchange* in column (1) is 0.067 and significant at the 5% level. When compared with the control group (industries in countries with no second-tier exchanges), the treated group's number of new startups increases by 32.6% per year, which is comparable to the economic significance in our baseline regression.

We acknowledge concerns that our patent-based definitions are subject to startups' different incentives for filing U.S. patents, even though such underreporting will bias us from finding any significant results. Nevertheless, we still consider two additional checks. First, when we consider only European countries that have more similar patent incentives, we find consistent yet weaker results, which we report in panel B of Table IA4 in the internet appendix.[9]

Second, we use the ratio of the total number of patents filed domestically as obtained from the World Bank divided by those filed in the United States as obtained from the USPTO, so we may measure the degree of underreporting (i.e., a higher value of the ratio implies a higher likelihood of underreporting). After we sort the ratio into terciles (quintiles) to form a rank variable *UnderReporting1* (*UnderReporting2*), we then reestimate our baseline regression (column (3) of Table 2) by including the interaction terms *Second-tier Exchange* × *UnderReporting1* and *Second-tier Exchange* × *UnderReporting2*. In column (1), the coefficient on *Second-tier Exchange* is 0.101 (significant at the 5% level), and the coefficient on *Second-tier Exchange* × *UnderReporting1* is −0.026 (also significant at the 5% level). These estimates imply that for the least underreported countries (those for which *UnderReporting1* = 0), our treatment effect is 0.101. As the degree of underreporting increases by one unit, the treatment effect becomes 0.026 smaller, suggesting that our estimates, despite their economic and statistical significance, may be a lower bound of the economic effect of second-tier exchanges on entrepreneurship.

4.2.2. Inverse Hyperbolic Sine of the Number of Startups. We acknowledge that the distribution of startups contains many zeros (over 80% of country-industry-year observations) and is highly skewed. To address the issue, we use the inverse hyperbolic sine (asinh) of the number of startups, following Card and DellaVigna (2020). The asinh function closely parallels the natural logarithm function when there are 2+ startups, and is well defined at zero. Under this specification, we can interpret the coefficients of our models as proportional effects relative to observations from the same country-industry-year cohort (i.e., as measuring log point effects). As shown in Table IA5 of the internet appendix, the coefficients on *Second-tier Exchange* remain statistically significant and are close to our baseline results, suggesting that our results are not subject to potential bias from log-linearization.

4.2.3. Alternative Baseline Specifications. As documented in Bernstein et al. (2020), the ratio of market

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capitalization to GDP, IPO volume, and patenting activity are determinants of second-tier exchanges, and we further control for them in Table IA6 in the internet appendix. Because these variables are missing for many of the sample countries, we include a separate missing indicator for each of these controls. As shown in Table IA6, the coefficients on *Second-tier Exchange* are positive and significant at the 1% level for all three specifications, suggesting that the effect of second-tier exchanges is distinct from that of known determinants of second-tier exchanges.

4.2.4. Addressing Nonabsorbing Treatment States. To address the concern that our treatment indicator variable (*Second-tier Exchange*) is nonabsorbing as discussed in Roth et al. (2023), we exclude countries that have experienced both the launch and closure of second-tier exchanges (i.e., United Arab Emirates, France, Switzerland, Belgium, Denmark, Germany, India, Singapore, and New Zealand) and then rerun our baseline regressions. We report our results in Table IA7 in the internet appendix. We find that the coefficients on *Second-tier Exchange* are positive and significant in all three columns and that the magnitudes are comparable to those in Table 2. Thus, our main inference is robust to the potential problem induced by the nonabsorbing state of the treatment variable.

4.3. Additional Checks for Staggered DiD

4.3.1. Pretreatment Trends. The validity of our DiD estimation requires a parallel trends assumption: absent the introduction of second-tier exchanges, entrepreneurial activity would have evolved similarly in both treatment and control countries. We thus decompose *Second-tier Exchange* into the eight binary indicators of $Year^{-3}$, $Year^{-2}$, $Year^{-1}$, $Year^{0}$, $Year^{1}$, $Year^{2}$, $Year^{3}$, and $Year^{4+}$ (e.g., $Year^{-3}$ indicates three years before a second-tier exchange is introduced, whereas $Year^{4+}$ indicates four or more years after the introduction) and then estimate the following regression modified from Equation (1):

$$\begin{aligned} Startups_{i,j,t} = {} & \alpha + \beta_1 Year_{i,t}^{-3} + \beta_2 Year_{i,t}^{-2} + \beta_3 Year_{i,t}^{-1} \\ & + \beta_4 Year_{i,t}^{0} + \beta_5 Year_{i,t}^{1} + \beta_6 Year_{i,t}^{2} \\ & + \beta_7 Year_{i,t}^{3} + \beta_8 Year_{i,t}^{4+} \\ & + \beta_9 Country\ characteristics_{i,t-1} \\ & + Country \times Industry\ FE_{i,j} \\ & + Industry \times Year\ FE_{j,t} + \varepsilon_{i,j,t}, \end{aligned} \tag{2}$$

in which all other indicator variables are defined likewise. The coefficients on $Year^{-3}$, $Year^{-2}$, and $Year^{-1}$ are of particular interest because their significance and magnitude indicate whether any significant difference in entrepreneurial activity exists between treated and control countries prior to the creation of second-tier exchanges.

As displayed in Figure 1(a), the coefficients on $Year^{-3}$, $Year^{-2}$, and $Year^{-1}$ are insignificant and close to zero, suggesting that treated and control countries share a similar trend in entrepreneurial activity prior to the creation of second-tier exchanges. These results support the parallel trends assumption necessary for our DiD test. Furthermore, the lack of significant lead effects implies that the creation of such exchanges is unlikely to be anticipated by prospective entrepreneurs in treated countries.

To further validate our DiD strategy, we use Figure 1(b) to examine whether any pretrend exists between treated and control countries with respect to macroeconomic conditions. To do so, we use the following variables as dependent variables in a country-year panel regression in the format of Equation (2) without controls: *GDP*, *Population*, *Openness* and *Inflation*. The insignificant coefficients on $Year^{-3}$, $Year^{-2}$, and $Year^{-1}$ suggest that treated and control countries' macroeconomic conditions do not differ before the creation of second-tier exchanges. Thus, our baseline result is unlikely driven by confounding factors related to macroeconomic conditions captured by these four variables.

Moreover, we implement a novel counterfactual estimator in the framework of Liu et al. (2024) and present our results in Figure IA1 in the internet appendix. According to Liu et al. (2024), such an estimator gives more robust and reliable dynamic plots by relaxing the constraint of homogenous treatment. Using this approach, Figure IA1(a) shows dynamic treatment effects with 95% confidence intervals based on bootstraps of 100 times when we use the interactive fixed-effect counterfactual estimator (IFE). Figure IA1(b) also reports the test for no pretrend, which is an equivalence test to check whether the pretreatment average treatment effects exceed an equivalence range. Figure IA1(b) shows that 95% confidence intervals of the pretreatment prediction error averages are within the equivalence range, and that the minimum range is narrower than the equivalence range.

