Venture capital, credit, and FinTech start-up formation: A cross-country study

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Abstract

Growing FinTech entrepreneurship is a recent global phenomenon. Drawing on the national innovation systems framework, we examine how countries' venture capital (VC) and credit markets differently affect FinTech entrepreneurship across countries. We argue that with their established and globally diffused norms and practices, VC investors—but not banks—require a critical mass of FinTech entrepreneurship in a country to more positively influence FinTech entrepreneurship. Moreover, we argue that VC and credit markets are substitutes, especially in countries with more FinTech entrepreneurship. Using quantile regressions on data from 53 countries, we find support for our hypotheses.

Entrepreneurial finance markets are important components of countries' national innovation systems (NIS) that aim to spur innovation (Nelson, 1993; Lundvall, 2010) and promote entrepreneurship (Ács et al., 2014). NIS refer to the way countries organize their different infrastructures, institutions and policies to ensure they interact, promote and then diffuse innovations that entrepreneurs subsequently exploit by creating start-ups in existing and new industries (Ács et al., 2014, 2017; Freeman, 1995; Lundvall, 1992, 2010). Providing financial support to entrepreneurs is among the most widely recognized ingredients of successful NIS (Melaas and Zhang, 2016; Nelson, 1993). This support usually takes the form of a greater availability of VC and credit (Ács et al., 2014).

Research shows that the greater availability of financial support increases a country's quantity (level or amount) and quality of entrepreneurship (e.g., Armour and Cumming, 2006; Chowdhury et al., 2019; Deloof et al., 2019; Guiso et al., 2004; Haddad and Hornuf, 2019; Popov and Roosenboom, 2013; Reynolds et al., 2000; Samila and Sorenson, 2011). Research further suggests that VC investors and banks around the world have adopted industry practices (or "proven" recipes) to reduce uncertainty, information asymmetry and transaction costs, to foster

entrepreneurship (Bruton et al., 2005; Winton and Yerramilli, 2008; Zacharakis et al., 2007). However, some other research shows that a greater availability of VC (Florida and Smith, 1990, 1993) and credit (Cole et al., 2016) are not a prerequisite for entrepreneurship quantity and quality. Instead, this research points, amongst other, to a lack of high-quality entrepreneurial initiatives rather than a lack of entrepreneurial finance as a bottleneck. Thus, currently, evidence is mixed regarding the importance of countries' financial support systems for entrepreneurship.

Despite the existence of prior research on the role of financing in promoting entrepreneurship, we have a limited understanding of why a greater availability of VC and credit is more or less effective *in different countries* for increasing entrepreneurship, and particularly for start-up formations in new "entrepreneurial industries" (Shane, 2008); i.e., those industries where entry by start-ups is a recent phenomenon. Our study addresses this important issue, aiming to overcome two shortcomings of the literature.

First, existing multi-country research typically examines how the greater availability of VC and credit in a country influences entrepreneurship quantity and quality *in the average country* (Haddad and Hornuf, 2019; Reynolds et al., 2000). Most of this evidence has "been presented as though [it is] general and valid across countries" (Ács et al., 2017: 999). We need to better understand why the impact of countries' VC and credit markets on entrepreneurship varies so widely across countries. Chowdhury et al. (2019), for instance, find that a country's financial support differently impacts entrepreneurship in the average developed versus the average developing country. This finding may reflect variations in countries' NIS and the dynamic interactions among their components (Lundvall, 1992; Nelson, 1993). Indeed, the NIS framework would suggest that financial and other types of support systems that work in one country might be less effective in another country (Li and Zahra, 2012). Yet, evidence on the cross-country differences in the effectiveness of these financial support systems for stimulating entrepreneurship,

particularly in new entrepreneurial industries, is scarce. However, such industries are characterized by significant market uncertainty as well as uncertainty about the viability and credibility of start-ups themselves. These uncertainties increase information asymmetry, thereby challenging both VCs and banks. VCs and banks each address these uncertainties by using their specific industry practices (Winton and Yerramilli, 2008). We propose that the established, global practices of VCs—but less so those of banks—require a critical mass (threshold) of entrepreneurship in an industry to more effectively channel support to entrepreneurship and hence increase entrepreneurship levels in that industry. Consequently, we move the literature forward by examining how countries' financial support systems differently relate to start-up formation in a new entrepreneurial industry across an entire range of countries with different levels of entrepreneurship in that industry.

Second, prior research has examined the impact of a specific form of financial support system (e.g., the availability of VC only) on new start-up formations (Popov and Roosenboom, 2013). Indeed, this segmentation of the entrepreneurial finance literature has been highlighted as one of its key limitations (Cole et al., 2016; Cumming and Johan, 2017). Further, when prior researchers have examined multiple entrepreneurial financing markets, they (implicitly) assumed these markets operate independently (Chowdhury et al., 2019). Thus, the independent effects of specific entrepreneurial financing markets have been explored without theorizing on or modeling their possible interaction effects. As a result, we do not know if distinct entrepreneurial finance markets complement or substitute each other. This practice contradicts the tenets of NIS which suggests that "any systemic approach to measure country-level entrepreneurship has to allow system components to interact to produce system performance" (Ács et al., 2014: 477). Thus, we also move the literature further by investigating how the interaction between VC and credit markets

differently affects entrepreneurship in different countries, especially in new entrepreneurial industries.

Taken together, we draw on the NIS framework to examine how countries' VC and credit markets differently influence FinTech entrepreneurship across countries with different levels of FinTech entrepreneurship. We focus on FinTech—defined as "a new financial industry that applies technology to improve financial activities" (Schueffel, 2017: 45)—because this setting allows us to examine how a country's financial support influences new firm formations in an industry where start-up entry is a recent phenomenon. Arner et al. (2016), for instance, argue that around 2008 a shift in the FinTech industry occurred, when entrepreneurial start-up entry boomed globally.[1] In such a setting, it may be particularly challenging for new firms to mobilize the resources they need to form and grow (Zimmerman and Zeitz, 2002), which highlights the importance of financial markets (and other support systems) in the NIS framework. However, past research does not clarify the relative importance of VCs and banks across countries in promoting entrepreneurship in new entrepreneurial industries.

In addition, FinTech is an important, growing industry that has the potential to revolutionize financing and how business transactions are conducted. It is a growth industry, with important implications for countries' global competitiveness. Governments across the world are deeply concerned with how they can use their respective NIS to promote such growth-oriented entrepreneurship that are crucial in our modern knowledge-based economies (e.g., Nambisan, 2017; Nambisan et al., 2019). Thus, our research context provides an interesting setting where we

[1] Arner et al. (2016: 23) highlight that pre-2008 for traditional financial services "[t]he expectation was … that … providers would be authorized financial institutions". Post-2008, Arner et al. (2016: 23) argue that "[t]he critical difference … lies in… who is providing financial services, with start-ups and technology firms supplanting banks in providing niche services to the public, business and the banks themselves".

can appreciate when countries' financial support systems are more (or less) effective in promoting entrepreneurship in industries where start-up entry is a relatively recent phenomenon.

Theoretically, the NIS framework suggests that actors in its different parts may develop their own and unique logics, reflecting their evolution and learning from experience (Melaas and Zhang, 2016; Thornton and Ocasio, 2008). These differences may lead to different outcomes that need to be harmonized in order to promote entrepreneurship (Melaas and Zhang, 2016; Patel and Pavitt, 1994). Consistent with this view, we suggest that several globally established norms and practices of VC investors (e.g., Bruton et al., 2005), such as their industry specialization and selection criteria, are likely to constrain the flow of VC to FinTech entrepreneurship in countries with limited FinTech entrepreneurship. If true, this will result in a weaker positive impact of the availability of VC on FinTech entrepreneurship in those countries with limited FinTech entrepreneurship. In contrast, banks are known to have developed their own unique norms and practices, which focus on firms' ability to repay debt and the availability of collateral, that are used for a broad set of firms in multiple industries (e.g., Mason and Stark, 2004). These practices function largely independently of the level of FinTech entrepreneurship in a country. Consequently, we expect that the impact of credit availability on FinTech start-up formations, while positive, remains broadly constant for countries with different levels of FinTech entrepreneurship. Finally, we expect that that VC and credit markets will play a substitutive role especially in countries with more FinTech entrepreneurship. One reason for this expectation is that banks could address a deficiency of VC in a country by also acting as strategic investors in FinTech, which is more likely to occur in countries with more FinTech entrepreneurship.

To understand these relationships and test our hypotheses, we use a longitudinal database that captures new FinTech start-up formations in 53 countries between 2009 and 2017. We employ quantile regressions, which are especially suitable to address our hypotheses on how the effects of

financial support systems on FinTech entrepreneurship could differ across countries with different levels of FinTech entrepreneurship. Standard Least Squares regression focuses on the average country and thus "implicitly assumes that the relationships of interest are uniformly distributed around the mean value of the response variable (and so makes it possible … to estimate a single rate of change that is valid across its distribution)" (Anokhin and Schulze, 2009: 472). Quantile regressions do not make such an assumption, allowing us to investigate how VC and credit markets influence FinTech entrepreneurship across countries with different levels of FinTech entrepreneurship. The results support our hypotheses, showing considerable consistency with the NIS framework. We also show that our results are robust to alternative dependent variables, controls for new entrepreneurial finance markets, and possible endogeneity issues.

The paper is structured as follows. In the next section, we develop our hypotheses by drawing on the NIS framework and the entrepreneurial finance literature. Then, we discuss the method including our data sources, sample, variables, and econometric approach. Subsequently, we present our main findings and robustness checks. Finally, we provide a discussion and detail how our study contributes to entrepreneurship theory and practice.

Theory and Hypotheses

Innovation is widely considered as a key source of competitiveness in global markets (Hughes, 2005). It is a key determinant of entrepreneurship in a society, the source of economic and technological progress and job creation. As a result, countries devote considerable energy and resources to developing their NIS (Freeman, 1995; Nelson, 1993; Lundvall, 1992, 2010). Nelson (1993: 4-5) views "systems" as "... a set of institutional actors that, together, plays the major role in influencing [countries'] innovative performance". Once in place, these systems, infrastructures,

and institutions interact to create, diffuse and transfer knowledge that spurs innovation that, in turn, can lead to the creation of new firms in existing and new fields. However, these systems, infrastructures and institutions evolve at different paces in different countries because of different policies, resource endowments and historical factors, making coordination essential to bring about desired outcomes (e.g., innovation, start-up formation as well as industry creation). A key tenet of the NIS framework is that the interaction among its components (e.g., systems, infrastructures, institutions) determines its outcomes; these interactions are usually shaped by the logics (i.e., modes of operations, practices, beliefs and norms) that actors in the system developed over time based on their experience, policy interventions and learning from others or from experience.

