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Relational Financing and Innovation in Emerging and Frontier Economies

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Abstract

While the issue of lack of insufficient access to financial resources for performance-enhancing innovative activity may be exacerbated for firms in less well-developed financial markets, relatively little is known about how external financing impacts innovation outside of industrialized environments. To fill this gap, we develop and test a theory explaining the relationship between external finance and innovation based on variation in financial market development, focusing on the capacity for relationship-based financing from family and private equity to alleviate financial constraints to innovation. Examining a large set of emerging market firms, we find that the impact of external financing on innovation depends on the financial market development and that relationship-based finance is an important driver of innovation, especially for smaller and less formally organized firms.

Jelcodes:O17,L14

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Abstract

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JEL Classification: G30, G32, O32, O57

Key words: external finance, relational financing, innovation, institutional voids, emerging economies

1 Introduction

The availability of financing enables industrial innovation (e.g., Kortum and Lerner, 2000), which, in turn, generates new products, services, technologies, or organization forms (Schumpeter, 1939) that maintain and enhance the vitality of the economy. However, financial resources for innovative activity are often scarce and vary across countries, industries, firms, and time (Hall, 2008; Hall, Lotti, and Mairesse, 2009; Hall, 1999; Kortum *et al.*, 2000). Given that the innovative process creates more desirable products or services, or more efficient production technologies, this variation in access to finance may confer competitive advantages, and hence, strategic rents, to firms. . The poor alignment between access to financing and innovative activity is particularly salient for firms in emerging economies where external financing is typically less abundant and very unevenly available (Ayyagari, Demirguc-Kunt, and Maksimovic, 2011; King and Levine, 1993). Yet while access to financing for innovation is strategically important for firms, the role of financial resources has scarcely been examined in the strategic management of innovation. Drawing from the theories of institutional voids, agency, and transaction costs, this paper develops and tests a theory explaining the role of external financing on innovation for firms in emerging economies where under-developed financial markets create institutional voids that firms need to overcome to make strategic innovation investments.

In less-developed financial markets, suppliers of critical resources such as finance may not be able or willing to respond to new investment opportunities, thus creating an institutional void (Khanna and Palepu, 2000; Miller *et al.*, 2009; Oliver, 1992). These institutional voids raise the cost to firms of acquiring the critical inputs for innovative activity such as human resources,

equipment, and facilities. As a result, access to innovation financing becomes a strategic resource for firms in emerging economies: only those few firms with sufficient access will develop and commercialize their innovative ideas that confer competitive advantages (de Aghion, 1999; Rodrik, 2004; Torres Filho, 2009).

Emerging and frontier economies are likely to exhibit significant institutional voids. Emerging markets are often defined in terms of the size, efficiency, and liquidity (IMF[1]; MSCI[2]). Frontier markets are even less established as emerging ones in terms of the market indicators (MSCI?). Institutional voids have been studied in the emerging-economy contexts of Korean and Taiwanese family businesses (Miller et al., 2009; Luo and Chung, 2013, respectively), Indian and Chilean conglomerates (Khanna and Palepu, 1997; 2000), and Russian corporate governance (as reviewed by Puffer and McCarthy, 2011), among others. However, under-developed institutions and their strategic remedies have not been examined in the context of innovation, even though innovation is a process that causes long-term success of firms (Geroski, 1993). Therefore, our theories of innovation lack an understanding of institutional differences that, as we demonstrate, have significant implications for the relational strategies and innovation outcomes of firms.

The purpose of this study is to examine how variation in institutional voids across countries impacts the capabilities of firms to innovate. Furthermore, we argue that alternatives to commercial financing that are based on private, often personal relationships serve as alternative

[1] http://www.imf.org/external/pubs/ft/weo/2012/update/02/index.htm

[2] http://www.msci.com/resources/products/indexes/global_equity_indexes/gimi/stdindex/MSCI_Market_Classification_Framework.pdf

strategies for firms in emerging and frontier economies in order to compensate for the strategic disadvantage that lack of commercial financing may present. Our theory posits that the trusted personal and local connections available through family and friend financing as well as private equity helps substitute for the lack of innovation financing in the presence of institutional voids.

We test our hypotheses regarding the effect of relational vs. other forms of financing on innovative activity in environments with varying levels of institutional voids using the World Enterprise Survey, a representative firm-level dataset of 19 emerging economies in East Asia, South Asia, Central Asia, and the Commonwealth of Independent States (CIS) collected by the World Bank. Whereas most studies of institutional voids and emerging economies have focused on one single country at a time, we are able to mobilize a much more generalizable research design that is sensitive to national institutional differences but not country-specific. Indeed, we exploit this cross-country and also cross-industry variation in financial development and financial obstacles and estimate cross-sectional and instrumental variable models.

We find that external financing is positively related to innovative activity, and its effect varies with the level of financial market development. Furthermore, we empirically demonstrate that the relational financing strategy allows firms to compensate for institutional voids. Family and friend financing and private equity strongly influence the likelihood of innovation by firms, and these relational strategies are particularly important for innovation by small and informally-structured firms in financial markets characterized by institutional voids. Taken together, whereas it is well known that informal social ties between investor and innovating firms are a precursor of resource attainment for venture-capital funded firms (Hsu, 2007), our results

highlight the important but thus far neglected role of family, friends, and other types of private investors in the financing of innovation by all types of innovating firms. Our study thus highlights financial strategies for innovators that are appropriate for different institutional environments.