4.3.2. Alternative DiD Specifications. Recent studies in the econometric literature highlight potential biases in staggered DiD estimates when multiple treatments occur at different times (Goodman-Bacon 2021). This is in part because earlier treatment groups serve as controls for later treatment groups, and also because a problem arises when heterogenous treatment effects exist. To address the impact of possible heterogenous treatment effects, we employ two alternative methods from the literature: (1) a stacked DiD method proposed by Cengiz et al. (2019), and (2) an imputation strategy proposed by Borusyak et al. (2024). In addition, to address potential bias induced by nonexogeneity when second-tier exchanges are created, we follow Arkhangelsky et al. (2021) and implement a synthetic DiD

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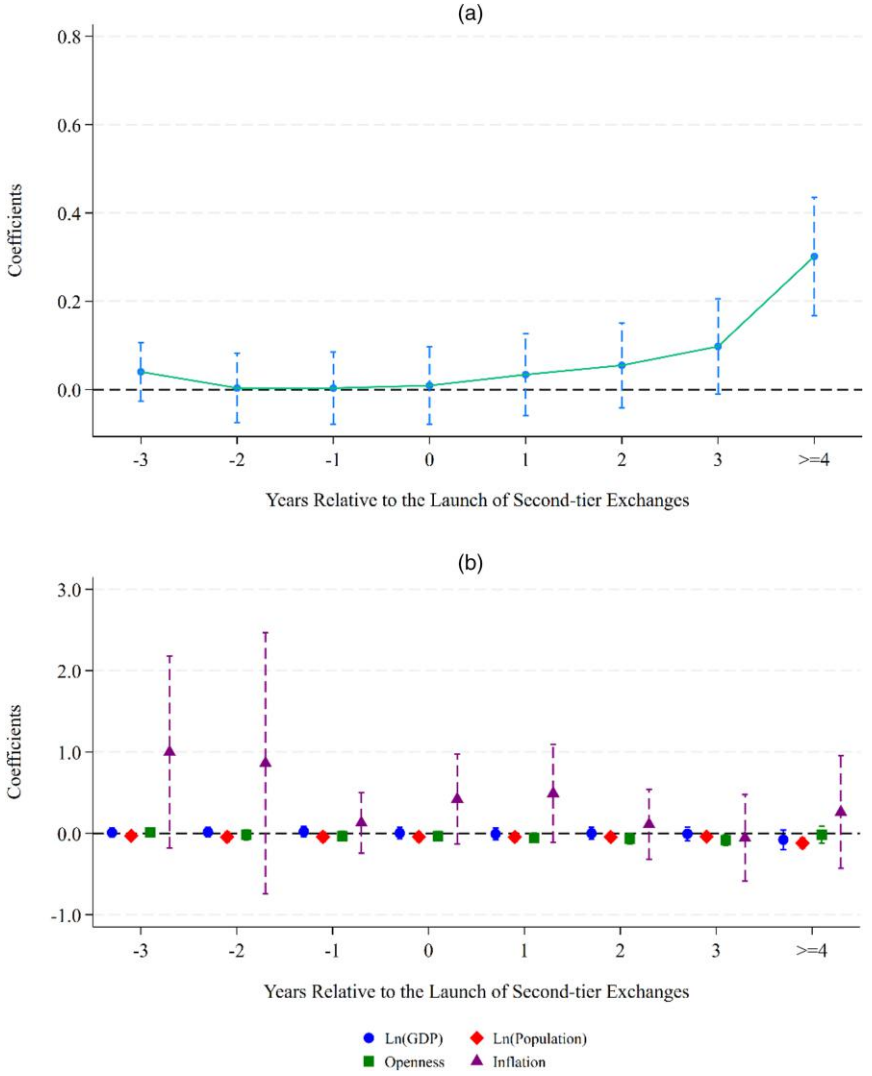
Figure 1. (Color online) Dynamic Treatment Effect on Startups and Country Macros



Notes. (a) Dynamic effects of the establishment of second-tier exchanges using Equation (2): $Startups_{i,j,t} = \alpha + \beta_1\ Year_{i,t}^{-3} + \beta_2 Year_{i,t}^{-2} + \beta_3\ Year_{i,t}^{-1} + \beta_4 Year_{i,t}^{0} + \beta_5 Year_{i,t}^{1} + \beta_6\ Year_{i,t}^{2} + \beta_7 Year_{i,t}^{3} + \beta_8 Year_{i,t}^{4+} + \beta_9 Country\ characteristics_{i,\,t-1} + Country \times Industry\ FE_{i,j} + Industry \times Year\ FE_{j,t} + \varepsilon_{i,j,t}$, in which we design the following year dummies for different years (all relative to the establishment year): $Year^{-3}$, $Year^{-2}$, $Year^{-1}$, $Year^{0}$, $Year^{1}$, $Year^{2}$, $Year^{3}$, and $Year^{4+}$. Variable definitions are provided in Table A.1 in the appendix. We then plot the coefficients and the 90% confidence interval for those year variables. (b) Similar coefficients on year dummies in regressions in which country macroeconomic variables serve as dependent variables.

estimator, which is robust to pretreatment trends between treated and control groups.

For the first estimator developed by Cengiz et al. (2019), we use a stacked DiD to create "clean" event-specific 2 × 2 data sets for treatment groups and then create "clean" control groups inside the treatment window. We next stack all of these data sets together and estimate a two-way fixed-effects DiD specification with data set-specific unit and time fixed effects. For the second estimator proposed in Borusyak et al. (2024), we run a regression of the outcome on individual cohort and time fixed effects in the sample of untreated observations, so we may predict the counterfactual outcome of our treated observations. Based on our predicted results, we can obtain an estimated treatment effect for each treated observation as well as a weighted average of these treatment effect estimates. For the last estimator by Arkhangelsky et al. (2021), we pair all treated country-industry units with control units that have not been treated and then drop countries that introduce second-tier exchanges. We thus compute synthetic weights, thereby reducing bias when exposure is not randomly assigned.[10]

Table IA8 in the internet appendix presents estimates from our three alternative DiD methods. We examine the impact of second-tier exchanges on entrepreneurial activity by using our baseline specification (column (3) of Table 2) in the country-industry-year panel. The

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sample includes countries that are treated (i.e., introducing second-tier exchanges) during the sample period and *clean* controls (i.e., never launched second-tier exchanges during the sample period). Our results in Table IA8 suggest that our main inference is fairly robust under alternative DiD specifications.

4.4. Additional Identification Test

We further implement an additional identification test based on ex ante industry-specific dependence on second-tier exchanges, following the approach of Rajan and Zingales (1998). Specifically, our first instrument separates all industries into groups with high and low dependence on second-tier markets by using each industry's NASDAQ IPO intensity over the period 1980–1989. We first map Pitchbook's primary industry groups to NASDAQ's IPO industries (Standard Industrial Classification (SIC) codes) using Pitchbook's "companysiccoderelation" table. If a primary industry group matches multiple SIC codes, we then calculate the mean cumulative intensity for each SIC code in NASDAQ's IPOs from 1980–1989 (from the SDC New Issues database) and rank all Pitchbook industries accordingly. We next construct an indicator variable $HighSecond\text{-}tierDependent_1$ that equals one if industry j is in the top half of this ranking, and zero otherwise. We implicitly assume that differential degrees of dependence on such markets persist across years and countries, so that we can exploit an industry's dependence on second-tier exchanges identified in the United States. We note that this instrument is valid because the United States is not in our sample, and also because our sample period is 1990–2020.

We also consider two alternative instruments, $HighSecond\text{-}tierDependent_2$ and $HighSecond\text{-}tierDependent_3$, which are constructed similarly except that we replace the sample period for computing industry dependence on second-tier exchanges by a past-three- and five-year rolling window, respectively, to accommodate time-varying dependence. We then interact *Second-tier Exchange* with each of the aforementioned indicator variables and estimate the following regressions in a country-industry-year panel:

$$\begin{aligned} Startups_{i,j,t} = {} & \alpha + \beta_1 Second\text{-}tier\ Exchange_{i,t} \\ & + \beta_2 Second\text{-}tier\ Exchange_{i,t} \\ & \times HighSecond\text{-}tierDependent_j \\ & + \beta_3 Country\ characteristics_{i,t-1} \\ & + Country \times Year\ FE_{i,t} \\ & + Country \times Industry\ FE_{i,j} \\ & + Industry \times Year\ FE_{j,t} + \varepsilon_{i,j,t}, \end{aligned} \tag{3}$$

in which *HighSecond-tierDependent* denotes one of our three measures for industry j's time-invariant (time-varying) dependence on second-tier exchanges from an ex ante perspective. In addition to country-industry and industry-year joint fixed effects, we include country-year joint fixed effects (*Country* × *Year FE*) that absorb any country-level omitted variables. Thus, Equation (3) offers us a causal interpretation. The coefficient of interest in Equation (3) is β_2. If this coefficient is positive and significant, then it implies that a disproportionately higher growth of entrepreneurial activity exists in industries that are more dependent on second-tier exchanges.