The NIS has proven to be a versatile and rich theoretical framework that has been used to explain how different countries organize themselves to innovate, why they enter particular industries but not others (Nelson, 1993), and how they stimulate entrepreneurship (Ács et al., 2014). The NIS framework emphasizes the presence of different institutions and underscores the importance of their interactions, including the presence of "supporting institutions" such as universities and research centers that provide skilled human capital and knowledge (Patel 1994) and financial markets that ensure the flow of financial resources (Melaas and Zhang, 2016). These ideas align well with emerging frameworks on "national systems of entrepreneurship" (Ács, et al., 2014, 2016) that often prescribe effective national policies that promote the creation and growth of start-ups and developing an entrepreneurial ecosystem. They, too, highlights the importance of supporting entrepreneurial financial systems that ensure the availability of finance.

Another attractive feature of the NIS framework is its ability to provide insights into why and when certain countries become more active in new entrepreneurial industries. To date, however, entrepreneurship research has not provided "adequate treatment [of entrepreneurship] as a country-level phenomenon" (Ács et al., 2014: 477). The NIS framework highlights the

importance of innovation carried out in the country as a major basis for these choices. It also underscores that innovation is not enough to make these decisions; supporting systems should exist to create momentum for entrepreneurs to assume the risks associated with new venture creation and subsequent growth. For instance, the presence of economic institutions can affect entrepreneurs' capital investment decisions by determining their access to capital (see Holmes et al., 2013).

In this paper, we focus on two country-level supporting entrepreneurial finance systems that play a key role in countries' NIS: VC and credit. This focus is consistent with a stream of research that shown how country-level financial support, in the form of VC or credit availability, influences the level and quality of entrepreneurship in the average country or across developing versus developed countries (e.g., Chowdhury et al., 2019; Haddad and Hornuf, 2019; Stenholm et al., 2013). VC and credit availability vary significantly across countries. As highlighted before, the NIS framework suggests that the effectiveness of these financial support systems may be influenced by the logics, norms or practices of actors in the NIS, which may work better in one country than another (Melaas and Zhang, 2016; Thornton and Ocasio, 2008), especially when these actors are confronted with new entrepreneurial industries. A number of industry norms and practices have emerged that shape the functioning of VCs and banks across the world. For example, Bruton et al. (2005) describe how VC investors across the world have adopted many of the practices originally developed in the US VC industry. As Zacharakis et al. (2007: 694) state "the VC profession exerts considerable pressures upon VCs to employ similar models of venture success, regardless of potentially contradicting institutional pressures presented by differences in country-specific institutions… Thus, as new VCs around the world attempt to reduce uncertainty … they choose to copy a 'proven' recipe". Similarly, banks have developed global practices that assess the ability of ventures to repay debt and provide collateral.

Drawing on the NIS framework, we propose that the relationship between country-level financial support systems, in the form of the availability of VC and credit, and FinTech entrepreneurship is not necessarily automatic or constant. More specifically, as presented below, industry practices adopted by financiers of entrepreneurship across the world, and especially those practices adopted by VC investors, may constrain the flow of the available capital in a country towards FinTech entrepreneurship, especially in countries with limited levels of such entrepreneurship. Consequently, the impact of the availability of VC on FinTech entrepreneurship may differ across countries. Moreover, consistent with the idea that components of given NIS are not independent (e.g., Nelson, 1993; Patel, 1994; Holmes et al., 2013), we also examine how VC and credit markets interact—i.e., whether they work as complements or substitutes—to influence entrepreneurship in FinTech, a new entrepreneurial industry.

Below, we draw on the NIS framework and first focus on how a country's VC availability differently affects FinTech entrepreneurship in countries with different FinTech entrepreneurship levels. Then, we focus on credit availability, followed by the interaction between the two variables.

The Impact of VC Availability on FinTech Entrepreneurship across Countries with Different FinTech Entrepreneurship Levels

Consistent with the NIS framework (Ács et al., 2014; Melaas and Zhang, 2016), research indicates that the greater availability of VC is expected to positively affect entrepreneurship (Samila and Sorenson, 2011), through at least two mechanisms. The first relates to the financing role of VC investors. Specifically, they provide "smart" money that is often crucial to form and grow innovative ventures. The second relates to entrepreneurial expectations. Specifically, when entrepreneurs assess their chances of success in establishing new ventures before founding

ventures, (perceived) VC availability is expected to positively affect the decision to enter into entrepreneurship by capital-constrained, would-be entrepreneurs.

Research suggests that the domestic availability of VC, which varies widely across countries, is crucial for entrepreneurship (Popov and Roosenboom, 2013). A common industry practice adopted by VC investors across the world is to invest primarily within their home country; they exhibit "a local bias" (Cumming and Dai, 2010). For instance, despite significant economic and policy integration within Europe, even today, some 60% of VC funds are invested within the home country of European VC investors (Invest Europe, 2019). Thus, it is challenging to raise VC from foreign VC investors and this challenge is even more acute for early-stage ventures (Vanacker et al., 2014a). VC investors often adopt this practice of investing within borders because geographic proximity is deemed essential to select promising ventures and remain actively involved with them post-investment (Gupta and Sapienza, 1992).[2]

In addition to investing domestically, as a norm, VCs favor high growth ventures and industries. In fact, multi-country evidence from the Global Entrepreneurship Monitor shows that VC availability "is strongly related to entrepreneurial opportunity, entrepreneurial capacity and motivation. It also strongly correlates with high-growth startups, or the proportion of start-ups expecting to create at least 15 jobs within the first five years" (Reynolds et al., 2000: 28; see also Chowdhury et al., 2019; Haddad and Hornuf, 2019; Popov and Roosenboom, 2013 for additional evidence). These observations indicate that an increase in VC availability should positively influence entrepreneurship *for the average country*. As Ács et al. (2014, 2016, 2017) point out, the evidence for the average country has often been assumed to be general and valid across countries.

[2] Domestic VC investors may form syndicates with foreign VC investors to support entrepreneurship. However, international syndicates are typically established after an initial round (or multiple rounds) of financing by domestic VC investors alone. Hence, domestic VC investors play a crucial role in the support of early stage firms in a country (e.g., Vanacker et al., 2014a).

Thus, as countries increase VC availability, this is expected to have a similar positive effect across countries. This evidence has often suggested a simple approach to policymakers: when they increase VC availability in their country this will also increase entrepreneurship levels in the country.

Drawing on the NIS framework, we argue that the impact of a country's VC availability on FinTech entrepreneurship will be different *across countries*. Specifically, we propose that a country's VC availability will more positively influence FinTech entrepreneurship in countries with higher levels of FinTech entrepreneurship. The NIS framework further suggests that the established logics, norms or practices of actors in the NIS may work better in one country than another, and as such influence the effectiveness of support systems (Melaas and Zhang, 2016). As we detail below, we expect that the common industry practices adopted by VC investors across the world might constrain the flow of a country's available VC to FinTech entrepreneurship when that country has lower levels of FinTech entrepreneurship. Hence, the availability of VC will have a stronger (weaker) positive effect on FinTech entrepreneurship, when that country has higher (lower) levels of FinTech entrepreneurship. We expect this relationship for several reasons.

First, contracts between the VC investors and their fund providers (e.g., institutional investors) play a crucial role in reducing uncertainty, asymmetric information and related transaction problems between both parties (Smith, 2010). However, VC investors are also bounded by these contracts, including an agreed-upon investment policy. It is common practice that contracts identify the focal area of investments on which VC funds will focus.[3] Without a FinTech industry of sufficient scale, it is unlikely that FinTech investments will be a major component in those pre-determined investment policies or that dedicated FinTech VC funds will be established.

[3] See, for example, the Institutional Limited Partners Association's (ILPA) Limited Partnership Agreement template: https://ilpa.org/wp-content/uploads/2019/10/ILPA-Model-Limited-Partnership-Agreement-October-2019.pdf

Indeed, for VC investors and their fund providers, it is only economically feasible to set up dedicated FinTech VC funds when the FinTech industry is of sufficient scale in a country, which guarantees sufficient high-quality deal flow. Consequently, in countries without a FinTech industry of sufficient scale, contracts between VC investors and their fund providers are unlikely to include FinTech as an investment priority. This situation will constrain the flow of existing VC in a country to FinTech entrepreneurship.

Relatedly, even when contracts are incomplete and leave some discretion to VC investors, they themselves often adopt the practice of specializing in specific industries aiming to reduce informational asymmetry and transaction costs when investing in entrepreneurial ventures (Cumming and Dai, 2011; Norton and Tenenbaum, 1993). VC investors that specialize in early-stage investments prefer less industry diversity and narrower geographic scope compared to other VC investors (Gupta and Sapienza, 1992). Thus, without a FinTech industry of sufficient scale in a country, the FinTech industry will unlikely be a focal investment area for VC investors even when those investors, for example, have a general investment focus on high tech sectors. FinTech business plans are less likely to attract interest during initial selection and are likely to be rejected by VC investors because they have a different investment focus (Fried and Hisrich, 1994). Consequently, in countries without a FinTech industry of sufficient scale, available VC is more likely to flow to other "traditional" industries (e.g., biotech and communication technology) targeted by VC investors and for which they have established dedicated teams in the past.

Second, VC investors across the world have a tendency to employ similar decision criteria in their selection and due diligence activities (Knight, 1994) although they might prioritize differently across these criteria (Zacharakis et al., 2007). These accepted industry norms and practices, which include a focus on human capital factors and market factors, may explain why VC investors are likely to avoid investing in FinTech in countries with limited FinTech

entrepreneurship. With respect to human capital factors, for example, VC investors typically focus on issues such as prior entrepreneurial experience (Kaplan et al., 2009; MacMillan et al., 1985). However, most new FinTech entrepreneurs lack prior entrepreneurial experience; rather, their background is often in banking (Brandl and Hornuf, 2017). It may take a generation of FinTech entrepreneurs and time before entrepreneurs with industry-specific experience emerge. In countries with more FinTech entrepreneurship, such experience generation will emerge more quickly, potentially strengthening the relationship between the available VC in a country and FinTech entrepreneurship.