The rest of the paper is organized as follows. The second section refers to the relevant literature used to formulate our empirical hypotheses regarding the relationship between external finance and innovative activity. The third section introduces the dataset as well as the empirical model and methods. In the fourth section, we describe and report the empirical analyses. The last section discusses the results and concludes.

2 Theoretical Background

We begin by developing a theoretical framework that explains how external financing affects firm innovation in environments with institutional voids. First, we discuss why innovation is underfunded even in the absence of institutional voids to motivate why external financing matters for innovation, particularly for small and young firms. Then we posit how institutional development impacts the relationship between access to external financing and a firm's likelihood of innovation. Finally, using agency theory and transaction cost theory, we discuss why relationship-based funding serves as a strategy for innovation funding, increasing the likelihood of innovation in less-developed institutional settings.

2.1 Extant research on financing of innovation investment

In contrast to the Modigliani and Miller (1958) theorem that states that a firm's capital structure is irrelevant, strategic management research has demonstrated that the costs and

governance arrangements associated with different types of financial resources have strategic implications (Barton and Gordon, 1988; Bromiley, 1990; Chatterjee, 1990; Chatterjee and Wernerfelt, 1991; Kochhar, 1996, 1997; Ngah-Kiing Lim, Das, and Das, 2009). Firms choose between internal and external financing of different forms (equity, debt) depending on their assets, environments, and activities (Myers and Majluf, 1984; Titman and Wessels, 1988; Williamson, 1988). Innovation activity, such as the creation of novel products or technologies, in particular, may be more difficult to fund externally because the output of innovative projects is highly uncertain, firm specific, and difficult to credibly describe ex ante (Vicente-Lorente, 2001). Moreover, pure R&D investment does not lead to the establishment of collateral, further increasing transaction hazards for potential investors (e.g., Simerly and Li 2000). As a result, the information asymmetry between outside investors and firms pursuing innovative activity leads to underinvestment of innovation even when the project is promising and markets are competitive (Hall, 2008; Jaffee and Russell, 1976; Stiglitz and Weiss, 1981). Thus, as innovation is a key process in developing the competitive advantage of a firm (Henderson and Cockburn, 1994; Kortum *et al.*, 2000; Leiponen, 2005; Von Hippel, 1976), funding for innovation activity is a strategic resource for capital-rationed firms: access to and types of finance determine which innovation activities firms are able to pursue.

Empirical studies show that internal financing is important for R&D investment (Hall, 1992; Himmelberg and Petersen, 1991), allowing firms to bypass the information asymmetry between the firm and outside investors. King *et al.* (1993), for instance, show that 80 percent of financing for investments in fixed assets and R&D by major companies in the United States originates

from internally generated funds. Thus, firms that have sufficient internal funds have greater degrees of freedom to pursue risky projects. For those firms with little internal cash flow, on the other hand, external financial resources remains critical (Kortum *et al.*, 2000).

2.2 Hypotheses: Financing of Innovation in the Presence of Institutional Voids

We consider the innovation financing problem in the context of differential financial development, and in particular, settings with institutional voids. We define financial development in terms of financial market size, efficiency, and liquidity. Larger, more efficient, and more liquid markets are more developed. We follow the extensive research by the World Bank to consider a multidimensional definition of financial development. The World Bank has a long tradition of research that has developed widely accepted indicators for financial development (cite? Levine 2005?)

Poor financial development leads to institutional voids when suppliers of finance are unable to provide resources to investments with positive expected returns (cite? Khanna & Palepu 2000?). Institutions fundamentally influence the decision making and business processes of organizations (Coase 1998, North 1990). For example, weak or absent institutions such as poorly functioning markets for critical resources limit the options available to firms to access strategic resources such as financial capital or managerial talent (Khanna and Yafeh, 2007; Sirmon, Hitt, and Ireland, 2007). The inefficiency of these markets will lead firms to pursue strategies that help compensate for institutional voids in order to decrease the cost of doing business (Hoskisson *et al.*, 2000; Khanna, 2000; Khanna *et al.*, 2007).

Here, we focus on the voids created by less-developed capital markets that inhibit the ability of firms to invest in profitable projects (Levine, 2005; Rajan and Zingales, 1998). As innovation investment is underfunded even in well-developed markets as discussed above, the additional challenges posed by institutional voids will make access to external financing even more critical for innovative activity. Consequently, under institutional voids, innovating firms will be even more financially constrained, and additional access to finance will have a relatively greater impact on firm innovation. Thus, we have the following baseline hypothesis:

H1 *In environments with less-developed financial markets, external financing will have a larger impact on a firm's likelihood of innovation, relative to environments with more-developed financial markets.*