We present our results in Table 3. The coefficient estimates of the interaction terms between *Second-tier Exchange* and *HighSecond-tierDependent*, β_2, capture the difference in entrepreneurial activity among industries that are more dependent on second-tier exchanges compared with those that are less dependent. They are positive and significant at the 5% level in all columns. For example, in column (1), the coefficient estimate of β_2 is 0.099 and is significant at the 1% level. This translates to a 20.8% $(= (1 + 0.996) \times (\exp(0.099) - 1))$ higher growth in the number of startups for a high-dependence industry versus that for a low-dependence industry.

Overall, our results in Table 3 imply that the association between second-tier exchanges and entrepreneurial growth is likely causal because preexisting industry-specific dependence is specific to the role of such markets and is unrelated to other factors.

5. Mechanisms and Alternative Explanations

5.1. VC Exit

In this section, we examine the VC exit mechanism that we discussed in Section 2. VCs are encouraged to increase their investment in entrepreneurial firms because newly launched second-tier exchanges offer them better IPO exit opportunities. We implement several mechanism tests at the aggregate and startup levels.

5.1.1. Aggregate VC Investment. If the launch of second-tier exchanges indeed enhances firm entry, we would then expect such an effect to be more pronounced in markets that experience a greater increase in VC funding after the launch of such markets. To explore this prediction, we employ two proxies to quantify the change in VC investment before and after the launch of such markets. Specifically, *%ChangeInVCInvestment* is a continuous variable that measures the percentage change in the amount of VC investment from one year before to one year after the launch of such markets in a given country-year unit. *HighIncreaseInVCInvestment* is an indicator variable that equals one if *%ChangeInVCInvestment* is above the sample median (across all countries) and zero otherwise.

The following regression model expands our baseline regression (column (3) of Table 2) by interacting *Second-tier Exchange* with *%ChangeInVCInvestment* or

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Table 3. Identification Test

Dependent: *Startups*	(1)	(2)	(3)
Second-tier Exchange × *HighSecond-tierDependent*$_1$	0.099***		
	(0.032)		
Second-tier Exchange × *HighSecond-tierDependent*$_2$		0.045**	
		(0.018)	
Second-tier Exchange × *HighSecond-tierDependent*$_3$			0.049***
			(0.018)
Constant	0.176***	0.181***	0.181***
	(0.003)	(0.001)	(0.001)
Country × *Year FE*	Y	Y	Y
Country × *Industry FE*	Y	Y	Y
Industry × *Year FE*	Y	Y	Y
Observations	197,064	197,064	197,064
Adjusted R^2	0.802	0.802	0.802

Notes. This table presents the results of an identification test. The dependent variable is *Startups*, which is the number of newly established startups in a given country-industry-year unit plus one in logarithm. The binary independent variable *Second-tier Exchange* equals one if a country has a second-tier exchange in or before year t, and zero otherwise (including after closure). Columns (1)–(3) test the differential effect of second-tier markets on entrepreneurial activity in industries that are more second-tier exchange dependent vs. industries that are less dependent ex ante. In column (1), the indicator variable *HighSecond-tierDependent*$_1$ equals one if the industry is ranked in the top half of all industries associated with NASDAQ IPO firms over the period 1980–1989, and zero otherwise. In column (2) ((3)), the indicator variable *HighSecond-tierDependent*$_2$ (*HighSecond-tierDependent*$_3$) equals one if the industry is ranked in the top half of all industries associated with NASDAQ IPO firms in the past three-year (five-year) rolling window, and zero otherwise. Variable definitions are provided in Table A.1 in the appendix. *Country* × *Year FE* denotes country-year joint fixed effects, *Country* × *Industry FE* denotes country-industry joint fixed effects, and *Industry* × *Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

HighIncreaseInVCInvestment:

$$\begin{aligned} Startups_{i,j,t} = {} & \alpha + \beta_1 Second\text{-}tier\ Exchange_{i,t} \\ & \times \%\ ChangeInVCInvestment_{i,j,t} \\ & (HighIncreaseInVCInvestment_{i,j,t}) \\ & + \beta_2 Country\ characteristics_{i,t-1} \\ & + Country \times Industry\ FE_{i,j} \\ & + Industry \times Year\ FE_{j,t} + \varepsilon_{i,j,t}. \end{aligned} \tag{4}$$

Table 4 presents our results. The coefficients on both interaction terms are positive and significant at the 5% level, indicating that the effect of second-tier exchanges is more pronounced among countries with larger increases in VC investment.

5.1.2. VC Investment Received by Startups. If second-tier exchanges foster entrepreneurial activity, we would then expect an increase in VC investment as well as higher firm valuation after the launch of such markets. To test these predictions, we exploit the deal-level record from the Pitchbook VC Global database. Specifically, we use the "DealSize" variable (total amount of capital invested in a company by an investor or group of investors for a specific transaction) in the deal table to quantify the total amount of VC investment in a startup at a particular round. If more than one VC investment deal exists in a given year for a particular startup, then we sum them up and call this variable *AnnInvestment*.[11] We also consider an indicator variable, *I(Investment)*, which equals one if the startup receives more than 0.1 million USD in a year and zero otherwise.

Moreover, we exploit two valuation measures: *Valuation* and *Valuation/Revenue*. The former is computed as the "DealSize" divided by the "PercentAcquired" (the percentage of stake acquired in the round of financing) and converted to USD when applicable. The latter variable, *Valuation/Revenue*, is the ratio between valuation and revenue. If more than one VC investment deal exists in a given year for a particular startup, we then take their averages. We next estimate the following regression for a firm-year panel:

$$\begin{aligned} & AnnInvestment_{k,i,j,t}\ or\ I(Investment)_{k,i,j,t} \\ & (Valuation_{k,i,j,t}\ or\ Valuation/Revenue_{k,i,j,t}) \\ & = \alpha + \beta_1 Second\text{-}tier\ Exchange_{i,t} \\ & \quad + \beta_2 Country\ characteristics_{i,t-1} \\ & \quad + Country \times Industry\ FE_{i,j} + Industry \times Year\ FE_{j,t} \\ & \quad + Firm\ FE_k + \varepsilon_{k,i,j,t}, \end{aligned} \tag{5}$$

in which k indexes the firm, i indexes the country, j indexes the industry, and t indexes the year. The dependent variable is one of the aforementioned variables (*AnnInvestment*, *Valuation*, and *Valuation/Revenue* are in logarithmic value plus one). In addition to the fixed effects in our baseline regression, we control for firm fixed effects in Equation (5) to account for any

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Table 4. Mechanism Tests: Heterogenous Increases in VC Investment

Dependent: *Startups*	(1)	(2)
Second-tier Exchange	0.034***	
× *%ChangeInVCInvestment*	(0.005)	
Second-tier Exchange		0.380**
× *HighIncreaseInVCInvestment*		(0.149)
Second-tier Exchange	0.181***	0.109*
	(0.067)	(0.062)
Constant	0.523*	0.580**
	(0.312)	(0.292)
Country controls	Y	Y
Country × Industry FE	Y	Y
Industry × Year FE	Y	Y
Observations	197,064	197,064
Adjusted R^2	0.720	0.723

Notes. This table tests our main inference with heterogenous degrees of increase in VC investment of second-tier exchanges. The binary independent variable *Second-tier Exchange* equals one if a country has a second-tier exchange in or before year t, and zero otherwise (including after closure). The interacting variable in column (1) is *%ChangeInVCInvestment*, a continuous variable that quantifies the percentage change in VC investment in the $(t-1,\ t+1)$ window in country i and year t. The interacting variable in column (2) is *HighIncreaseInVCInvestment*, an indicator variable that equals one if the percentage change in VC investment in the $(t-1, t+1)$ window in country i and year t is greater than the sample median, and zero otherwise. The dependent variable is *Startups*, which is the number of newly established startups in a given country-industry-year unit plus one in logarithm. Country controls include *GDP*, *Population*, *Openness*, and *Inflation*. Variable definitions are provided in Table A.1 in the appendix. *Country × Industry FE* denotes country-industry joint fixed effects, and *Industry × Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

unobserved firm-specific and time-invariant factors that may affect VC investment or valuation.