With respect to market factors, VC investors typically focus on criteria such as the presence of entry barriers and competitor strength. However, before 2008, it was generally thought to be extremely difficult for entrepreneurial start-ups to enter an industry fraught with regulatory challenges that was dominated by large-scale financial institutions with strong reputations (Arner et al., 2016). Such an early perspective is expected to have constrained the flow of available VC to FinTech entrepreneurship. However, as more examples emerge of how specific organizational forms (e.g., FinTech start-ups) are successful in a country, their legitimacy within that country will increase (e.g., Guler et al., 2002). Consequently, in countries with more FinTech entrepreneurship, VC investors may evaluate the market prospects of FinTech start-ups more favorably, which is expected to increase the flow of available capital to FinTech entrepreneurship in those countries.

Third, without a FinTech industry of sufficient size in their country, VC investors are likely to lack the necessary networks which, in turn, may hamper their selection and value adding activities related to these ventures. VC investors across the world rely on their network of pre-existing ties with entrepreneurs, consultants, other investors to reduce informational asymmetry problems (Florida and Kenney, 1988; Shane and Cable, 2002). In countries with limited FinTech entrepreneurship, VC investors' FinTech-relevant networks are expected to be limited. This may

hamper VCs' ability to source relevant knowledge, information, and people. In turn, this situation is apt to limit VCs' ability to select promising FinTech start-ups and to contribute value-adding services post-investment (e.g., Shane and Cable, 2002). Therefore, VC investors may be reluctant to invest in FinTech start-ups in countries with limited FinTech entrepreneurship. This reluctance is likely to limit the flow of VC funds to start-ups in countries with limited FinTech entrepreneurship.

Overall, VC is a crucial form of finance for FinTech entrepreneurs. But in countries with limited FinTech entrepreneurship, VC investors are less likely to focus on FinTech investments. The traditional selection criteria used by VC investors may also constrain the flow of their funds to FinTech entrepreneurship, especially in countries with limited FinTech entrepreneurship. Moreover, in these countries, VC investors are less likely to have developed FinTech-relevant networks that facilitate their selection activities and value-adding activities. These arguments suggest that the generally accepted industry norms and practices adopted by VC investors worldwide may limit the flow of available venture capital funds to FinTech entrepreneurship, especially in countries with low levels of FinTech entrepreneurship.

Thus, drawing on the NIS framework, we expect that a similar increase in VC availability in two countries may have a different effect on FinTech entrepreneurship in these countries, when they have different FinTech entrepreneurship levels. Specifically, VCs are more likely to integrate FinTech in their existing practices or routines in countries with more FinTech entrepreneurship, thereby becoming more likely to support this new entrepreneurial industry. Such increased resource availability in these countries, enhances entrepreneurs' assessments of the feasibility and desirability of creating FinTech start-ups (e.g., Ács et al., 2014), thereby increasing FinTech start-up formation. These observations suggest the following hypothesis:

Hypothesis 1: *A country's VC availability will have a more (less) positive effect on FinTech entrepreneurship in countries with a higher (lower) level of FinTech entrepreneurship.*

The Impact of Credit Availability on FinTech Entrepreneurship across Countries with Different FinTech Entrepreneurship Levels

A growing body of research underscores the importance of bank debt (and debt finance more broadly) for entrepreneurial ventures, including start-ups. Evidence from the U.S. (Robb and Robinson, 2014), U.K. (Cosh et al., 2009), Belgium (Deloof and Vanacker, 2018; Hanssens et al., 2016), Italy (Deloof et al., 2019) and Australia (Cassar, 2004), among other countries, shows that debt is a major source of financing for start-ups, including technology-based start-ups. Consistent with the NIS framework (Melaas and Zhang, 2016), a well-developed domestic credit market, where credit is more easily available, may be crucial for entrepreneurship as well (see also Chowdhury et al., 2019).

Also, in the case of credit markets, national borders are important. Particularly small and young firms are highly dependent on their domestic banking market for access to credit (Zhao and Jones-Evans, 2017). To reduce concerns arising from informational asymmetry between banks and new firms, banks generally grant credit only to domestic new firms. While foreign banks are unlikely to focus on new firms in other countries (e.g., Deloof et al., 2019), entrepreneurs themselves also generally resort to local and domestic banks. Consistent with these ideas, Chowdhury et al. (2019) using a sample of 70 countries show that the availability of domestic credit is positively related to the quality of entrepreneurship.

We propose that the positive effect of countries' availability of credit on FinTech entrepreneurship will be largely independent of the size of countries' level of FinTech

entrepreneurship. Banks across the world have developed industry practices as to whether to provide a loan or not. Specifically, banks' decision to provide funding to any firm is informed by hard information (e.g., financial statements and the availability of collateral). For any firm, banks focus on the availability (prospects) of positive cash flows and the availability of collateral and give little emphasis to market, entrepreneur and other issues (Mason and Stark, 2004). Hence, for FinTech start-ups, banks' credit provision decisions will not be fundamentally connected to the level of FinTech entrepreneurship in a country. In many cases, banks may also require personal guarantees or provide personal loans to entrepreneurs, who can then use this money to form and grow their ventures. Again, the availability of personal guarantees will not be connected to the level of FinTech entrepreneurship in a country.

Banks across the world also commonly rely on soft information collected through personal relationships (Deloof et al., 2019; Howorth and Moro, 2006). Banks have at least two advantages when collecting and evaluating soft information related to FinTech start-ups that are broadly independent of the level of FinTech entrepreneurship in a country. First, most people that set up FinTech start-ups have prior track records within financial institutions (e.g., Brandl and Hornuf, 2017), which is likely to reduce informational asymmetries. Second, banks are likely to have in-house specialized experience to evaluate FinTech business plans. Both elements can foster the provision of business and/or personal loans to FinTech start-ups, independent of the level of the FinTech entrepreneurship in a country.

Overall, consistent with prior research, we contend that the development of a country's credit market will be positively related with FinTech entrepreneurship given that bank debt is an important source of finance for entrepreneurship (Chowdhury et al., 2019). However, we extend prior research by arguing that the positive relationship between the development of a country's credit market and FinTech entrepreneurship will be largely independent of the level of FinTech

entrepreneurship in a country. We expect this relationship because banks' evaluation process is broadly independent of the size of the country's FinTech industry. These observations suggest the following hypothesis:

> ***Hypothesis 2:*** *A country's private sector credit availability will have a broadly constant positive effect on FinTech entrepreneurship, independent of the level of FinTech entrepreneurship in countries.*

The Interaction between VC and Credit Markets and FinTech Entrepreneurship across Countries with Different FinTech Entrepreneurship Levels

The NIS framework also highlights the importance of the interactions among its components for promoting innovation and entrepreneurial activities (Lundvall, 2020; Nelson, 1993). As Ács and colleagues (2014: 482) state "[a] fundamental defining characteristic of systems is that they consist of components that *interact* to produce system performance". NIS recognize the possibility that different actors (e.g., VCs and banks) operating at different parts of the system may develop unique ways of doing things, espouse different policies, or apply different criteria when making decisions. These differences could produce conflicts on occasion; they may also induce substitution (Ács et al., 2014).

Researchers have mainly studied the independent impact of countries' financial institutional support, in the form of VC or credit, for entrepreneurship (e.g., Chowdhury et al., 2019; Haddad and Hornuf, 2019). Further, common wisdom indeed suggests that the different practices of VC investors, who provide equity or equity-linked securities, and banks, who provide debt financing, cater for different types of entrepreneurial ventures (e.g., De Bettignies and Brander, 2007; Ueda, 2004; Winton and Yerramilli, 2008) and thus operate rather independently.

However, more recent research evidence indicates that both types of investors at least partially overlap in the types of ventures they fund. For instance, in VC-backed firms, debt financing also plays a crucial role (Robb and Robinson, 2014; Vanacker et al., 2012). Thus, VC investors and banks might at least partially compensate for the limited availability of funding from the other source and as such play a substitutive role. Cosh et al. (2009) also find that entrepreneurs generally obtain their desired amount of funding but not necessarily in the form or source they would like. Again, these observation point to the possibility of a substitutive effect between VC and banks as funding sources within a country's NIS.

A banking market that guarantees the provision of credit to start-ups could also have a non-trivial indirect effect on FinTech entrepreneurship. Indeed, banks might not only provide debt, but they could also function as strategic investors in FinTech start-ups. Hornuf et al. (2018: 5) highlight that banks may "opt for different forms of alliances such as product-related collaborations and financial engagements. The latter may come in the form of a majority or minority equity stake". As strategic investors in FinTech start-ups, banks may provide an alternative for traditional VC. Actually, banks might be very suitable and effective as strategic investors for specific fast-growing forms of FinTech, such as InsurTech and PropTech.

Insurance is a heavily regulated industry and very complex, even compared to the already complex banking industry. Hence, the new players of InsurTech will likely face huge regulatory barriers, limited information and limited client base. Banks, however, also often trade insurance products, which gives them a lead to support this form of FinTech entrepreneurship or enter themselves into this traditional yet increasingly digitized industry. As another example, PropTech is related to the real estate market and mortgages, which is still dominated by traditional banking institutions. Overall, not only VC investors but also banks can address the financing and broader resource needs of FinTech start-ups (i.e., they are substitutes). Thus, we would expect a country's

VC market to exhibit a less positive impact on FinTech entrepreneurship when this country's credit markets are more developed.

Recognizing that organizational practices diffuse more easily within the NIS when they have gained legitimacy (e.g., Guler et al., 2002), the role of banks as strategic investors[4] is expected to be more pronounced as FinTech entrepreneurship gains greater legitimacy in a country. Historically, there has been a "restraint of banks to fully endorse the new possibilities of digitalized financial services" (Brandl and Hornuf, 2017: 1). Higher FinTech entrepreneurship levels in a country, however, might serve as a key source of legitimacy for FinTech entrepreneurship. Furthermore, higher FinTech levels in a country may also create not only a business opportunity but also a sense of urgency for banks to take strategic initiatives to not overlook the growing FinTech industry.