In settings with deficient institutions, firms will pursue strategies to overcome these institutional voids. In an emerging economy context, we posit that relational financing may enable firms to fund innovation even if financial markets are underdeveloped (Bergemann and Hege, 2005). By relational financing we refer to financing by investors with private and exclusive insider knowledge, such that entrepreneurial actions become more observable relative to arms-length financial contracting (ibid). Thus, firms and investors use pre-existing social ties to enter into financial relationships (Boisot and Child, 1996; Mesquita and Lazzarini, 2010). For example, venture capital funding decisions are to a significant degree based on personal relationships and trust (Baron and Markman, 2000; Batjargal and Liu, 2004; Shane and Cable, 2002). Social ties may stimulate trust and permit actors to share non-contractible information (Tsai and Ghoshal 1998), thus reducing uncertainty for the investor. Therefore, by making internal actions more

observable, relational financing reduces the information asymmetry problems arising from innovative activity, alleviating the ex-ante information asymmetry in selecting positive net present value projects, and the ex-post information asymmetry in monitoring. Thus, we hypothesize that in less-developed financial markets, access to relational financing significantly increases the likelihood that firms facing institutional voids innovate:

H2 *In environments with les well-developed financial markets, relational financing will have a larger positive impact on a firm's likelihood of innovation, relative to environments with more developed financial markets.*

In particular, the social ties of family and friends are likely to facilitate a trusting relationship with the innovator or access to information regarding the firm that outside creditors may not have (Lee and Persson, 2012). Thus, seeking financing from family and friends is a strategy through which firms in emerging economies may overcome institutional voids in financial markets. We hypothesize that this type of financing will have a comparatively larger impact on a firm's ability to innovate in less-developed institutional settings: Among highly financially constrained firms in less-developed financial markets, those that are able to overcome institutional voids by obtaining relational funding from family and friends are likely to strongly increase their propensity to innovate.

H2a *In environments with less well-developed financial markets, financing from family and friends will have a greater positive impact on a firm's likelihood of innovation, relative to environments with more developed financial markets.*

Building on transaction cost economics, we conceptualize private equity finance as a more

relational funding source relative to debt. Debt and equity can be viewed as governance mechanisms with different capacities to monitor managerial action (Williamson, 1988). Commercial lenders such as banks have more limited monitoring opportunities, whereas equity investors have greater discretion because equity investors are (1) residual claimants, (2) contract long term, and (3) participate in selecting a board of directors that makes pivotal decisions regarding the management of the firm (Williamson, 1988). The heightened involvement of equity investors over time leads to a more intrusive, long-term relationship-based governance compared to debt, which is more rule-based and market-like. Private equity investors typically have even greater information access and discretion compared with investors in public equity markets, because private investors may provide direct advice and mentoring to the management team, in exchange for in-depth inside information (Fenn, Liang, and Prowse, 1995). Thus, we expect that in less-developed financial markets where firms tend to be highly financially constrained, those firms that are able to overcome institutional voids through private equity financing, are likely to strongly increase their propensity to innovate. Thus, we hypothesize:

H2b *In environments with less-developed financial markets, private equity financing will have a greater impact on a firm's likelihood of innovation, relative to environments with more-developed financial markets.*

Further, both types of relational financing are expected to be relatively more important for innovation activities by firms subject to greater information asymmetries vis à vis their potential investors. Smaller and younger firms may be particularly susceptible to innovation funding obstacles with neither the cash flow available to fund innovation internally, nor the track record

of performance that increases credibility to outsiders. As a result, external investors will require a premium for funding innovation activity, leaving smaller and younger innovating firms highly financially constrained (Himmelberg *et al.*, 1991), even though they are the primary drivers of macroeconomic dynamism (Acemoglu, Zilibotti, and Aghion, 2006). Furthermore, firms organized in less formalized business structures such as sole proprietorships or partnerships have less external monitoring and less sophisticated governance processes that do not allow external investors to keep track of the firm's activities and investments. Nevertheless, it is difficult and costly, if not impossible, for firms to strategically change their size, age, or business structure. Although firms may grow and evolve from a small and young sole proprietorship to a larger and more established limited liability corporation, they are unlikely to do so for a specific innovation investment project. In other words, it is difficult and rather unlikely for firms to choose their size, age, or legal business structure based on their innovation strategies. In environments with institutional voids, these types of firms are even more highly financially constrained, compared with their larger counterparts, and they are likely to depend on private relationships for finance, rather than banks or the government. Thus, in less-developed financial settings, relational financing will have an even greater effect on innovation activities of small, young, and informally structured firms. We hypothesize:

H3 *Relational financing has a greater impact on a firm's likelihood of innovation for smaller, younger, and informally structured firms, as compared with larger, older, and formally structured firms.*

3 Econometric Analysis

3.1 Empirical model

Our empirical framework considers a risk-neutral firm deciding whether to engage in innovation investment to maximize its profit. The probability that the firm innovates is empirically modeled using a probit model. Let Y^*_{ijk} be the expected profit from the innovation project of a firm i in industry j in country k. If the profit is greater than zero, the firm will invest in the innovation project. We assume that Y^*_{ijk} is a function of firm, industry, and country characteristics:

$$Y^*_{ijk}=\alpha*EXTFIN_{ijk}+\beta*EXTFIN_{ijk}*FINDEV_k+\boldsymbol{\gamma}\,\mathbf{Firm}_i+\boldsymbol{\delta}\,\mathbf{Industry}_j+\boldsymbol{\zeta}\,\mathbf{Country}_k+\varepsilon_{ijk} \quad (3.1)$$