Table 5 presents our results. In panel A for *AnnInvestment* and *I(Investment)*, we find that the coefficients on *Second-tier Exchange* in both columns are positive and statistically significant—1% for *AnnInvestment* and 5% for *I(Investment)*. Thus, our results support both intensive and extensive margins of the effect of second-tier exchanges, even after we control for firm fixed effects. In other words, after such markets are created, more startups receive VC funding, and each VC investment is larger.

In panel B of Table 5, we use startup valuation measures as our dependent variables (*Valuation* and *Valuation/Revenue*). In columns (1) and (3), we fill the valuation measures with the most recent nonmissing value in a startup if it does not receive VC investment in a given year t (i.e., we assume that the startup's valuation stays the same as the prior year and does not change in year t); meanwhile, we skip missing values in columns (2) and (4). The coefficients on *Second-tier Exchange* in all four columns are positive and significant at the 5% level; thus, a significant increase in startup valuation exists after the launch of second-tier exchanges, even after we control for firm fixed effects.

5.1.3. Startups' IPO Likelihood and Valuation. If the launch of second-tier exchanges indeed encourages VC investment by facilitating VCs' exit through IPOs, we would then expect a higher IPO likelihood and a more favorable IPO valuation at exit. To test these predictions, we first use the Pitchbook Other Global data set to obtain the form of exits for startups. We define the firm-year-level indicator variable *I(IPO)*, which takes the value of one if firm k is publicly listed in year t, and zero otherwise. Further, we *manually* check the name of exchanges where startups are listed to identify if each IPO is a second-tier exchange IPO; if that is the case, we then set the indicator variable *I(SecondIPO)* to one, and zero otherwise. We then estimate a linear probability model at the firm-year level as follows:

$$\begin{aligned} &I(SecondIPO)_{k,i,j,t}(I(IPO)_{k,i,j,t}) \\ &= \alpha + \beta_1 Second\text{-}tier\ Exchange_{i,t} \\ &\quad + \beta_2 Country\ characteristics_{i,t-1} \\ &\quad + Country \times Industry\ FE_{i,j} + Industry \times Year\ FE_{j,t} \\ &\quad + Firm\ FE_k + \varepsilon_{k,i,j,t}, \end{aligned} \tag{6}$$

in which k indexes the firm, i indexes the country, j indexes the industry, and t indexes the year, and for which the dependent variable is either *I(SecondIPO)* or *I(IPO)*. Panel A of Table 6 presents our results. The coefficients on *Second-tier Exchange* are positive and significant at the 5% and 10% levels in columns (1) and (2), respectively, suggesting that both second-tier exchange IPOs and IPOs in general become significantly more likely following the creation of such markets.

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Table 5. Mechanism Tests: Second-Tier Exchanges and VC Investment

Panel A: Second-tier exchange and VC investment

Dependent	(1) *AnnInvestment*	(2) *I(Investment)*
Second-tier Exchange	0.306***	0.008**
	(0.056)	(0.003)
Constant	−5.468	0.252
	(5.145)	(0.335)
Country controls	Y	Y
Country × Industry FE	Y	Y
Industry × Year FE	Y	Y
Firm FE	Y	Y
Observations	106,530	950,201
Adjusted R^2	0.615	0.115

Panel B: Second-tier exchange and startup valuation

Dependent	(1) *Valuation*	(2) *Valuation*	(3) *Valuation/Revenue*	(4) *Valuation/Revenue*
Second-tier Exchange	0.149***	0.380***	0.150**	0.367***
	(0.046)	(0.081)	(0.057)	(0.116)
Constant	0.422	−2.617	6.093	1.222
	(2.907)	(10.645)	(6.970)	(14.262)
Country controls	Y	Y	Y	Y
Country × Industry FE	Y	Y	Y	Y
Industry × Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Observations	175,566	51,371	46,399	13,867
Adjusted R^2	0.906	0.814	0.916	0.765

Notes. This table tests the investment behavior of VCs after the launch of second-tier exchanges. For both panel A and panel B, the binary independent variable *Second-tier Exchange* equals one if a country has a second-tier exchange in or before year t, and zero otherwise (including after closure). In panel A, regressions are at the firm-year level. Column (1) tests the intensive margin, conditional on investment; the dependent variable *AnnInvestment* is the log of one plus annual VC investment (summed across deals per company per year and converted to USD at the deal date). Column (2) tests the extensive margin, for which the dependent variable *I(Investment)* equals one for any VC investment greater than 0.1 million USD in that year, and zero otherwise. Panel B, also at the firm-year level, analyzes valuations. The dependent variables in columns (1) and (2) of panel B are *Valuation*, the natural logarithm of one plus the postmoney valuation, for which the postmoney valuation is computed as the deal investment amount divided by the percentage of stake acquired in the round of financing and averaged across deals within a year, and then converted to million USD at the deal date. The dependent variables in columns (3) and (4) are *Valuation/Revenue*, the natural logarithm of the ratio of postmoney valuation to revenue. For columns (1) and (3), we fill in zeros for firm-year observations without VC investment and keep firm-year observations after the first VC investment. In columns (2) and (4), we only keep firm-year observations with VC investment. Country controls include *GDP*, *Population*, *Openness*, and *Inflation*. Variable definitions are provided in Table A.1 in the appendix. *Country × Industry FE* denotes country-industry joint fixed effects, and *Industry × Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Next, we examine the quality of second-tier exchange IPOs compared with that of main board IPOs, so we may address the concern that second-tier exchanges attract low-quality firms. We focus on the subsample of firms that are founded after the launch of such markets and that succeed in IPO in year t. We estimate the following deal-level regression:

$$\begin{aligned} ValuationRatio_{k,i,j,t} = {} & \alpha + \beta_1 Second\text{-}tier\ Exchange\ IPO_k \\ & + \beta_2 Country\ characteristics_{i,t-1} \\ & + Country \times Industry\ FE_{i,j} \\ & + Founding\ Year\ FE_t \\ & + Country \times IPO\ Year\ FE_{i,t} + \varepsilon_{k,i,j}, \end{aligned} \tag{7}$$

in which k indexes the IPO firm, i indexes the country, j indexes the industry, and t indexes the IPO year. The independent variable *Second-tier Exchange IPO*$_k$ is an indicator that equals one if the IPO occurs on a second-tier exchange, and zero otherwise. We exploit three valuation ratios as dependent variables. Specifically, $(Valuation/Revenue)_{IPO}$, $(Valuation/EBITA)_{IPO}$, and $(Valuation/Cashflow)_{IPO}$ are the ratios of postmoney valuation to revenue; earnings before interest, taxes, depreciation, and amortization; and cash flow, respectively, in logarithm. We control for founding year fixed effects to absorb the general time trend at firm creation, and also control for the *Country × IPO Year* fixed effect to account for any country-specific time trend at the IPO year.

We present our results in panel B of Table 6. The coefficients on *Second-tier Exchange IPO* are positive and significant at the 5% level in columns (1) to (3), implying that the valuation of IPO firms listed on second-tier

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Table 6. Mechanism Tests: Second-Tier Exchanges and VC Exit

Panel A: Second-tier exchange and IPO likelihood

Dependent	(1) *I(SecondIPO)*	(2) *I(IPO)*
Second-tier Exchange	0.006**	0.032*
	(0.003)	(0.019)
Constant	−0.225	0.223
	(0.156)	(0.492)
Country controls	Y	Y
Country × Industry FE	Y	Y
Industry × Year FE	Y	Y
Firm FE	Y	Y
Observations	518,020	518,020
Adjusted R^2	0.712	0.746

Panel B: Second-tier exchange and IPO valuation

Dependent	(1) $(Valuation/Revenue)_{IPO}$	(2) $(Valuation/EBITA)_{IPO}$	(3) $(Valuation/Cashflow)_{IPO}$
Second-tier Exchange IPO	0.172***	0.175**	0.209**
	(0.058)	(0.070)	(0.083)
Constant	0.517	14.789*	21.285*
	(11.251)	(7.200)	(11.414)
Country controls	Y	Y	Y
Country × Industry FE	Y	Y	Y
Country × IPO Year FE	Y	Y	Y
Founding Year FE	Y	Y	Y
Observations	3,344	1,440	2,528
Adjusted R^2	0.432	0.280	0.151