When banks were still reluctant to strategically enter the FinTech entrepreneurship domain, VC could serve as an alternative funder of start-ups. As FinTech entrepreneurship grew in a country, which turned out to become a serious competitor of the banking institutions, banks had to defend their positions, for example, by increasing M&A activity with FinTech start-ups.[5] Banks could defend their position in countries with high levels of FinTech entrepreneurship by acting as strategic investors, acquiring their competitors, or entering the FinTech arena with their own players. These activities make VC less essential because start-ups can increasingly draw on the resources of banks which can serve as their strategic partners. Again, banks are especially likely to enter into these strategic activities when the FinTech industry in their country is reaching a critical scale and increasingly could function as a credible competitor in their markets. Thus, in countries

[4] Note that the role of a bank as a strategic investor is very different from its role of a traditional credit provider.
[5] https://www.cbinsights.com/research/top-us-banks-fintech-acquisitions/

with higher levels of FinTech entrepreneurship, banks could increasingly act as a substitute for VC. These observations suggest the following hypothesis:

> ***Hypothesis 3:*** *A country's VC market will less positively impact FinTech entrepreneurship when its credit market is also more developed (i.e., VC and credit markets are substitutes), especially when countries have more FinTech entrepreneurship.*

Method

Data Sources and Sample

To test our hypotheses, we developed a database covering 53 countries using multiple secondary data sources. Our main data source is *Dealroom.co* (e.g., Autio et al., 2018; Bradley et al., 2019). Dealroom.co is an online platform that connects professional investors (as well as corporates and governments) and tech companies. Dealroom.co tracks over 800,000 companies and 50,000 investors. It collects and daily updates its information from sources that include (a) crowdsourced, user-generated data from founders, VC investors, accelerators, governments, technology journalists, (b) data from social media, curated media, analytics providers and their in-house web crawlers, (c) machine learning algorithms that are trained on human inputs and are applied to a large data set of "below the radar" companies to predict their activities and growth, and (d) Dealroom's internal research team, which also checks and maintains the data.[6]

We selected the FinTech start-ups that were established between 2009 and 2017 (inclusive). To do so, we were aided by the fact that Dealroom has a specific search option for FinTech firms. FinTech firms are technology start-ups active in financial management solutions, investing, payments, mortgages and lending, insurance, banking, and cryptocurrency (in line with the definition of Schueffel (2017)). To ensure that all start-ups tracked were included in our dataset,

[6] For more details, see: https://intercom.help/dealroom/articles/1897479-how-does-dealroom-co-collect-its-data

we removed hidden filters (including the requirement that firms are still active), which could cause bias (e.g., survivor bias). We collected data on start-up activity up to 2017 to ensure that Dealroom has sufficient time to identify all start-up activity. This step was important because data on 2018 start-up activity was incomplete at the time of data collection (our data were last updated on the 13th of March 2019). Given that our level of analysis is the country-year, we aggregated the data to obtain the number of new FinTech start-ups at the country-year level.

We extended our dataset with other variables at the country-year level by adding additional data from Dealroom and other multi-country data sources, including the World Economic Forum, the Fraser Institute, and the World Bank. We discuss our variables and their data sources in more detail below. These steps resulted in a dataset of 415 country-year observations covering FinTech start-up activity.

Variables

To minimize concerns over reverse causality, we measured the independent variables and controls at time *t-1* and the dependent variable at time *t*.[7] Appendix A provides an overview of all variables, their description, and data source.

Dependent variable. Our dependent variable is the *number of new Fintech start-ups* at the country-year level (see Haddad and Hornuf, 2019). To avoid double counting, each start-up is included only once; i.e. in its founding year. Moreover, to avoid survivorship bias, we include the original number of start-ups launched in a specific country-year. Thus, we do not limit our selection

[7] In the robustness section, presented later, we discuss additional tests that we have conducted to reduce the possibility that endogenous explanations drive our findings.

to those start-ups that have survived until the date of our data collection. In the analyses reported in this paper, we take the natural logarithm of this variable plus one.[8]

Independent variables. The two independent variables that we use in our study measure VC availability and private sector credit availability at the country-year level. These measures are time-varying, available across a broad range of countries and were consistently defined across countries and time.

To test Hypothesis 1, *VC availability* is measured as an index, which relates to the question: "In your country, how easy is it for entrepreneurs with innovative but risky projects to find venture capital?" (See also Stenholm et al., 2013). This index comes from the World Economic Forum, Global Competitiveness Report—a data source that is often used in multi-country studies (e.g., Ács et al., 2014; Haddad and Hornuf, 2019; Terjesen and Hessels, 2009). The index ranges between 1 and 7, where 1 stands for "extremely difficult" and 7 refers to "extremely easy". The countries in our sample vary significantly in terms of VC availability with Greece scoring the minimum value of 1.7 and the US scoring the maximum value of 5.128.

The World Economic Forum's Executive Opinion Survey captures the opinion of approximately 12,775 business executives from 133 countries (hence capturing multiple respondents per country) and is "*the longest-running and most extensive survey of its kind, capturing the opinions of business leaders around the world on a broad range of topics for which statistics are unreliable, outdated, or nonexistent for many countries*". One could argue that perceived VC availability does not capture actual availability. But, the World Economic Forum index correlates strongly with other more "objective" measures (e.g., the correlation is about 80%

[8] In the robustness section, we also describe the use of an alternative dependent variable measuring the relative number of FinTech start-ups. We further present the advantages and disadvantages of absolute versus relative measures. Our results remain robust when we use this alternative dependent variable.

with the VC investments as percentage of GDP ratio for European countries from Invest Europe) that are unfortunately available for fewer countries or shorter time frames. Moreover, while perceived availability and objective availability are highly correlated, perceived availability might be particularly important because under uncertainty people do not necessarily capture reality but form "'beliefs … of the way the system works" (North, 2005: 2). This is why we have argued earlier that the perceived lack of VC in a country might also constrain entrepreneurs from setting up a start-up (see also Samila and Sorenson, 2011).

To test Hypothesis 2, *private sector credit availability* is measured as an index that ranges between 0 and 10, where countries obtain higher ratings as the share of credit extended to the private sector increases. This index is a subcomponent of the credit market regulations index from the Economic Freedom Index of the Fraser Institute (based on data the Institute obtained from a variety of sources, including the World Bank, World Economic Forum and International Monetary Fund). Data compiled by the Fraser Institute is also used in previous multi-country studies (e.g., Haddad and Hornuf, 2019; Johnson et al., 1998). The countries in our sample show significant variation in private sector credit availability, with countries scoring 0 (such as Ghana) and 10 (such as Singapore).

To test Hypothesis 3, we calculate the interaction term by multiplying VC availability by private sector credit availability (*VC availability x Private sector credit availability*).

Control variables. We also control for a range of other variables that might affect FinTech entrepreneurship, the development of VC, or credit markets, and that have been shown to be relevant in previous research.

A country's regulatory environment can influence its entrepreneurship activity and the development of its VC market and credit market (e.g., Chowdhury et al., 2019; Holmes et al., 2016; Li and Zahra, 2012; Stenholm et al., 2013). We control for the *ownership of banks* and *interest rate*

controls, which along with the private sector credit availability (i.e., one of our independent variables) are components of the credit market regulations index of the Fraser Institute. We also control for *labor market regulations*, which captures issues such as hiring and firing, minimum wage and work hours. Then, we add *business market regulations*, which capture (for example) administrative requirements, bureaucracy costs, ease of starting a business, and tax complacence costs. Higher values of these indices indicate more economic freedom. These indices come from the Fraser Institute and are based on other data from the World Bank and the World Economic Forum among other sources.

Bankruptcy laws can also influence entrepreneurship and the supply of credit towards innovative projects (Armour and Cumming, 2006; Estrin et al., 2017). We include the *strength of legal rights* index from the World Bank, Doing Business database. This variable ranges between 0 and 12 and captures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. We control for the *protection of minority shareholders* that can influence entrepreneurship and VC markets (Vanacker et al., 2014b). We use an index that is available from the World Bank and that is based on the following question: "In your country, to what extent are the interests of minority shareholders protected by the legal system? [1 = not protected at all; 7 = fully protected]".

The last regulation-related control variable is the dummy *regulatory sandbox*. A sandbox is a regulatory framework that is friendly to FinTech firms and investments. We created a dummy variable that takes value one for the countries that adopted regulatory sandboxes (e.g., Jenik and Lauer, 2017) and from the year in which the sandbox became effective. This variable takes the value of zero for the observations in those countries when the sandbox was not effective yet, or for those countries that have not adopted a Sandbox.

We further control for the development of the broader financial system that can boost entrepreneurship within a country (King and Levine, 1993). Specifically, we capture the size of the banking industry, measured by the ratio of *deposits to GDP*; the size of the insurance industry, measured as the *insurance penetration rate* (defined as the sum of the life and non-life insurance premiums to GDP) and; the development of stock markets by taking the ratio of *stock market capitalization* to GDP.[9] We also include the *MSCI returns* available at Morgan Stanley Capital International (Cumming et al., 2010). The MSCI returns of the broad global equity index were calculated as the annual percentage changes of the actual values of the index per country.

Next to a country's financial market, another important factor market is the *labor market*. We control for the size of a country's labor force, which is available at the World Development Indicators database. It also proxies for the market size in each country.

We also control for the general economic development of countries by means of the *GDP per capita (100k)*, which is available at the World Development Indicators database.

Some countries just have more technology-based start-up activity in general than in other countries. We control for this activity with *New Start-up Formation* (available in Dealroom) excluding FinTech start-up activity. *New Start-up Formation* (along with *labor market* discussed above) control for the size of the market of each country.

Finally, entrepreneurship and FinTech entrepreneurship more specifically can benefit significantly from technological advancements (Haddad and Hornuf, 2019). We control for *mobile subscriptions* per 100 residents and the *Internet penetration rate*, available at World Telecommunication/ICT Development report database, Netcraft, respectively.

Econometric Approach

[9] These three variables are constructed with data available at the World Bank, Sigma Reports, Swiss Re World Federation of Exchanges, Global Stock Markets Factbook and supplemental S&P data, Standard & Poor's.

To test our hypotheses, we rely on quantile regression (see Koenker, 2005, for a comprehensive monograph). Quantile regression is more robust, granular, and informative than linear regression.

Linear regression is based on the mean value, which is sensitive to unusually large observations and hence can yield biased estimations, potentially increasing the chances of misleading conclusions. An alternative to the mean is the median, also known as the 50% quantile of the probability distribution. In addition to the lack of robustness, the mean only tells where the center of the probability distribution is likely to be but remains silent on other areas of the probability distribution. Quantiles (not only the median but others lower and higher than 50%) solve this problem.