EXTFIN and FINDEV are our main explanatory variables of interest. EXTFIN is the share of external finance in funding new investments, and FINDEV is a country level moderating variable of financial market development. Because we also control for country-level fixed effects, we do not include the direct effect of FINDEV, only the interaction effect. **Firm** is a vector of firm characteristics, including firm size, ownership (government and foreign), exporting, training, and legal structure. **Industry** represents industry-level characteristics, and **Country** represents country-level characteristics. ε_{ijk} is the *iid* error term and α, β, $\boldsymbol{\gamma}$, $\boldsymbol{\delta}$ and $\boldsymbol{\zeta}$ are the parameters to be estimated. Let I_{ijk} be an index variable that equals to one if firm i in industry j and country k engages in innovation activity, zero otherwise. Since Y^*_{ijk} is not observable, we assume that

$$I_{ijk} = 1, \text{ if } Y^*_{ijk} > 0, \text{ and 0 otherwise} \quad (3.2)$$

Then,

$$\Pr(I_{ijk} = 1) = \Pr(\varepsilon_{ijk} > -\alpha * EXTFIN_{ijk} - \beta * EXTFIN_{ijk} * FINDEV_k - \boldsymbol{\gamma}\ \boldsymbol{Firm_i} - \boldsymbol{\delta}\ \boldsymbol{Industry_j} - \boldsymbol{\zeta}\ \boldsymbol{Country} \quad (3.3)$$

Assuming that ε_{ijk} are normally distributed, we can estimate equation (3.3) by probit maximum likelihood.

To identify the causal effect of external finance on innovation activities, we must address unobserved heterogeneity. Both innovation and external finance may be affected by unobservable factors that can potentially bias the coefficient of external finance in the probit model in several ways. On one hand, firms with innovative activity may be more motivated to seek external finance due to unobservable heterogeneity such as managerial ability, generating a positive bias on the coefficient of external finance. On the other hand, investors might be reluctant to finance an innovative firm that involves greater risks, creating a negative bias. The empirically observed bias, therefore, depends on which of these factors, demand for or supply of funding dominates. Moreover, there may be reverse causality whereby past innovation actually leads to subsequent external finance. This would generate an upward bias in our cross-sectional results.

To address the endogeneity issue, we utilize instrumental-variable methods to exploit exogenous variation in the external finance variables and thus better identify their effects on innovative activity. Whereas it is very difficult to find firm-level instrumental variables, we have developed both industry- and country-level instruments to attempt to identify our empirical models. Thus, our main instruments include a country-level measure of the quality of democratic

institutions, and the country-industry averages of obstacles related to access to external finance. We argue that these represent exogenous variation in the national and industrial environments in terms of the general availability of external finance.

Our industry-level instrument is a firm-level measure of financial obstacles aggregated up to the country-industry level. This measure taken from the World Bank Enterprise survey itself, asks each respondent to assess whether they experience any obstacles in accessing financial resources. Aggregated up to the country-industry, it describes whether the immediate economic environment of the firm has abundant or limited finance. However, there is no theoretical reason to expect that the obstacles to financing of the other firms in this industry directly influence the innovativeness of the focal firm, other than through the availability of finance for this firm, i.e., the instrument is theoretically valid.

The country-level instrumental variable is an index of political constraints developed by Henisz (2000). This indicator examines the presence of multiple veto points in the political governance process and essentially measures the availability of checks and balances that guarantee a democratic rather than autocratic process of governance. This measure has been found to negatively correlate with political business risks, i.e., it reflects the political climate for financial investments. Moreover, it is certainly exogenous from the point of view of firm-level access to finance. Nevertheless, it measures the institutional foundation for financial decision making, and therefore, influences innovation mainly through associated financial arrangements. In autocratic countries, financial investments are likely to be made based on political favoritism and nepotism rather than a competitive process, whereas strong democratic institutions are likely

to be associated with more open competitive processes for financial allocation. Political constraints thus are expected to measure the quality of financial resource allocation in a country.

We empirically test the validity of our instruments by reporting Hansen's J-test of overidentifying restrictions which essentially test whether the instruments are correlated with the error term. We also consider the alternative explanation of industry-level financial access generating innovation spillovers which might undermine the validity of the industry-level instrument. Therefore, we test the robustness of our estimation results to the inclusion of an additional control variable, industry innovativeness, and to a split-sample analyses that explore the strength of our results in conditions where spillovers are unlikely to be an issue (see Section 4 for more detail).

Finally, in order to ensure that our methodology is otherwise empirically sound, we conduct specification tests such as the Kleibergen-Paap and Cragg-Donald tests for weak instruments and the Stock and Yogo test for the likelihood of bias.

3.2 The dataset

Our analysis is based on the micro data from the World Bank Enterprise Survey 2007. Conducted every 3–4 years since 2002, the purpose of the survey is to provide information regarding local investment conditions in developing economies and how these conditions impact firm-level productivity. A stratified random sampling methodology based on firm size, business sector, and geographic region ensures no sampling selection issues arise, and that the data generated is

representative of firms within each country.[3] The first part of the survey describes firms' business and the investment climate, with questions relating to firms' perceptions of infrastructure and services, sales and supplies, degrees of competition, crime, land, business-government relations, and investment climate constraints. The second part of the survey contains questions on production costs, investments, balance sheets, and labor costs.