Notes. This table tests exit performance after the launch of second-tier exchanges. Panel A estimates a linear probability model of IPO likelihood. The regression is at the firm-year level. The dependent variable *I(IPO)* is an indicator that equals one if firm *k* is publicly listed in year *t* (i.e., the "DealType" is "IPO" in or before year *t*), and zero otherwise. Exchange names are then manually checked to see if the IPO is a second-tier exchange IPO; if so, we then set the indicator variable *I(SecondIPO)* to one, and zero otherwise. Panel B tests the quality of IPOs in second-tier exchanges. The binary independent variable *Second-tier Exchange* equals one if a country has a second-tier exchange in or before year *t*, and zero otherwise (including after closure). In panel B, the regression is at the IPO deal level. The dependent variables are IPO valuation ratios: IPO valuation to revenue ($(Valuation/Revenue)_{IPO}$); IPO valuation to earnings before interest, tax, and amortization ($(Valuation/EBITA)_{IPO}$); and IPO valuation to cashflow ($(Valuation/Cashflow)_{IPO}$), respectively. These ratios are obtained from the deal table of Pitchbook Other Global. The independent variable *Second-tier Exchange IPO* is a firm-level indicator that equals one if the firm is listed on second-tier exchanges, and zero otherwise. Country controls include *GDP*, *Population*, *Openness*, and *Inflation*. Variable definitions are provided in Table A.1 in the appendix. *Country × Industry FE* denotes country-industry joint fixed effects, and *Industry × Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

exchanges is significantly higher than that of firms listed on main exchanges.[12] This is consistent with the notion that growth firms tend to be riskier and have higher market valuation, given the same revenue, profits, and cash flows. Overall, our results in Tables 4–6 support that the VC exit is an important mechanism through which second-tier exchanges facilitate entrepreneurial activity.

5.2. Alternative Explanations

We further discuss the following alternative explanations related to startups' quality, overall business conditions, and governmental pro-entrepreneurship policies.

5.2.1. Startups' Quality. Given that second-tier exchanges usually have lower listing requirements than main exchanges, concerns may exist about the quality of startups promoted by such new equity markets. In addition to the valuation results that we presented in Sections 5.1.2 and 5.1.3, we further examine startups' innovation performance at both the aggregate and startup levels.[13] Panel A of Table IA9 in the internet appendix shows that there is a significant increase in both the number of patent applications per startup and the total number of patents applied for per country-industry unit after the launch of second-tier exchanges.

To further examine the concern about startup quality, we test whether there is any change in the strength of shareholder protection and other governance scores after the creation of second-tier exchanges. We present our results in panel B of Table IA9 in the internet appendix. The dependent variables in columns (1) to (4) are *PMI*, which is the score for protecting minority

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investors that we obtain from the World Bank Doing Business Project; *Control of Corruption*; *Government Effectiveness*; and *Regulation Quality* (all obtained from World Governance Indicators (WGI)), respectively. These variables are widely used in the literature to capture a country's level of corporate governance (Knack and Keefer 1995, Hall and Jones 1999, Bae et al. 2012). The coefficients on *Second-tier Exchange* in all four specifications of panel B are statistically insignificant and trivial in economic magnitude. Overall, we find that the creation of second-tier exchanges is not associated with a compromised level of governance.

5.2.2. Overall Business Conditions. Second, our baseline results may be simply driven by overall economic booms rather than by a surge of startups (although we have controlled for local GDP). To examine this possibility, we implement a placebo test by using USPTO trademark data to measure local business activity (Conti and Guzman 2023). Whereas a patent protects technological inventions, processes, or scientific creations, a trademark protects brands, logos, and slogans; unlike the former, trademark application reflects innovation activity across a wide range of industries irrespective of a business's technological nature (Mendonça et al. 2004, Chen et al. 2022, Hsu et al. 2022). We define the variable $Startups_{TM}$ as the natural logarithm of one plus the number of firms that are first-time trademark applicants and that apply for fewer than five trademarks in country i in year t. Given that there is no technology subsection information associated with trademarks, we report our results when we estimate Equation (1) using $Startups_{TM}$ in panel C of Table IA9 in the internet appendix at the country-year level. We find that the coefficients on *Second-tier Exchange* are insignificant. Because we do not find a significant coefficient for trademark-based entrepreneurial activity, we can infer that second-tier exchanges promote technology-focused startups rather than general businesses.

5.2.3. Confounding Pro-entrepreneurship Policies. Third, there may be confounding pro-entrepreneurship policies bundled with the creation of second-tier exchanges that drive entrepreneurial activity. Table IA10 in the internet appendix provides a list of typical examples of such policies. To examine this possibility, we control for bundled policies and test if the effect of second-tier exchanges is subsumed away. Specifically, we gather information on a country's pro-entrepreneurship policy during our sample period from the Online Inventory of Best Practices in Entrepreneurship of the United Nations Conference on Trade and Development (UNCTAD)[14] and code the indicator variable *Bundled Policies_D* in column (1) as one for years after the implementation of a pro-entrepreneurship policy in a given country, and zero otherwise. Moreover, *Bundled Policies_C* in column (2) denotes the number of implemented bundled policies to reflect the cumulative effect of multiple policies (if any). Panel D of Table IA9 in the internet appendix shows that the coefficients on *Second-tier Exchange* remain significant, whereas *Bundled Policies_D* and *Bundled Policies_C* are statistically insignificant and significant at the 10% level, respectively. Thus, our results are unlikely to be attributed to confounding pro-entrepreneurship policies.

6. Cross-Sectional Variation

In this section, we test the heterogenous effects of the launch of second-tier exchanges in countries with varying intuitional conditions. We first exploit a series of macroeconomic variables obtained from the Global Macro Database (GMD) (Müller et al. 2025): government expenditure measured in millions of local currency units in percentage of nominal GDP (*govexp_GDP*), government deficit measured in millions of local currency units in percentage of nominal GDP (*govdef_GDP*), unemployment rate (*unemp*), short-term interest rate (*strate*), and money supply (*M1* and *M2*). Next, we interact the main independent variable, *Second-tier Exchange*, with indicator variables (*HighGovExp*, *HighGovDef*, *HighUnemployment*, *HighSTRate*, *HighM1*, and *HighM2*, respectively) that take the value of one if the respective values of the macroeconomic variables are in the top tercile of all sample countries for the first sample year (year 1990), and zero otherwise.

In panel A of Table 7, we present our results. The coefficient on *Second-tier Exchange* × *HighUnemployment* is negative and significant at the 1% level, suggesting that the positive effect of second-tier exchanges on entrepreneurial activity is more pronounced in countries with lower labor market frictions as characterized by lower unemployment rates. The coefficient on *Second-tier Exchange* × *HighSTRate* is also negative and significant at the 1% level whereas that on *Second-tier Exchange* × *HighM2* is positive and significant at the 10% level, implying that the main effect is stronger in countries with lower costs of capital as captured by a lower short-term rate or a more abundant money supply.