The two drawbacks of the linear regression model, we have just discussed, limits its validity for testing our hypotheses. Since the database is worldwide and we want to test differences across countries with different levels of FinTech start-up formation, we need a model that allows different effects of the independent variables on the number of new Fintech start-ups depending on the level of the latter; i.e. the quantile of the FinTech start-up formation. The linear regression model cannot do this since the slope coefficients measure the effect of an independent variable on the average number (across countries and years) of new FinTech start-ups.[10]

Quantile regressions provide estimates that are robust to large observations while allowing for different slope coefficients depending on the level of start-up formation. Recall that a quantile looks at a particular area of the probability distribution. Visually, we can slice a probability

[10] Instead of the linear regression model, one may consider a panel data model with country and year fixed effects. This approach brings more flexibility but the effect of the independent variables on the number of new Fintech start-up is still measured by a single coefficient for all countries and years. The panel data model could be enhanced with different slope coefficients per country and for each independent variable, but this renders the model unreliable (parameter uncertainty would be too high) and computationally challenging. A simpler alternative would be to run a linear regression per country, but independent estimations per country means losing the information in the correlations between countries. Also, the number of observations used for estimation would reduce substantially, increasing the chances of biased estimates due to unusually large observations.

distribution in tranches. For each tranche, we can examine the effect of the independent variables on the number of new FinTech start-ups. Important to note, quantile regression does not slice the data. All data are used for the estimation of each tranche of the probability distribution, giving more weight on data that belong to that tranche (using the so-called check function).

More specifically, let p denote the probability level of the quantile. The choice of p determines the tranche we analyze—for instance, if $p=0.50$ the tranche is around the median. For a given p, we model the quantile of the number of new Fintech start-ups conditional to the independent and control variables:

$$Q_p(New\ Fintech\ start-ups_t|Info_{t-1}) = \omega_p + \beta_p independent_{t-1} + \delta_p control_{t-1}$$

Our interest is the 3x1 vector of coefficients β_p.The first element of β_p captures the effect VC availability (needed for testing Hypothesis 1), the second captures the effect of private sector credit availability (Hypothesis 2), and the third captures the interaction term (Hypothesis 3).

We now turn into the display and reading of the results of a quantile regression using a hypothetical example. For a sequence of probability values (we use $p=0.1,\ldots,0.9$), we obtain a corresponding sequence of estimated parameters. It is usual practice in quantile regression to plot the probability values $0.1,\ldots,0.9$ against the estimated parameters $\beta_1, \ldots \beta_9$ for the main independent variables (see for instance Coroneo and Veredas, 2012, and Goedhuis and Sleuwaegen, 2010), and interpret the plot in terms of the probability distribution.

For the sake of illustration, let us assume that the probability distribution follows a bell curve, represented with dots in the right-hand side plots (Panels B and D) of Figure B.1 in Appendix B. We distinguish two cases that are relevant for testing our hypotheses.

In the first case, all the betas are the same and equal to 0.5, i.e. $\beta_1 = \cdots = \beta_9 = 0.5$, as plotted in Panel A of Figure B.1. (Appendix B). The effect of the independent variable in the number of

new Fintech start-ups is positive and equal for all tranches. Since all the betas are positive, the effect on the probability distribution is a uniform shift to the right, as shown in Panel B of Figure B.1 (from dotted to solid line curves).

In the second case, the betas are positive and increasing with the probability values. This situation is plotted in Panel C of Figure B.1. (Appendix B). The effect of the independent variable in the number of new Fintech start-ups is not only positive but also increases with the tranches. That is, tranches with a high number of new Fintech start-ups (that are in the right of the distribution) are more affected by the independent variable than tranches with a low number of new Fintech start-ups (that are in the left of the distribution). In terms of the probability distribution (Panel D), the effect is asymmetric, increasing the probability of the number of new Fintech start-ups in tranches when this number is already high, while the effect is limited in the tranches when the number is low.

Results

Table 1 presents descriptive statistics for the study's variables. Appendix C shows the correlations between all variables.[11] We further calculated the descriptive statistics for the variables across all the years of interest (2009 to 2017) (Appendix D) and we document the number of countries and observations observed per year (Appendix E). As noted earlier, our sample contains significant variation in terms of perceived VC availability and private sector credit availability, and our dependent variable is highly skewed, which fits together with the use of quantile regression.

[Insert Table 1 about here]

[11] We also calculated Variance Inflation Factors. The maximum Variance Inflation Factor is well below the critical threshold of 10 (Neter et al., 1996).

Table 2 presents estimation results for the baseline model (i.e., without the interaction effect) and allows for testing Hypotheses 1 and 2. As mentioned earlier, we run quantile regressions across 9 tranches (hence 9 columns, one for each probability level: 0.1 to 0.9), representing different levels of FinTech entrepreneurship activity.

[Insert Table 2 about here]

Results Related to Control Variables

Before discussing the results related to our hypotheses, we first discuss the control variables. Table 2 shows that entrepreneurship activity (new start-up formations, excluding FinTech) positively affects next year FinTech start-up formation. Likewise, the effect of Internet penetration rate is positive and significant for all the different levels of FinTech entrepreneurship activity (except for p=0.1).

Focusing on the macro variables, economic development positively influences entrepreneurship (Toma et al., 2014) and this view is supported by our results too: GDP per capita has a positive and significant impact across all probability levels. Also, the size of a country's labor market positively affects the number of FinTech start-ups.

As for financial services, the size of the banking industry positively affects FinTech entrepreneurship, which is supported by the literature that suggests that many services of the traditional financial services industry are disrupted by digitization (Puschmann, 2017). The development of the insurance sector also positively affects FinTech entrepreneurship across all probability levels, which is line with the literature that suggests that a strong insurance industry promotes entrepreneurship and supports economic activity (Masci, 2012). The stock market capitalization to GDP has a negative relationship with next year FinTech start-up formations. One possible explanation is that well-developed stock markets push investors to invest less in alternative projects such as FinTech start-ups.

As expected, the regulatory environment within a country also has a significant impact on domestic economic activity. This view is supported by our results since the coefficients of the strength of legal rights are positive and significant across all levels of entrepreneurship activity. By contrast, protection of minority shareholders has a negative impact.

Main Results Related to Independent Variables

Hypothesis 1 stated that the perceived VC availability in a country will more positively impact FinTech entrepreneurship in countries with higher levels of FinTech entrepreneurship. Table 2 shows that perceived VC availability positively and significantly influences next year FinTech start-up formations across all probability levels (estimates are different from zero at 1% significance level). Moreover, consistent with Hypothesis 1, the impact of perceived VC availability on new FinTech start-ups is stronger for the higher probability levels (i.e., countries with more FinTech entrepreneurship).

This effect can be observed graphically in Figure 1, Panel A, which shows the coefficients of VC availability at the different quantiles. A Wald test for the null of equality of the nine estimated parameters yields a p-value smaller than 0.001, providing evidence that the effect of VC availability across levels of FinTech start-up formation differs. Coefficients are not only statistically different, but the differences are also economically significant. Specifically, a one-unit increase in the VC availability index is related to an almost 25.2% increase in the number of next year FinTech start-up formations for the countries with the smallest FinTech entrepreneurship level. But, an equivalent improvement of the VC availability index is related to an almost 62.6% increase in the number of next year FinTech start-up formations for the countries with the largest FinTech entrepreneurship level. Combined, we find strong support for Hypothesis 1.

[Insert Figure 1 about here]

Hypothesis 2 stated that the positive influence of countries' private sector credit availability on FinTech entrepreneurship would be largely independent of the level of countries' FinTech entrepreneurship. The results show that private sector credit availability positively and significantly influences next year FinTech start-up formations across all probability levels (estimates are different from zero at 10% significance level or better). Specifically, a one unit increase of the private sector credit score is related to a 6% increase in the number of FinTech start-ups. Moreover, consistent with Hypothesis 2, the impact of private sector credit availability on new FinTech start-ups does not differ markedly over the different probability levels. This effect can be observed graphically in Figure 1. Panel B shows the coefficients of private sector credit availability at the different quantiles. A Wald test for the null of equality of the nine parameters gives a p-value close to 0.99. Combined, we find support for Hypothesis 2.

Next, Table 3 presents the results of the quantile regression estimation including the interaction effect between the two independent variables. Hypothesis 3 suggested that VC and credit markets would act as substitutes, especially in countries with more FinTech entrepreneurship. Thus, we expect a negative interaction effect between VC availability and private credit availability, especially for the higher probability levels (i.e. countries with more FinTech entrepreneurship). Consistent with Hypothesis 3, we find a negative and significant interaction effect between VC availability and private credit availability, which becomes sharper from the 40% quantile of the new FinTech start-up distribution. This interaction effect becomes more negative in the upper tail of the distribution. Specifically, a one unit increase of the interaction term relates to 1.3% decrease for the countries at 10th probability level. While, countries at the 90th probability level face a 7.6% decrease in their number of FinTech start-ups for a similar change of the interaction term.

[Insert Table 3 about here]

This effect can be observed graphically in Figure 2, which shows the coefficients of the interaction effect. A Wald test for the null of equality of the nine parameters yields a p-value smaller than 0.001. Combined, we find support for Hypothesis 3.

[Insert Figure 2 about here]

Robustness Checks and Additional Tests

We conducted a set of additional regressions and tests to investigate the robustness of our primary results. First, we used an alternative dependent variable. Second, we controlled for additional sources of financing besides VC and credit. Third, we delve deeper into potential endogeneity concerns.

Dependent variable as a relative measure. In our main results, we focus on the absolute level of FinTech entrepreneurship and control for the size of an economy. In our first robustness tests, we used an alternative dependent variable: the number of FinTech start-ups squared divided by the total number of start-ups launched per country and year. We square the numerator to ensure that results are mainly driven by the number of FinTech start-ups instead of by the fluctuations of the denominator. Conclusions are qualitatively similar to those in the main results. The impact of VC availability is stronger in countries with higher relative FinTech entrepreneurship levels. The impact of private sector credit remains broadly constant across countries with different relative FinTech entrepreneurship levels. Last, the interaction term between VC and credit availability has also an increasingly negative impact in countries with higher relative FinTech entrepreneurship levels. Detailed results appear in Appendix F.