We use surveys conducted in 2003 and 2005 for a cross section of firms from nineteen Asian and Commonwealth of Independent States (CIS) countries, i.e., former Soviet states, where innovative activity has rarely been studied (see Table 1 for a complete list of countries included in the sample). The full survey sample contains over 11,600 firms, but due to item non-response for our key variables, we utilize data for 6,940 firms covering key manufacturing and service sectors including agriculture, food, leather, textiles, electronics, and telecommunications.

In order to determine whether our estimation sample of 6,940 firms is representative of the total set of 11,600 firms surveyed by the World Bank, we compare the distributions of several variables between our partial sample and the full sample. The overall shape of the distribution of the number of observations by country and industry is similar, and the distribution of firm size is identical for our estimation sample and the full survey sample. While a smaller percentage of firms in the estimation sample are innovating relative to the full sample, this suggests that our results may be a conservative estimate of the response of innovation to external finance. Thus, we believe the estimation sample is reasonably representative of the entire population of firms in

[3] Larger firms are purposely oversampled, however, since these firms typically represent a large component of economic growth, yet otherwise would be sampled less in the random sampling methodology, as the majority of firms in the sampled countries are of smaller size.

the included countries.

Table 1 summarizes the observations and the key variables in each of the 19 countries and 25 industries. The number of firms in each country varies considerably with the size of the economy. China and India, for instance, two of the largest emerging economies, constitute 38 percent of the sample. About 37 percent of the firms are from East Asian countries, 43 percent from Eastern Europe and the CIS, and 20 percent from South Asia (China is included in the East Asian country group, whereas India is in the South Asian group).

Table 1 Innovation, external finance, and observations by country and by industry

Panel A

Country	Share of innovating firms	Average firm-level share of external finance	Number of observations
Armenia	0.772	29.919	307
Azerbaijan	0.816	2.336	304
Belarus	0.858	17.592	211
Cambodia	0.975	73.511	487
China	0.537	38.674	1,333
Georgia	0.699	25.959	73
India	0.711	39.711	1,365
Indonesia	0.759	35.412	291
Kazakhstan	0.721	17.786	308
Kyrgyzstan	0.813	12.086	139
Moldova	0.816	19.644	239
Mongolia	0.774	38.459	146
Philippines	0.833	28.029	174
Russia	0.701	7.854	431
Tajikistan	0.814	5.294	102
Turkey	0.579	40.145	330
Ukraine	0.814	22.600	430
Uzbekistan	0.614	4.658	114
Vietnam	0.910	62.126	156

Panel B

Industry	Share of innovating firms	Average firm-level share of external finance	Number of observations
Accounting and finance	0.269	33.194	67
Advertising and marketing	0.509	24.843	159
Agroindustry	0.921	66.629	89
Auto and auto components	0.730	39.183	371
Beverages	0.850	25.267	446
Chemicals and	0.709	43.098	302
Construction	0.774	21.059	376
Electronics	0.747	34.458	491
Food	0.746	37.942	398
Garments	0.677	35.908	728
Hotels and restaurants	0.766	32.189	201
IT services	0.711	38.497	187
Leather	0.866	34.478	67
Metals and machinery	0.751	30.327	676
Mining and quarrying	0.741	27.586	58
Non-metallic and plastic	0.676	39.444	216
Other manufacturing	0.887	33.943	53
Other services	0.660	38.288	462
Other transport equipment	0.889	17.222	9
Paper	0.716	26.800	95
Real estate and rental	0.586	17.471	87
Retail and wholesale trade	0.650	23.256	738
Telecommunications	0.938	11.563	32
Textiles	0.824	44.508	313
Transport	0.798	24.438	178
Wood and furniture	0.723	26.217	141
Total	0.724	32.684	**6,940**

The information available in the survey confers several advantages in light of our research questions. First, our data cover both publicly traded and privately held firms, ranging from micro-enterprises (fewer than 20 employees) to large establishments (100 employees and over). With the vast majority of research in emerging economies focused on publicly traded firms even

though the majority of private sector activity originates from SMEs, data on smaller enterprises is significantly more representative of the true economic context. Next, the data are based on a standardized questionnaire and a uniform sampling methodology across a large set of countries. As a result, it yields comparable information of firm-level variables and facilitates direct industry and country comparisons. Third, the survey measures family and friend financing, a less formal, and rarely captured source of external financing compared to commercial debt and equity markets. In addition, the measures of innovation used in this survey are more congruent with innovative activity in emerging markets (see Section 3.3. below for more explanation). Finally, this is an appropriate context to study differences in institutional environments, as emerging economies have considerable variation in their financial and political institutions (Wright et al. 2005).

3.3 Variables

Our primary outcome variables for innovative activity are the responses of six innovation-related questions. These measures are derived from the definition of innovation in the Oslo Accord (OECD, 2005), which considers innovation that is "new to the firm," rather than traditional measures such as patenting and R&D activity (see Appendix A for further detail on this measure). These measures are well-suited for describing innovation in developing economies where imitation of the technological frontier is likely to be commonplace and where technological change results from the adaptation of foreign technologies for domestic applications (Acemoglu *et al.*, 2006). Our primary measure of innovation is a binary indicator for any of seven activities

considered innovative activities: developed a major new product line, upgraded an existing product line, introduced new technology that has substantially changed the way that the main product line is produced, brought in-house a major production activity that was previously outsourced, outsourced a production activity that was previously in-house, obtained a new licensing agreement, or formed a new joint venture with a foreign partner. See Appendix A for a further description of this variable.