Second, we examine the heterogenous effects of the launch of second-tier exchanges in countries with differing degrees of related infrastructure in panel B of Table 7. Specifically, we measure patent protection by using the patent protection index (*PPI*) in Park (2008) for the year 1995, quantify the quality of human capital with the help of the fraction of R&D personnel (*RDPersonnel*) obtained from the World Competitiveness Yearbook for year 1995 (the earliest available year), and then measure the effectiveness of local governments by rule of law (*RuleOfLaw*) obtained from the WGI at year

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Table 7. Cross-Sectional Analyses

Panel A: Macroeconomic factors

Dependent: *Startups*	(1)	(2)	(3)	(4)	(5)	(6)
Second-tier Exchange × *HighGovExp*	0.029					
	(0.118)					
Second-tier Exchange × *HighGovDef*		0.027				
		(0.127)				
Second-tier Exchange × *HighUnemployment*			−0.315***			
			(0.116)			
Second-tier Exchange × *HighSTRate*				−0.419***		
				(0.095)		
Second-tier Exchange × *HighM1*					0.086	
					(0.114)	
Second-tier Exchange × *HighM2*						0.191*
						(0.107)
Second-tier Exchange	0.183*	0.183*	0.311***	0.373***	0.149**	0.089*
	(0.103)	(0.109)	(0.075)	(0.082)	(0.065)	(0.048)
Constant	0.535*	0.543*	0.511	0.460	0.539*	0.531*
	(0.306)	(0.313)	(0.319)	(0.314)	(0.312)	(0.311)
Country controls	Y	Y	Y	Y	Y	Y
Country × *Industry FE*	Y	Y	Y	Y	Y	Y
Industry × *Year FE*	Y	Y	Y	Y	Y	Y
Observations	197,064	197,064	197,064	197,064	197,064	197,064
Adjusted R^2	0.719	0.719	0.722	0.725	0.719	0.720

Panel B: Innovation-specific factors

Dependent: *Startups*	(1)	(2)	(3)
Second-tier Exchange × *HighPPI*	0.258**		
	(0.122)		
Second-tier Exchange × *HighRDPersonnel*		0.277**	
		(0.117)	
Second-tier Exchange × *HighRuleOfLaw*			0.270**
			(0.121)
Second-tier Exchange	0.007	−0.078	0.044
	(0.107)	(0.073)	(0.107)
Constant	1.579***	0.568	0.484
	(0.511)	(0.933)	(0.308)
Country controls	Y	Y	Y
Country × *Industry FE*	Y	Y	Y
Industry × *Year FE*	Y	Y	Y
Observations	137,550	74,970	197,064
Adjusted R^2	0.750	0.799	0.721

Notes. This table tests our main inference with heterogenous country-level characteristics. The binary independent variable *Second-tier Exchange* equals one if a country has a second-tier exchange in or before year *t*, and zero otherwise (including after closure). The binary interacting variables are measured at the first sample year (1990) when applicable. If the value of a variable is not available in year 1990, we use the earliest available value. In panel A, the interacting variable in column (1) is *HighGovExp*, which equals one if the government expenditure measured as a percentage of nominal GDP is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (2) of panel A is *HighGovDef*, which equals one if the government deficit measured as a percentage of nominal GDP is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (3) of panel A is *HighUnemployment*, which equals one if the unemployment rate is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (4) is *HighSTRate*, which equals one if the market rate on short-term government securities or interbank rates is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (5) ((6)) is *HighM1* (*HighM2*), which equals one if *M1* (*M2*) is in the top tercile of sample countries, and zero otherwise. In panel B, the interacting variable in column (1) is *HighPPI*, which equals one if the patent protection index is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (2) is *HighRDPersonnel*, which equals one if the number of researchers in R&D per capita is in the top tercile of sample countries, and zero otherwise. The interacting variable in column (3) is *HighRuleOfLaw*, which equals one if the "rule of law score" is in the top tercile of sample countries, and zero otherwise. "Rule of law" measures public confidence in and adherence to societal rules, including contract enforcement, property rights, police, courts, and crime levels. Percentile rank shows a country's position from 0 (lowest) to 100 (highest). The dependent variable is *Startups*, which is the number of newly established startups in a given country-industry-year unit plus one in logarithm. Country controls include *GDP*, *Population*, *Openness*, and *Inflation*. Variable definitions are provided in Table A.1 in the appendix. *Country* × *Industry FE* denotes country-industry joint fixed effects, and *Industry* × *Year FE* denotes industry-year joint fixed effects. We report robust standard errors clustered at the country level in parentheses.

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1996 (the earliest available year). We introduce interacting terms similar to that in panel A of Table 7. We find that all coefficients on the interaction terms are positive and significant at the 5% level, indicating that the effect of second-tier exchanges is more pronounced among countries with better protection of intellectual property rights, higher-quality human capital, and better governance practices.

These results are consistent with economic intuition and suggest the following points. First, although the creation of second-tier exchanges enhances entrepreneurship, the degree of such an effect also hinges on country-specific infrastructure and institutions. For example, as our empirical evidence suggests, intellectual property protection and quality human capital are two major elements associated with entrepreneurship. Second, the cost of debt plays an important role in startup formation, as entrepreneurs often finance new ventures with personal savings and borrowed funds. Third, our finding that second-tier exchanges are more effective in countries with lower unemployment rates (reflecting lower labor market frictions) suggests complementarity between financing and labor. Finally, governance standards are also important as they determine the enforcement of laws and regulations, which are relevant to both the protection of (intellectual) property and the regulation of managers and government officials.

7. Conclusion

7.1. Summary

In this paper, we find significantly more startups are founded following the launch of second-tier exchanges, which supports a unique and important role of equity markets with respect to entrepreneurial growth. This relation remains robust in several advanced DiD tests. To further strengthen a causal interpretation of this relation, we implement interaction regressions based on industry-specific dependence on second-tier exchanges. We also rule out alternative concerns including lower IPO quality, economic booms, and governmental pro-entrepreneurship policies.

We further provide supporting evidence for a VC exit mechanism. Specifically, we show that, after the launch of second-tier exchanges, (i) startups receives more VC investment, (ii) startups have higher valuation from VCs, (iii) startups file more patents, (iv) startups are more likely to succeed in IPO, and (v) startups are valued higher at IPO. At the aggregate level, we find that more startups are created in countries with more VC investment after the launch of such markets. Finally, our cross-sectional analyses suggest that the effect of second-tier exchanges on entrepreneurial activity is amplified by financial resources, human capital, and intellectual property protection.

Our evidence suggests that the creation of new stock exchanges—those characterized by more lenient listing requirements and that target small and medium-sized innovative firms—can have economic effects by improving domestic entrepreneurial activity and innovation. This finding is timely and relevant given the accelerating competition among technologies in today's intellectual property-based economy.

7.2. Implications

Our paper offers important implications for policy makers, security regulators, and financial market participants from the perspective of innovation and entrepreneurship. First, from the perspective of policy makers, stock exchanges, especially those friendly to entrepreneurs, should be embedded in national or regional innovation systems. By creating a viable and visible exit pathway for VC investments, second-tier exchanges can essentially derisk early-stage investment, thereby encouraging more capital flow to startups. Doing so, in turn, fosters a more dynamic entrepreneurial landscape that leads to the creation of more business ventures. In addition, the availability of second-tier IPOs likely accelerates the life cycles of startups and releases entrepreneurs from financial constraints, all of which are conducive to aggregate technological innovation. Thus, governments should not only focus on early-stage funding (e.g., R&D subsidies, seed funds) but also pay attention to the infrastructure that facilitates expansion and scaling.

Second, from the perspective of securities regulators, we highlight the importance of carefully designing financial markets that make funding more accessible for smaller and younger firms albeit with safeguards that maintain investor confidence. By introducing convenient venues with lower entry requirements (e.g., lower fees, simplified procedures), governments can reduce upfront costs and uncertainty for young, high-potential ventures. Doing so makes public equity markets a more viable exit route for angel investors and VCs, spurring greater funding flows into early-stage ventures. However, to preserve market quality and functioning, regulators must account for postlisting transparency and monitoring mechanisms so that investor protection is not sacrificed in the pursuit of growth and innovation.

We also note that second-tier exchanges enhance VCs' and entrepreneurs' learning and experimentation because stock prices offer important information about investment opportunities and technology prospects (Bond et al. 2012). Because second-tier exchanges facilitate feedback effects derived from market equilibrium security prices, they offer valuable signals and reduce learning costs for VCs and entrepreneurs, both of which likely lead to more entrepreneurial activity (Ferreira et al. 2014, Kerr et al. 2014b, Ewens et al. 2018).

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Moreover, public listing and associated funding facilitate the acquisition of external innovation (Bena and Li 2014, Bernstein 2015, Caskurlu 2020), which fosters commercialization and transactions of innovative ideas and intellectual property that likely encourage high-tech entrepreneurship (Hochberg et al. 2018, Serrano and Ziedonis 2019).