While relative measures have the advantage of directly controlling for the size of an economy, they also have disadvantages. Because the dependent variable is a ratio, a positive, negative or insignificant impact refers to the two components of the ratio. For example, private sector credit might increase both the entrepreneurship activity for FinTech and the overall market

individually. But if the extent of the impact is similar for both components then their relationship does not change, and private sector credit appears to have an insignificant impact at the ratio itself. Consequently, in our primary analysis, we prefer to employ an absolute measure as a dependent variable that directly measures FinTech entrepreneurship but control for the size of an economy. However, it is comforting that our conclusions remain robust using a relative measure of FinTech entrepreneurship as well.

Additional financing sources besides venture capital and credit. We also conducted a robustness test including controls for the number of crowdfunding platforms and the number of Initial Coin Offerings (ICOs), respectively (Data from *Dealroom.co*). We did not include these variables in our main results and interpretation. Our reason for not doing so is that crowdfunding and ICOs are part of FinTech, hence there is the potential concern of constructed correlation (the independent variables are a component of our dependent variable). However, even when we control for these alternative sources of financing, our results still broadly support the hypotheses. Detailed results appear in Appendix G.

Possible endogeneity. To probe causality, three conditions need to be fulfilled (e.g., Van de Ven, 2007): (i) there should be a correlation between the independent variables and dependent variable; (ii) there should be temporal precedence, where the independent variables occur before the dependent variable; and (iii) there should be no spurious correlation caused by unobserved variables that impact both our dependent and independent variables.

Condition (i) above is met in that we do find significant correlations. Condition (ii) is also met. The bidirectional relationship between entrepreneurship and institutions has been suggested by Chowdhury et al. (2019) and others. We report our dependent variable at time *t* and the independent variables (and controls) at time *t-1*. This approach ensures temporal precedence. To investigate if condition (iii) is met, we perform additional econometric tests. Because standard tests

for linear regression do not generalize to quantile regression, we use a test introduced by Kim and Muller (2013). They propose a relatively straightforward way for testing endogeneity in our framework. Recall that p_i is the i^{th} probability level (e.g. 10%....90%). Let θ_i be the percentage of negative residuals at the i^{th} probability level. The test is based on testing the null hypothesis $p_i = \theta_i$. Put it differently, the test checks if the theoretical and empirical probability levels are statistically the same (just like in linear regression, we test that the empirical mean of the residuals is equal to the theoretical expectation of the errors (zero)). Since we have 9 probability values, we conduct 9 tests. Appendix H shows the results of these tests. Since the p-values range from 0.57 to 0.96, we can safely conclude that endogeneity does not influence our findings.

Discussion

Research underscores the importance of financial resources for start-up formation and the evolution of industries within countries (Ács et al., 2014). Though there are multiple sources to raise funds, venture capital and credit are two widely used sources by start-ups operating in new entrepreneurial industries, such as the FinTech industry, which we use as a research context. However, to date, research has ignored two fundamental questions that we sought to answer in this study: (1) Does the impact of VC and credit availability on FinTech entrepreneurship differ across countries with varying levels of FinTech entrepreneurship? And (2) Is there a substitution effect between VCs and banks when it comes to financing ventures across countries with varying levels of FinTech entrepreneurship? Benefiting from the insights the NIS framework provides, our analyses lead us to answer these two questions affirmatively. Our results contribute to several streams of literature, including the emerging FinTech literature and the literature on the relationship between entrepreneurial finance systems and entrepreneurship activity across countries.

Existing work on FinTech entrepreneurship has primarily focused on the functioning of particular FinTech subsectors, such as different forms of crowdfunding (Ahlers et al., 2015; Belleflamme et al., 2014) or Initial Coin Offerings (Bellavitis et al., 2020; Fisch, 2019; Huang et al., 2019). More recently, studies have focused on the overall FinTech industry. Cumming and Schwienbacher (2018), for instance, examine the factors that drive FinTech venture capital levels. Hornuf et al. (2019) investigate how FinTech start-ups interact with banks. Our research both complements and extends this literature.

Prior research has also focused on how countries' financial support systems in the form of a greater availability of venture capital (Armour and Cumming, 2006; Chowdhury et al., 2019; Haddad and Hornuf, 2019; Popov and Roosenboom, 2013; Reynolds et al., 2000; Samila and Sorenson, 2011) and credit (Chowdhury et al., 2019; Deloof et al., 2019; Guiso et al., 2004) influence the level and quality entrepreneurship in the average country. Research has also focused on how institutional pressures may push investors to operate similarly or differently across countries (e.g., Bruton et al., 2005; Collewaert et al., 2019; Zacharakis et al., 2007).

Reflecting on prior studies, probably the most closely related to our research is the paper by Haddad and Hornuf (2019). They use a multi-country dataset (based on Crunchbase) and examine how country institutions relate to FinTech start-up formations in the *average country*. Our findings related to the 50% quantile of the probability distribution (the median country) are broadly in line with their findings. Our study also relates to Chowdhury et al. (2019), who examine the impact of a country's financial support systems on entrepreneurship quantity and quality, where they make a distinction between developed versus developing countries. Our study provides evidence on the validity and replicability of prior results, an increasingly important concern in many academic fields (Bettis et al., 2016). However, our study is not just a replication of Haddad

and Hornuf (2019) or Chowdhury et al. (2019), it also extends our theoretical understanding in several important ways.

First, consistent with the NIS framework, we propose that the global industry practices and norms of VC investors (Bruton et al., 2005) will influence the strength of the relationship between VC availability and FinTech entrepreneurship across countries with different FinTech entrepreneurship levels. The reason for this expectation is that VC investors' pre- and post-investment process is more effective when there is a critical mass of FinTech entrepreneurship in a country. Consistent with this argument, we find that the relationship between VC availability and FinTech entrepreneurship is weaker (stronger) in countries with less (more) FinTech entrepreneurship.

For banks, however, we suggest that their industry practices work differently (Winton and Yerramilli, 2008) and largely independent from FinTech entrepreneurship levels in a country. Hence, the relationship between credit availability and FinTech entrepreneurship will be (positive and) constant across countries. Our findings also support this view. From a theory point of view, this evidence clearly adds new important knowledge on how global industry practices of investors (and especially VC investors) influence the strength of the relationship between financial institutional support at the country level and entrepreneurship across countries.

These findings reinforce the importance of norms, practices and logics these entities espouse, as articulated in other streams of research (Thornton and Occasion, 2008). However, we add to this view by highlighting the importance of having a critical mass (threshold) of entrepreneurship beyond which this logic unfolds and has profound effect on investment in a new but important entrepreneurial industry, namely FinTech. As such we clarify a key boundary condition for this logic to have its effect.

Relatedly, we also contribute to research on start-up formation in a new entrepreneurial industry, FinTech, which only recently experienced significant entry by start-ups (Arner et al., 2016). This context is theoretically interesting because of the ubiquity of entrepreneurial industries and the fact that resource mobilization is usually acute in such a setting (Zimmerman and Zeitz, 2002). Thus, a country's financial support system may promote new firm formation. In general, we find that VC and banks that positively influence entrepreneurship in general, are also positively related to the start-up formation in the FinTech industry. However, we also add important nuance to the (often implicit) idea that the "good" systems and institutions that permeate NIS have an equally strong effect across countries (e.g., Haddad and Hornuf, 2019). Indeed, our results suggest that a country's availability of VC has a much stronger relationship with FinTech entrepreneurship in countries where there are higher levels of FinTech entrepreneurship. These findings add important nuance to the findings of Haddad and Hornuf (2019) which speak to the average country.

Finally, by examining the interaction between VC and credit availability, our study also adds to the theoretical idea that countries' support systems often interact (e.g., Holmes et al., 2003; Lundvall, 1992, 2010; Nelson, 1993). This idea has received much less empirical scrutiny than warranted, particularly in the domain of countries' financial support systems. Indeed, as Cumming and Johan (2017) suggest, the entrepreneurial finance literature is largely segmented by the source and type of financing. Cross-country studies have often focused on the role of the availability of VC for entrepreneurship or the role of the availability of credit for entrepreneurship. But few studies have examined both in combination, and those studies that do have often viewed them as functioning independently (e.g., Chowdhury et al., 2019; Haddad and Hornuf, 2019). However, we go beyond these earlier studies by showing that VC and credit markets play a substitutive role, particularly in those countries with higher FinTech levels. Thus, VC availability is less important for FinTech entrepreneurship when countries have better private credit availability, especially in

countries with more FinTech entrepreneurship. Overall, our study provides new insights on how countries' financial support systems differently interact to influence entrepreneurship levels in different countries.

Our results also offer an empirical contribution. They highlight the need for (and the value of) having quantile regressions in the entrepreneurship researchers' toolbox. While we are certainly not the first to use quantile regressions in entrepreneurship, they have been only sporadically used in the entrepreneurship literature (e.g., Anokhin and Schulze, 2009; Goedhuys and Sleuwaegen, 2010). This is unfortunate because their use may push entrepreneurship scholars to ask different types of questions that take into account the broader distribution of specific phenomena. As Andriani and McKelvey (2007: 1225) state: "Scholars need to step beyond the idea that *studying averages* is the only 'good' science, is the only method relevant to good management research, and is what offers something useful to managers. Sometimes yes, but we think *mostly no* for management researchers".

Limitations and Avenues for Future Research

As with any research, our study has a number of limitations that open important avenues for future research. First, potential endogeneity is always a concern in a context without a natural experiment, such as ours. Although we measure the relationship between country financial support on *next year* FinTech start-up formation across countries, and as such ensure that a probable cause precedes its effects, such an approach is not sufficient to make causal claims. Still, our approach is consistent with previous work (e.g., Chowdhury et al., 2019; Haddad and Hornuf, 2019) and the NIS framework that highlights a bidirectional relationship between systems and outcomes (FinTech entrepreneurship). However, we have conducted and described additional robustness tests, which suggest that endogeneity does not influence our findings. Future research, however, could identify

unique exogenous shocks to examine how a country's institutional support systems differently influence entrepreneurship in different countries.

Second, we focus on the relationship between a country's financial support systems in the form of VC and credit on FinTech entrepreneurship. We do not claim that VC or debt finance are the only available financing sources that could relate to FinTech entrepreneurship. Indeed, other sources of financing might be important as well. In our robustness tests, we discussed some of these alternatives such as crowdfunding and ICOs. We also wanted to examine the impact of angel financing. Unfortunately, current cross-country data availability on angel financing is very limited. While there are important differences in how angel investors and VCs operate, there is also important overlap in their practices (Van Osnabrugge, 2000). Angels invest their own money and hence they have more freedom relative to VCs to invest in FinTech (while VCs are bounded by investment policies agreed with their investors). Angels, however, also frequently rely on decision heuristics (i.e., investing in industries they know and where they accumulated experience) and networks. Consequently, they might also be constrained to invest in FinTech in countries with limited existing FinTech entrepreneurship. These theoretical expectations remain subject to empirical test as reliable cross-country angel data becomes available.