Our main explanatory variable of interest measures firm-level external finance. In the survey, firms were asked to identify the contributions over the last year of each of the following sources of financing for new investments: internal funds, local commercial banks, foreign commercial banks, leasing arrangements, investment funds/special development financing, trade credit, credit cards, equity, family, and informal sources (e.g. money). As financing for innovation is not directly surveyed, we use the contribution of each external financial resource for new investment as a proxy for the available financing for innovation activity. In other words, we assume that the funding for all types of new investment is positively correlated with funding for innovation investment.

In order to create a measure of financial market development, we utilize 8 country-year level financial market development measures provided in the World Bank Financial Development and Structure Dataset [WBFDS].[4] These measures come from 3 sources: the International Financial

[4] This dataset is publicly available and can be found here: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

Statistics from the IMF, the Emerging Market Database (Standard & Poor's various years), and the Bank for International Settlements (BIS). The 8 variables include 3 measuring stock market depth/size (liquid liabilities to gross domestic product (GDP), bank deposits to GDP, and stock market capitalization), 3 measuring financial market efficiency is (net interest margin, overhead costs and banking sector concentration), and 2 measuring the activity of the financial market (stock market value traded to GDP, and the stock market turnover ratio). More detailed information on these measures can be found in the appendix.

To proxy for financial market institutional voids, we construct a single measure of financial market development using factor analysis of the 8 financial market development variables listed above. Factor analysis is used in economics and management to reduce dimensionality and derive a set of uncorrelated variables for further analysis when the use of several highly intercorrelated variables may yield misleading results in regression analysis (Kim and Mueller 1978). We utilize the first factor as our primary measure for financial market development. We also test for the hypotheses using the next three factors, and the results are qualitatively highly aligned taking into account that the other factors represent orthogonal aspects of the financial environment.

Firm-level control variables include firm size, age, legal status, export activity, government ownership, foreign ownership, and in-house training for employees. Size is often found to be correlated with the likelihood of innovation (e.g., Leiponen and Helfat, 2009). We utilize the natural logarithm of the number of employees. Firm age is also included as a control variable, because younger firms have been found to be more innovative (Sørensen and Stuart, 2000). In

our sample, firms' ages range from 0 to 149 years. When the survey was conducted, more than 50 percent of the firms in our sample were less than 10 years old, and about 80 percent of firms in our sample were less than 20 years old. We expect very young firms to be particularly affected by "the liability of newness" in attracting funding (Stinchcombe and March, 1965) and therefore we utilize a dummy for firms younger than 6 years.

We also control for several different ownership types including foreign and government owned. Almeida and Fernandes (2008) show that foreign-owned firms are less likely to engage in technological innovation than minority foreign-owned firms or domestic firms. We also control for the share of government ownership, as the inclusion of social welfare in the objective function of public firms may lead to different incentives to innovate relative to private ownership.

Additionally, we control for export activity. In our sample, approximately 17 percent of firms engaged in export activities. Firms facing strong competition in export markets may be forced to more frequently improve their technological capabilities than firms exclusively oriented to the domestic market. Finally, we also control for firms' internal training investments that are important for developing the human resource base essential for innovation. In the survey, firms were asked whether they offered formal training to their employees. Within the sample, 43 percent of firms provided such training.

To control for internal finance, we include the industry average for the share of internal finance for working capital. As we cannot include a firm-level internal finance variable because of its collinearity with the share of external finance (shares of internal and external finance sum

up to 100% in our dataset), this measure is intended to control for the impact of cash flow on innovation investment, and the assumption is that a substantial part of cash flow is correlated among firms in an industry. In addition to firm- and industry-level variables and industry dummies, we control for country-level differences with a full set of country dummies.

Table 2 summarizes the contribution of each source of financial resources for new investment. In accordance with much earlier research, internal funds are the most important financial resource for new investment, but the contribution of external finance is greater for these small Asian companies than for large companies in industrialized countries (Fazzari, Hubbard, and Petersen, 1988). The overall patterns of use of financial resources agrees with the "pecking order theory" in terms of the ranking of debt vs. equity finance: The top three external sources of finance for investment are local commercial banks, the equity market, and family or friends, although if most of family funding is in the form of equity, then the two forms of equity finance together are greater than debt finance.