Third, from the perspective of entrepreneurs, the advent of a liquid, growth-focused trading venue fundamentally motivates talent to pursue new ventures. Second-tier exchanges increase entrepreneurs' success rates and expected payoffs from their ventures. As a result, talented scientists and engineers are more likely to become entrepreneurs rather than to work for large, established firms (Gentry and Hubbard 2000, Puri and Robinson 2013, Manso 2016, Metrick and Yasuda 2021, Bias and Ljungqvist 2023). Second-tier exchanges may also shape entrepreneurs' profiles: Hellmann (2007), Azoulay et al. (2020), and Babina and Howell (2024) all find that entrepreneurs possess improved qualifications after the launch of such markets. Moreover, Ouimet and Zarutskie (2014) show that startups tend to attract younger employees, and Akcigit et al. (2017) find that inventors produced their highest-quality inventions early in their careers. Finally, an enhanced entrepreneurial spirit will likely contribute to a positive-feedback loop that inspires more innovation (Akcigit and Kerr 2018).

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Appendix

Table A.1 defines the variables used in this paper.

Table A.1. Variable Definitions

	Units	Description
Firm data		
Startups	Count	The number of newly established startups in a given country-industry-year unit plus one in logarithm. Source: Pitchbook Venture Capital Global (PBVCG)
$Startups_1$	Count	The number of firms that are first-time applicants in year t plus one in logarithm. Source: USPTO
$Startups_2$	Count	The number of firms that are first-time applicants and applied for fewer than three patents in year t plus one in logarithm. Source: USPTO
$Startups_3$	Count	The number of firms that are first-time applicants and applied for fewer than five patents in year t plus one in logarithm. Source: USPTO
$Startups_4$	Count	The number of firms that are first-time applicants and applied for fewer than 10 patents in year t plus one in logarithm. Source: USPTO
Startups_asinh	Count	The inverse hyperbolic sine of the number of newly established startups in a given country-industry-year unit. Source: PBVCG
$Startups_{TM}$	Count	The number of firms that are first-time trademark applicants and applied for fewer than five trademarks in year t plus one in logarithm. Source: USPTO
I(Investment)	Binary	A firm-year level indicator that equals one if firm k receives VC investment in year t. To ensure that we capture a meaningful investment amount, we require that the amount be greater than 0.1 million USD. Source: PBVCG
AnnInvestment	Constant 2015 US$	The natural logarithm of one plus annual VC investment conditional on positive investment, in which annual investment is the total "DealSize" (from the "deal" table) invested in a company by all investors in a year; multiple deals per company per year are summed. Amounts in foreign currency are converted to USD at the deal-date exchange rate from the Federal Reserve Board. Source: PBVCG.
Valuation	Constant 2015 US$	The natural logarithm of one plus the postmoney valuation, in which the postmoney valuation is computed as the total amount of capital invested into a company by an investor or group of investors for a specific deal, divided by the percentage of stake acquired in that financing round, and averaged across deals if there are multiple rounds of investment within a year. For transactions in foreign currency, the amount is converted to USD based on the exchange rate at the deal date; rates are obtained from the Federal Reserve Board. Source: PBVCG

Table A.1. (Continued)

	Units	Description
Valuation/Revenue	Percent	The natural logarithm of the ratio of postmoney valuation to revenue. Source: PBVCG
$(Valuation/Revenue)_{IPO}$	Percent	The natural logarithm of the ratio of IPO valuation to revenue. Source: Pitchbook Other Global (PBOG)
$(Valuation/EBITDA)_{IPO}$	Percent	The natural logarithm of the ratio of IPO valuation to earnings before interest, taxes, depreciation, and amortization. Source: PBOG
$(Valuation/Cashflow)_{IPO}$	Percent	The natural logarithm of the ratio of IPO valuation to cashflow. Source: PBOG
I(IPO)	Binary	A firm-year level indicator that equals one if firm k is publicly listed in year t (i.e., the "DealType" is "IPO" in or before year t), and zero otherwise. Source: PBOG
I(SecondIPO)	Binary	A firm-year level indicator that equals one if firm k is publicly listed on a second-tier exchange in year t, and zero otherwise. Source: PBOG and hand-collection
Second-tier Market IPO	Binary	A deal-level indicator that equals one if a particular IPO is listed on second-tier exchanges, and zero otherwise. Source: PBOG and hand-collection
Exchange data		
Entry Year	Year	The year in which a country introduced a new second-tier exchange. Source: Bernstein et al. (2020) and hand-collection
Exit Year	Year	The year in which a country closed an existing second-tier exchange. Source: Bernstein et al. (2020) and hand-collection
Second-tier Exchange	Binary	For countries that introduce second-tier exchanges, the indicator variable *Second-tier Exchange* takes the value of one for the period after the entry year (and before the exit year, if any), and zero for the period prior to the introduction (and after the closure, if any). For countries that never introduce such boards in our sample period, *Second-tier Exchange* always takes the value of zero. Source: Bernstein et al. (2020) and hand-collection
Country data		
GDP	Constant 2015 US$	The natural logarithm of the country-year-level sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Figures are converted to constant 2015 U.S. dollars. Source: World Bank World Development Index (WDI)
Population	Count	The natural logarithm of total population based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Source: WDI
Openness	Percent	The sum of the ratio of imports and exports as a percentage of GDP. Imports/exports is filled with zero if missing. Source: WDI
Inflation	Percent	Inflation, measured by the annual growth rate of the GDP implicit deflator, shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. Source: WDI
TotalPatent	Count	The total number of patent applications by residents in logarithm. Source: WDI
MarketCap	Percent	The market capitalization of companies listed on the domestic exchange measured as a percentage of GDP in logarithm. Source: World Bank Financial Sector
IPOProceeds	Constant 2015 US$	Total IPO proceeds in logarithm. Source: SDC Platinum
PMI	Score	The score for protecting minority investors (*PMI*) benchmarks economies against regulatory best practices for this indicator set. The score, ranging from 0 (worst) to 100 (best), is calculated using the methodology in the DB06-14 studies. Source: World Bank Doing Business Project
Control of Corruption	Score	*Control of Corruption* (in percentile rank) captures perceptions of the extent to which public power is exercised for private gain. Percentile rank indicates a country's rank among all countries covered by the aggregate indicator, with 0 as the lowest and 100 as the highest. Percentile ranks are adjusted to correct for changes over time in the composition of the countries covered by the WGI. Source: WGI
Government Effectiveness	Score	*Government Effectiveness* (in percentile rank) captures perceptions of the quality of public services, the quality of civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of a government's commitment to such policies. Source: WGI
Regulation Quality	Score	*Regulation Quality* captures perceptions of a government's ability to formulate and implement sound policies and regulations that permit and promote private sector development. Source: WGI
HighRuleOfLaw	Binary	*Rule of Law* captures perceptions of the extent to which agents have confidence in and abide by the rules of society (in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence). Percentile rank indicates a country's rank among all countries covered by the aggregate indicator, with zero corresponding to lowest rank, and 100 corresponding to highest rank. *HighRuleOfLaw* is an indicator that equals one if the "Rule of Law" is in the top tercile of sample countries in year 1996, and zero otherwise. Source: WGI

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Table A.1. (Continued)