Third, our use of quantile regressions has pushed us to address new types of research questions. Our study has pointed towards the different relationships between some financial support systems and FinTech entrepreneurship across countries with different FinTech entrepreneurship levels. However, quantile regressions can do even more. Robust measures of location, volatility, skewness and kurtosis can be easily constructed with sample quantiles (see, for instance, Dominicy and Veredas (2013)). Since they can also be constructed with quantile regressions, these measures are also conditional to the independent and control variables. Thus, for instance, we can understand the drivers of volatility and extreme variations in FinTech

entrepreneurship across countries. Overall, we believe that a better integration of quantile regressions into entrepreneurship researchers' empirical toolbox can help the field by providing "new ways of seeing" relationships that move beyond seeing "averages".

Finally, our focus on cross-country differences in FinTech entrepreneurship is consistent with the NIS framework but it has both advantages and disadvantages. By focusing on a broad set of countries, our study has high external validity. However, we do not consider within-country differences. While this trade-off is common, future researchers need to examine if our findings also operate within countries. Next, by focusing on FinTech entrepreneurship, we are able to isolate the impact of country financial institutional support on entrepreneurship in an industry that was previously not populated by entrepreneurial start-ups. We could also focus on other types of high-quality entrepreneurship, such as ICT or biotechnology but these industries have a much longer tradition of start-up activity. Hence, while examining additional industries would allow us to speak to a broader set of industries, it could also mask differences in the impact of countries' financial support on entrepreneurship across these different industries with different characteristics and development stages. Finally, in 2020, after the time frame of our study, the coronavirus (SARS-CoV-2) started spreading globally. Future research could examine how such a crisis influences the relationships between entrepreneurial finance and (FinTech) entrepreneurship. It is noteworthy, however, that start-up entry in FinTech itself started to grow especially after another major crisis, namely the 2008 financial crisis. Ultimately, the generalizability of our findings to a within-country context, other industries and other time frames remains subject to future research.

Practical Implications

Policy-makers around the world are interested in how country support systems and institutions relate to entrepreneurship, and especially start-up formation in industries that have the potential to shape the future competitiveness of their economies. Our study has shown that a one standard

deviation increase in VC availability[12] is related to a 26% increase in next year Fintech start-up formation for the median country. Moreover, a one standard deviation increase in credit availability[13] is related to a 12.5% increase in next year Fintech start-up formation for the median country. It is also very interesting to note from Figure 1 that the confidence band of the effect of credit availability (Panel B) is generally much larger than the confident band around the effect of VC availability (Panel A). Combined, the evidence derived from our study suggests that there are good reasons why policy-makers should focus on VC availability for entrepreneurship but credit availability also plays a role.

Interestingly, the relationship between credit availability and FinTech entrepreneurship is broadly consistent across countries with fundamentally different FinTech entrepreneurship rates. The relationship between VC availability and FinTech entrepreneurship, however, becomes much stronger in countries with the highest level of FinTech entrepreneurship relative to the median country. Our study has shown that a one standard deviation increase in VC availability is related to a 18.75% increase in next year Fintech start-up formation for countries in the 10th quantile of FinTech entrepreneurship (e.g., Croatia's venture capital availability at 2.3 would increase to the levels of Peru at 3.07). While the same one standard deviation increase in VC availability (e.g., India's venture capital availability at 3.39 would increase to the levels of the US at 4.11) is related to a staggering 46.5% increase in next year Fintech start-up formation for countries in the 90th quantile of FinTech entrepreneurship.

Conclusion

[12] A one standard deviation increase in VC availability entails a move from the Turkish level at 2.52 to the Czech level at 3.30 in the year 2015.

[13] A one standard deviation increase in credit availability entails a move from the South African level at 7.25 to the Thai level at 9.37 in the year 2014.

In this paper, we studied how countries' financial support systems in the form of VC and credit availability differently influence FinTech entrepreneurship across countries with substantially different FinTech entrepreneurship levels. Using the NIS framework, we have argued that with their established and globally diffused norms and practices, VC investors—but not banks—require a critical mass of FinTech entrepreneurship in a country to more positively influence FinTech entrepreneurship in that country. We have also argued that VC and credit markets are substitutes, especially in countries with higher FinTech entrepreneurship levels. We examined these issues in 53 countries over the 2009-2017 period. Using quantile regressions, we find broad support for our hypotheses. Our study adds new insights at the nexus of research on NIS, entrepreneurship and entrepreneurial finance, especially in the context of FinTech, a new and growing entrepreneurial industry.

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Table 1: Descriptive statistics

	Mean	Median	SD	Skewness	Kurtosis	Max	Min
Dependent Variable							
ln(FinTech start-ups)	2.14	1.95	1.51	0.67	0.34	7.03	0.00
Independent Variables							
VC availability	3.18	3.10	0.75	0.24	-0.78	5.13	1.70
Private sector credit availability	8.12	8.69	2.06	-1.97	4.45	10.00	0.00
VC availability x Private sector credit availability	26.35	26.49	10.05	-0.20	-0.16	48.95	0.00
Control Variables							
Ownership of banks	8.17	10.00	2.40	-1.19	0.36	10.00	2.00
Interest rates controls	9.69	10.00	0.83	-3.25	11.28	10.00	5.00
Labor market regulations	6.59	6.50	1.32	0.12	-0.95	9.46	3.91
Business market regulations	6.87	6.82	1.15	-0.34	0.19	9.27	3.38
Strength of legal rights	5.19	5.00	2.64	0.34	-0.13	12.00	0.00
Protection of minority shareholders	4.57	4.53	0.71	0.01	-0.60	6.22	2.82
Regulatory sandbox	0.03	0.00	0.18	5.20	25.21	1.00	0.00
Deposits to GDP	0.74	0.63	0.48	2.86	11.82	3.47	0.14
Insurance penetration rate (%)	4.15	3.34	3.02	1.51	2.42	17.07	0.57
Stock market capitalization to GDP	0.84	0.49	1.46	5.79	36.42	11.79	0.07
MSCI returns	0.00	-0.04	0.34	0.50	0.89	1.23	-0.89
Labor market (10mn)	4.82	1.49	12.67	4.64	22.13	78.71	0.06
GDP per capita (100k)	0.24	0.16	0.21	1.00	0.48	0.97	0.01
New Startup Formation (10)	34.98	5.30	132.07	6.85	49.12	1169.00	0.00
Mobile subscriptions per capita	1.18	1.16	0.30	0.67	2.32	2.41	0.29
Internet penetration rate	0.59	0.64	0.24	-0.57	-0.60	0.98	0.04

Rows-wise, the table is divided into three parts: the dependent variable at the top of the table, the independent variables in the middle, and the control variables at the bottom. All variables are defined in Appendix A. SD stands for standard deviation.

Table 2: Quantile regression estimation of new FinTech start-up formation (main effects)

Probability levels	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Independent Variables									
VC availability	0.252***	0.308***	0.288***	0.335***	0.348***	0.369***	0.546***	0.606***	0.626***
	(0.09)	(0.104)	(0.092)	(0.115)	(0.102)	(0.089)	(0.084)	(0.071)	(0.058)
Private sector credit availability	0.083***	0.045*	0.043*	0.047*	0.059**	0.062**	0.051**	0.052**	0.045***
	(0.031)	(0.024)	(0.025)	(0.028)	(0.026)	(0.026)	(0.025)	(0.021)	(0.017)
Control Variables									
Ownership of banks	-0.107***	-0.065**	-0.068**	-0.068**	-0.083***	-0.063**	-0.03	-0.007	-0.023*
	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.028)	(0.019)	(0.006)	(0.01)
Interest rates controls	0.002	0.004	0.004	0.004	0.006	0.001	0.001	0.003	0.003
	(0.001)	(0.003)	(0.003)	(0.003)	(0.008)	(0.001)	(0.001)	(0.002)	(0.002)
Labor market regulations	-0.016*	-0.026	-0.03	-0.028	-0.033	-0.023	-0.025	-0.038*	-0.019**
	(0.009)	(0.021)	(0.023)	(0.027)	(0.024)	(0.018)	(0.018)	(0.022)	(0.009)
Business market regulations	-0.031*	-0.039	-0.052	-0.046	-0.053	-0.045	-0.052	-0.047*	-0.036*
	(0.017)	(0.027)	(0.036)	(0.039)	(0.033)	(0.031)	(0.032)	(0.027)	(0.019)
Strength of legal rights	0.061**	0.055**	0.054**	0.056**	0.057**	0.07***	0.053**	0.04**	0.038***
	(0.024)	(0.023)	(0.023)	(0.026)	(0.026)	(0.024)	(0.021)	(0.015)	(0.015)
Protection of minority shareholders	-0.374***	-0.383***	-0.303***	-0.305***	-0.258***	-0.303***	-0.341***	-0.348***	-0.235***
	(0.063)	(0.07)	(0.074)	(0.08)	(0.071)	(0.068)	(0.067)	(0.047)	(0.04)
Regulatory sandbox	-0.036	-0.029	-0.035	-0.03	0.008	-0.017	-0.024	-0.032	-0.031
	(0.027)	(0.026)	(0.03)	(0.03)	(0.007)	(0.02)	(0.022)	(0.023)	(0.022)
Deposits to GDP	0.708***	0.788***	0.675***	0.722***	0.78***	0.787***	0.713***	0.618***	0.696***
	(0.248)	(0.236)	(0.224)	(0.26)	(0.23)	(0.247)	(0.21)	(0.171)	(0.15)
Insurance penetration rate (%)	0.094***	0.198***	0.198***	0.18***	0.162***	0.165***	0.135***	0.103***	0.099***
	(0.032)	(0.031)	(0.028)	(0.029)	(0.03)	(0.03)	(0.026)	(0.023)	(0.02)
Stock market capitalization to GDP	-0.232***	-0.38***	-0.369***	-0.35***	-0.37***	-0.395***	-0.401***	-0.369***	-0.426***
	(0.073)	(0.069)	(0.065)	(0.084)	(0.071)	(0.076)	(0.024)	(0.052)	(0.051)
MSCI returns	0.128	0.162	0.148	0.143	0.051	0.118	0.134	0.131	0.169
	(0.098)	(0.15)	(0.132)	(0.129)	(0.049)	(0.11)	(0.114)	(0.094)	(0.106)
Labor market (10mn)	0.025***	0.025***	0.025***	0.024***	0.04***	0.042***	0.046***	0.041***	0.032***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)
GDP per capita (100k)	1.28***	0.78*	0.793**	0.868**	0.913*	1.129***	1.79***	1.316***	1.155***
	(0.408)	(0.425)	(0.39)	(0.434)	(0.475)	(0.407)	(0.397)	(0.347)	(0.295)
New Startup Formation (10)	0.005***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Mobile subscriptions per capita	0.039*	0.038	0.048	0.039	0.008	0.024	0.046	0.018	0.032
	(0.022)	(0.033)	(0.047)	(0.039)	(0.007)	(0.02)	(0.034)	(0.012)	(0.023)
Internet penetration rate	0.304	0.592*	0.871***	0.976***	1.085***	1.18***	1.182***	1.56***	1.285***
	(0.219)	(0.352)	(0.369)	(0.387)	(0.372)	(0.351)	(0.326)	(0.288)	(0.238)
Observations	415	415	415	415	415	415	415	415	415