Table 2 Descriptive statistics

	Mean	Std. dev.	Min	Max
Dependent variables				
Product or process innovation	0.704			
Product innovation	0.415			
Process innovation	0.376			
Technology licensing	0.171			
Joint venture with a foreign partner	0.085			
Internalize production	0.131			
Outsource production	0.148			
Financial variables				
Share of internal finance for investment	52.008	44.300	0	100
Share of external finance for investment	47.604	44.189	0	100
Share of domestic bank finance	16.477	30.901	0	100
Share of equity finance	8.704	25.767	0	100
Share of finance from family and friends	6.688	21.299	0	100
Share of finance from investment funds	1.443	10.658	0	100
Share of informal finance	1.320	9.458	0	100
Share of other sources of finance (foreign banks, leasing, trade credit, credit cards, other)	13.717			
Firm-level control variables (continuous)				
Government ownership	9.454	28.136	0	100
Firm age	14.721	14.337	1	149
Employees				
Binary variables (0,1)	**Mean**			
Publicly traded firm	0.063			
Privately held limited company or cooperative	0.286			
Sole proprietorship, partnership, or other organization form	0.650			
Age less than 6 years	TBA			
Primarily foreign ownership	0.116			
Any exports	0.169			
In-house training	0.425			

From the different sources of external finance we construct a summary variable of external finance by adding up the contribution percentage for new investment from domestic commercial

banks, foreign commercial banks, equity markets, and family and friends. We use this summary variable to analyze the effect of the availability of external finance on innovation. In addition, we also estimate the impact of the different sources of finance separately.

4 Results

We first provide baseline results using logit and two-stage least squares models regarding the effect of external finance on the likelihood of innovation. The first specification in table 3 shows that external finance statistically significantly increases the odds of innovation. 1% percentage increase in the share of external finance increases the odds of innovation by 0.2%. Government ownership, industry-level internal finance, and financial development significantly reduce the odds of innovation, whereas firm size, exporting, and in-house training significantly increase the odds. We also include full sets of country and industry dummies to control for the environmental variation.

Table 3 baseline models

	Logit		Logit		2SLS	
Innovation	Odds ratio	SE	Odds ratio	SE		
Constant	0.198***	0.032	0.195***	0.034	0.010	0.050
External finance	1.002***	0.001			0.007***	0.001
Local bank finance			1.003**	0.001		
Foreign bank finance			1.000	0.006		
Equity finance			1.009***	0.002		
Family/friend finance			1.005**	0.002		
Investment fund finance			0.998	0.004		
Informal finance			1.003	0.003		
Internal finance_industry	0.967***	0.004	0.969***	0.004	-0.001	0.001
Gov't ownership	0.996**	0.001	0.997**	0.002	0.000	0.000
Young firm	1.019	0.074	1.101	0.089	-0.015	0.016
Log(employees)	1.148***	0.022	1.149***	0.024	0.019***	0.004
Foreign ownership	1.008	0.109	1.034	0.115	0.042**	0.020
Exporting	1.864***	0.189	1.601***	0.187	0.070***	0.017
In-house training	2.303***	0.195	2.251***	0.212	0.133***	0.014
Log pseudolikelihood	-3451.70		-2631.43		Kleibergen-Paap LM	132.487
Pseudo R^2	0.1229		0.145		Cragg-Donald F test	76.329
Observations	6480		5129		Stock-Yogo max bias	<10%
					Hansen J	0.40 p-value 0.51

The second specification in this table provides simple cross-sectional likelihood estimates of the different component sources of external finance. The odds of innovation are the most strongly increased by funding from (private) equity, family and friends, and local banks. Foreign banks, investment funds, and informal finance do not have measurable effects. However, it is interesting to note that bank finance has only the third-largest impact on the odds of innovation. The relational forms of finance, equity and family/friend funding, have greater effects.

In the third specification, we estimate a 2SLS instrumental-variable (IV) model using political constraints and country-industry-level financial obstacles as instruments on external finance. This is now a linear probability model, and we continue to find a strong positive coefficient. We do not estimate IV probit models, because the linear probability IV model is more robust and

generates estimates that are directly comparable across models, which is not the case with IV probit. Most control variables display similar effects in the IV model as in the logit model in specification 1. Our specification tests provide strong support for our claims of instrument validity. Both Kleibergen-Paap LM-test and Cragg-Donald Wald F-test reject the null of weak identification, and the critical values of Stock and Yogo tests suggest the lowest expected levels of bias. Hansen's J test clearly approves the null of no correlation between instruments and the error term: the Chi-squared p-value is 50.6%. In the appendix, we also provide first-stage estimates to directly evaluate instrument strength. We find that both instruments have t-values in excess of 5.0 so they are very strong predictors of external finance, yet, per Hansen's J test, not correlated with the error term.

Next, we test whether external finance has a larger impact on the innovative activity of a firm in less well-developed financial markets (hypothesis 1). To understand the role of institutional voids in the relationship between external financing and firm innovation, we estimate equation 3.3, using both logit (in odds ratios), OLS, and instrumented linear probability (2SLS) models. We can directly estimate an interaction effect in a nonlinear logit model when we assess odds ratios rather than coefficients. In the 2SLS models we split the sample into high and low financial development, because we are not able to find sufficiently strong and distinct instruments for the interaction term. Independent of the estimation method, the impact of external finance is always positive, and it is statistically significant in the logit and OLS models. The interaction between external finance and financial development is significant and negative in the logit and OLS models, implying that additional external finance has a lesser impact on

innovation in more developed financial markets. Innovating firms are thus more financially constrained in less-developed markets.