	Units	Description
HighPPI	Binary	An indicator variable that equals one if the patent protection index is in the top tercile of sample countries in year 1995, and zero otherwise. Source: Park (2008)
HighRDPersonnel	Binary	An indicator variable that equals one if the number of researchers in R&D per capita is in the top tercile of sample countries in year 1995, and zero otherwise. Source: World Competitiveness Yearbook
HighGovExp	Binary	An indicator variable that equals one if government expense as a percentage of GDP is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD
HighGovDebt	Binary	An indicator variable that equals one if government debt as a percentage of GDP is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD.
HighUnemployment	Binary	An indicator variable that equals one if the unemployment rate is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD
HighSTRate	Binary	An indicator variable that equals one if the short-term interest rate is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD
HighM1	Binary	An indicator variable that equals one if *M1* is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD
HighM2	Binary	An indicator variable that equals one if *M2* is in the top tercile of sample countries in year 1990, and zero otherwise. Source: GMD
HighShareholder Protection	Binary	An indicator variable that equals one if the shareholder protection index is in the top tercile in year 2015, and zero otherwise. *Shareholder Protection* is a score on a scale from 0 to 100, for which zero denotes the worst performance. Since 2006, the index has been available as part of the World Bank's Doing Business database. The coverage of all countries in our sample is incomplete until 2013. There was a change in the index construction methodology in 2014; therefore, we use the 2015 minority shareholder protection index to exploit the cross-sectional variation. Source: World Bank's Doing Business—Protecting Minority Investors database
HighProceeds	Binary	An indicator variable that equals one if total IPO proceeds in country *i* and year *t* is in the top tercile, and zero otherwise. Source: SDC Platinum
HighIPONumber	Binary	An indicator variable that equals one if the number of IPOs in country *i* and year *t* is in the top tercile, and zero otherwise. Source: SDC Platinum
Bundled Policies_C	Count	A count variable that equals the cumulative number of pro-entrepreneurship policies in country *i* as of year *t*. Source: UNCTAD
Bundled Policies_D	Binary	An indicator variable that equals one for country *i* that implements a pro-entrepreneurship policy in year *t* and afterward, and zero otherwise. Source: UNCTAD
UnderReporting1	Rank	An integer rank variable in the range of zero to three indicating the degree of underreporting bias. A higher value implies greater underreporting. Specifically, we compute the ratio of the number of patents filed in the United States to the total number of patents filed locally and sort this ratio into terciles. Note that we assume countries that file for zero patents in the United States exhibit the greatest degree of underreporting and are therefore assigned a rank of three. Source: WDI and USPTO
UnderReporting2	Rank	An integer rank variable in the range of zero to five indicating the degree of underreporting bias. A higher value implies greater underreporting. Specifically, we compute the ratio of the number of patents filed in the United States to the total number of patents filed locally and sort this ratio into quintiles. Note that we assume countries that file for zero patents in the United States exhibit the greatest degree of underreporting and are therefore assigned a rank of five. Source: WDI and USPTO
Industry data		
HighSecond-tier Dependent$_1$	Binary	We use the concordance table "companysiccoderelation" in Pitchbook to link the primary industry group to SIC codes. In companies for which one primary industry group is matched to multiple SIC codes, we compute the mean cumulative intensity of each SIC code in the NASDAQ IPO sample over 1980–1989 obtained from the SDC New Issues database. We then rank all Pitchbook industries based on the mean cumulative intensity. The indicator variable equals one if industry *j* belongs to the top half, and zero otherwise. Source: Pitchbook and SDC Platinum
HighSecond-tier Dependent$_2$	Binary	The construction of *HighSecond-tierDependent*$_2$ is similar to that of *HighSecond-tierDependent*$_1$ except that it takes the value of one if industry *j* belongs to the top half of all industries associated with NASDAQ IPO firms over the past three years, and zero otherwise. Source: Pitchbook and SDC Platinum
HighSecond-tier Dependent$_3$	Binary	The construction of *HighSecond-tierDependent*$_3$ is similar to that of *HighSecond-tierDependent*$_1$ except that it takes the value of one if industry *j* belongs to the top half of all industries associated with NASDAQ IPO firms over the past five years, and zero otherwise. Source: Pitchbook and SDC Platinum

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Endnotes

[1] Klepper (2001), Gompers et al. (2005), and Puri and Robinson (2013) provide reviews of incentives and motivations associated with entrepreneurial activity.

[2] Debt financing is also important for entrepreneurial activity (Beck and Levine 2002, Black and Strahan 2002, Kerr and Nanda 2009, Robb and Robinson 2014). That said, debt and credit financing could be less effective than equity financing in promoting entrepreneurial activity because of concentrated risk, information asymmetry, adverse selection, and unequal bargaining power (Brown et al. 2009, Chava et al. 2013).

[3] The literature has shown that entrepreneurial activity is influenced by VCs (e.g., Chemmanur et al. 2011, Bernstein et al. 2016, Janeway et al. 2021, Lerner 2022), angel investors (Kerr et al. 2014a), government funding (Lerner 2000, Howell 2017, Bai et al. 2021), incubators and accelerators (Cohen et al. 2019, Yu 2020), crowdfunding activity (Yu and Fleming 2022), banking activity (Black and Strahan 2002, Kerr and Nanda 2009, Robb and Robinson 2014), patent infringement threats (Appel et al. 2019), regulatory barriers (Klapper et al. 2006, Benzarti et al. 2020, Gottlieb et al. 2022), risk diversification (Hall and Woodward 2010), and institutional quality (Iwasaki et al. 2022).

[4] For instance, Vismara et al. (2012) find that in the European market, firms listed on second-tier exchanges significantly underperform firms listed on main boards with respect to long-run stock performance. Jenkinson and Ramadorai (2013) find that small firms that switched from the London main board to the AIM experience a negative announcement stock return but exhibit a longer-term upward drift in stock returns and improved operating performance after the switch. Harwood and Konidaris (2015) review the current states of small- and medium-sized enterprise (SME) exchanges in seven emerging economies and provide recommendations on policy design. Finally, Choi and Lee (2021) document a positive impact of Korean second-tier exchanges on the valuation of growth firms.

[5] Pitchbook's data cover nearly 4.5 million companies, 2.5 million investments, over 525,000 investors, 45,000 limited partners, 125,000 funds, and 4 million people. Over the past five years, Pitchbook's Data Operations team has logged over 10 million research hours to collect and verify its data (source: https://www.silicon.co.uk/press-release/pitchbook-extends-market-leadership-in-global-capital-market-data-coverage). To assess its international startup coverage, we consulted three experts in entrepreneurship research. All indicated that Pitchbook is the best available source for non-U.S. startups.

[6] According to Ewens and Marx (2024), about 45% of patents were filed in the first three years of a U.S. firm's life; therefore, it is reasonable to use first-time patent filers to characterize startups. We acknowledge a limitation of this patent-based definition: first-time patent applicants could be either subsidies or new incorporations of existing firms, incumbent firms that switched to R&D-active businesses, or incumbent firms that changed names or underwent a merger or acquisition (M&A).

[7] It is common in the literature to use USPTO patent data to measure country-specific innovations (e.g., Jaffe and Trajtenberg 2002, Griffith et al. 2006, Lerner 2009, Acharya et al. 2013). Additionally, the territorial principle of U.S. patent law requires anyone seeking protection in the United States—the world's largest technology market—to file with the USPTO.

[8] When a secondary market is introduced in a country-industry-year unit, it is associated with a 0.463 (=(1+ 0.996) × (exp(0.209) − 1)) increase in its number of new startups. As the average number of new startups is 0.996 for each country-industry-year (see panel B of Table 1), the *Second-tier Exchange* dummy in turn corresponds to an average increase of 0.465 (=0.463/0.996) in the number of new startups.

[9] We identify the list of member states in the European Patent Organization (EPO) (https://www.epo.org/en/about-us/foundation/member-states, retrieved May 11, 2025).

[10] The STATA commands for the three methods are stackedev, did_imputation, and sdid, respectively.

[11] If such investments are in a foreign currency, we then match the currency with the daily exchange rate in the Federal Reserve Board Reports on the deal date, so we may convert the currency to USD value. We require that this variable be greater than zero for us to test the intensive margin.

[12] We note that 7.49% of all deals in the Pitchbook Other Global database are IPOs. After merging them with the VC investee company sample, we have 5,551 non-U.S. IPOs in the sample period, 47.43% of which have positive and nonmissing $(Valuation/Revenue)_{IPO}$ values, 21.40% of which have positive and nonmissing $(Valuation/EBITA)_{IPO}$ values, and 36.45% of which have positive and nonmissing $(Valuation/Cashflow)_{IPO}$ values.

[13] We match USPTO assignee names to Pitchbook firm name to collect startup-level patent records. The detailed matching procedure is available upon request.

[14] Data are available at https://unctad.org/topic/enterprise-development/entrepreneurship-policy-hub/best-practices-entrepreneurship and were accessed on November 17, 2023.

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