Rows-wise, the table is divided into two parts: independent variables at the top and control variables at the bottom. For each variable, the first row shows the estimated parameters, the *, **, and *** stars indicating significance at 10%, 5%, and 1% respectively. The second row shows the standard errors in parenthesis. The columns show results for probability levels 0.1 to 0.9. All variables are defined in Appendix A. All independent and control variables (with the exception of new start-up formation) are measured at t-1, while the dependent variable is measured at t.

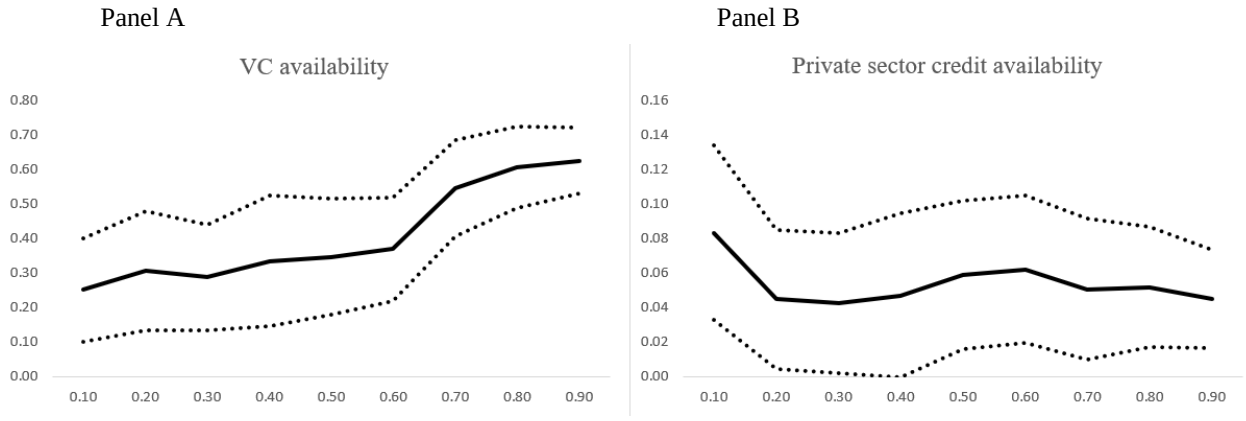
Table 3: Quantile regression estimation of new FinTech start-up formation (main effects and interaction term)

Probability levels	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Independent Variables									
VC availability	0.280***	0.611***	0.552***	0.708***	0.867***	0.952***	1.022***	1.115***	1.369***
	(0.092)	(0.108)	(0.108)	(0.102)	(0.102)	(0.084)	(0.089)	(0.087)	(0.044)
Private sector credit availability	0.122***	0.127***	0.134***	0.173***	0.197***	0.217***	0.241***	0.175***	0.221***
	(0.028)	(0.032)	(0.035)	(0.035)	(0.031)	(0.028)	(0.029)	(0.027)	(0.014)
VC availability x Private sector credit availability	-0.013**	-0.037***	-0.031***	-0.042***	-0.061***	-0.068***	-0.073***	-0.058***	-0.076***
	(0.006)	(0.01)	(0.01)	(0.011)	(0.01)	(0.01)	(0.009)	(0.007)	(0.004)
Control Variables									
Ownership of banks	-0.087***	-0.074**	-0.064**	-0.057**	-0.074**	-0.057**	-0.061**	-0.041**	-0.051***
	(0.302)	(0.029)	(0.028)	(0.028)	(0.032)	(0.023)	(0.025)	(0.018)	(0.013)
Interest rates controls	-0.112***	-0.068***	-0.052**	-0.068**	-0.047	-0.049**	-0.038*	-0.046***	-0.043***
	(0.032)	(0.032)	(0.029)	(0.034)	(0.031)	(0.024)	(0.021)	(0.022)	(0.012)
Labor market regulations	-0.075**	-0.048	-0.069*	-0.061	-0.053	-0.102***	-0.051*	-0.061**	-0.051**
	(0.036)	(0.032)	(0.039)	(0.041)	(0.037)	(0.032)	(0.031)	(0.028)	(0.017)
Business market regulations	-0.009	-0.008	-0.01	-0.008	-0.008	-0.003	-0.008	-0.008	-0.007**
	(0.006)	(0.007)	(0.008)	(0.007)	(0.007)	(0.002)	(0.008)	(0.004)	(0.003)
Strength of legal rights	0.07***	0.065**	0.051**	0.056**	0.038*	0.07***	0.036*	0.048***	0.053***
	(0.026)	(0.021)	(0.022)	(0.025)	(0.023)	(0.019)	(0.019)	(0.019)	(0.012)
Protection of minority shareholders	-0.158**	-0.337***	-0.341***	-0.39***	-0.368***	-0.414***	-0.412***	-0.451***	-0.512***
	(0.067)	(0.075)	(0.081)	(0.078)	(0.078)	(0.061)	(0.061)	(0.059)	(0.031)
Regulatory sandbox	0.003	-0.021	-0.014	-0.015	-0.012	-0.009	-0.012	0.002	-0.02*
	(0.003)	(0.015)	(0.012)	(0.013)	(0.011)	(0.007)	(0.01)	(0.001)	(0.011)
Deposits to GDP	1.014***	0.91***	0.638***	0.811***	0.738***	0.631***	0.485***	0.649***	0.645***
	(0.253)	(0.241)	(0.231)	(0.255)	(0.214)	(0.191)	(0.172)	(0.191)	(0.122)
Insurance penetration rate (%)	0.099***	0.186***	0.188***	0.181***	0.163***	0.155***	0.13***	0.128***	0.09***
	(0.028)	(0.031)	(0.029)	(0.028)	(0.028)	(0.022)	(0.023)	(0.022)	(0.016)
Stock market capitalization to GDP	-0.332***	-0.361***	-0.322***	-0.352***	-0.344***	-0.317***	-0.258***	-0.363***	-0.346***
	(0.072)	(0.072)	(0.069)	(0.075)	(0.069)	(0.063)	(0.061)	(0.057)	(0.042)
MSCI returns	0.221	0.181	0.174	0.147	0.16	0.07	0.137	0.219	0.197**
	(0.143)	(0.162)	(0.115)	(0.127)	(0.131)	(0.075)	(0.099)	(0.139)	(0.097)
Labor market (10mn)	0.028***	0.026***	0.025***	0.025***	0.034***	0.049***	0.043***	0.039***	0.028***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.003)

GDP per capita (100k)	1.136***	1.116***	0.708*	0.971**	1.229***	1.921***	2.226***	1.354***	0.93***
	(0.438)	(0.424)	(0.403)	(0.476)	(0.469)	(0.383)	(0.398)	(0.329)	(0.212)
New Startup Formation (10)	0.004***	0.004***	0.004***	0.004***	0.004***	0.003***	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mobile subscriptions per capita	-0.088	-0.076	-0.062	-0.07	-0.065	-0.059	-0.078	-0.078	-0.071*
	(0.06)	(0.055)	(0.045)	(0.077)	(0.068)	(0.053)	(0.079)	(0.051)	(0.038)
Internet penetration rate	0.508*	-0.267	1.153***	0.884**	1.028***	1.126***	1.034***	1.457***	1.717***
	(0.283)	(0.229)	(0.365)	(0.402)	(0.381)	(0.296)	(0.316)	(0.295)	(0.196)
Observations	415	415	415	415	415	415	415	415	415

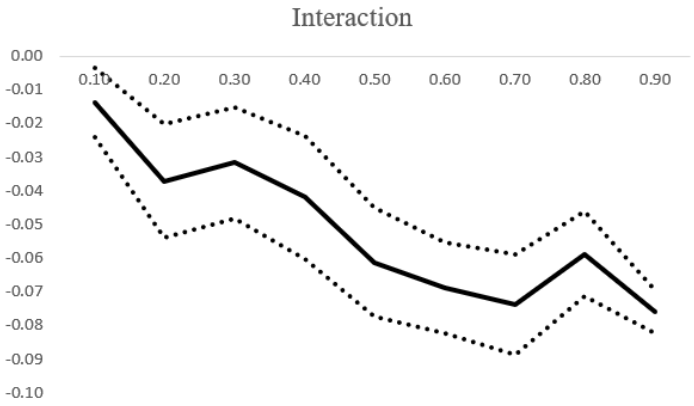
Rows-wise, the table is divided into two parts: independent variables at the top and control variables at the bottom. For each variable, the first row shows the estimated parameters, the *, **, and *** stars indicating significance at 10%, 5%, and 1% respectively. The second row shows the standard errors in parenthesis. The columns show results for probability levels 0.1 to 0.9. All variables are defined in Appendix A. All independent and control variables (with the exception of new start-up formation) are measured at t-1, while the dependent variable is measured at t.

Figure 1: Coefficients and confidence bands for the independent variables



Results for VC availability (Panel A) and private sector credit availability (Panel B) from Table 2. For each plot, the horizontal axis represents the probability levels and the vertical axis the estimated betas (solid line) and the 90% confidence bands.

Figure 2: Coefficients and confidence bands for the interaction term



Results for the interaction between VC availability and private sector credit availability from Table 3. The horizontal axis represents the probability levels and the vertical axis the estimated betas (solid line) and the 90% confidence bands