In the split-sample 2SLS models we similarly find that external finance is more strongly associated with innovation in countries with more significant financial market institutional voids than in more efficient financial markets. A simple z-test[5] of the difference between the coefficients of external finance in the high development and low development samples confirms the statistical significance of the difference. A z-test is a reasonable test for the coefficient differences, because our subsamples are large and independently sampled (. These results provide support for hypothesis 1.

[5] The standard error of the estimated difference of the coefficients d is $SE(d)=s\sqrt{[(s_1)^2+(s_2)^2]}$ where $s=\sqrt{\{[(n_1-p)s_1^2+(n_2-p)s_2^2)]/[n_1+n_2-2p]\}}$, s_1 is the standard deviation of the first coefficient, s_2 is the standard deviation of the second coefficient, n_1 is the size of the first sample, n_2 is the size of the second sample, and p is the total number of coefficients in the model.

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Table 4. The interaction of external finance and financial development

	Logit		OLS		2SLS high development		2SLS low development	
Variable	Odds ratio	sig SE	Coef.	sig SE	Coef.	sig SE	Coef.	sig SE
Constant	0.188***	0.030	0.253***	0.028	0.282**	0.141	0.063	0.053
External finance	1.003***	0.001	0.001***	0.000	0.0048**	0.002	0.006***	0.001
Ext.finance*Fin. Development	0.998***	0.000	0.0003***	0.0001				
Internal finance_ind	0.969***	0.004	-0.005***	0.001	0.003*	0.002	-0.002**	0.001
Gov't ownership	0.996**	0.001	-0.001***	0.000	0.001*	0.000	0.000	0.000
Young firm	1.010	0.074	0.002	0.013	-0.033	0.027	-0.009	0.018
Log(employees)	1.149***	0.022	0.026***	0.004	0.029***	0.008	0.018***	0.005
Foreign ownership	1.017	0.110	-0.005	0.017			0.058	0.022
Exporting	1.842***	0.187	0.087***	0.015	0.110***	0.023	0.015	0.023
In-house training	2.352***	0.199	0.129***	0.012	0.135***	0.022	0.138***	0.017
Pseudo-likelihood	-3442.36				Kleibergen-Paap LM	20.10		120.52
(Pseudo) R^2	0.125		0.137		Cragg-Donald F test	12.08		71.44
					Stock-Yogo max IV size	<15%		<10%
					Hansen J (p-value)	0.61 (0.43)		1.26 (0.26)
Observations	6480		6480		2599		3881	

We also find that in terms of our control variables, the largest firms, exporting firms and those providing in-house training are significantly more innovative. The direct effects of foreign ownership, government ownership, and firm age are not consistently estimated.

We next test hypothesis 2a by interacting the share of family and friend financing with the financial market development variable and estimating equation 3.3. Results in Table 5 indicate that the interaction between family and friend financing and financial development is very strong and significant. However, we are unable to identify the main effect of family and friend financing in the logit and OLS models. In contrast, in the 2SLS models with split samples we find that this source of finance has a large and statistically significant effect only in the less-developed financial markets. In more developed financial markets, the coefficient is positive but we are unable to estimate it precisely. The difference between the coefficients is statistically

different according to a z-test.

As before, the Cragg-Donald, Stock and Yogo, and Hansen's J tests all provide support for our 2SLS specifications, although identification in the more highly developed financial market sample is weaker – the tests for the strength and validity of instruments are more marginally accepted for this sample. However, weak or invalid instruments would likely bias the result in the direction of finding an effect, which we do not do. Separate estimations of the first stage (see appendix) also provide evidence that our instruments are sufficiently strong.

Table 5. The interaction of family and friend finance and financial development

	Logit		OLS		2SLS high development		2SLS low development	
Variable	Odds sig	SE	Coef.sig	SE	Coef. sig	SE	Coef. sig	SE
Constant			0.280***	0.028	0.511***	0.120	-0.011	0.094
Family finance	1.000	0.002	0.000	0.000	0.001	0.005	0.034***	0.005
Family finance*Fin. Development	0.997 ***	0.001	-0.001***	0.000				
Internal finance_ind	0.967 ***	0.004	-0.005***	0.001	0.001	0.001	0.005***	0.001
Gov't ownership	0.996 ***	0.001	-0.001***	0.000	0.001	0.001	0.001	0.001
Young firm	1.027	0.075	0.004	0.013	-0.036	0.026	-0.107***	0.041
Log(employees)	1.146 ***	0.022	0.025***	0.004	0.037***	0.008	0.042***	0.008
Foreign ownership	1.011	0.109	-0.005	0.017	-0.035	0.034	0.197***	0.040
Exporting	1.833 ***	0.186	0.087***	0.015	0.116***	0.026	0.068*	0.035
In-house training	2.298 ***	0.195	0.125***	0.012	0.153***	0.026	0.202***	0.038
Pseudo-likelihood	-3446.				Kleibergen-Paap LM	13.35		49.08
(Pseudo) R^2	0.124		0.137		Cragg-Donald F test	10.41		44.16
					Stock-Yogo max IV size	<20%		<10%
					Hansen J (p-value)	2.44 (0.12)		0.17 (0.68)
Observations	6480		6480		2599		3881	

Next we test hypothesis 2b regarding the relational finance effect of private equity finance. In the logit and OLS models we find a positive and significant main effect, but we also find a very small positive and weakly significant interaction effect which suggests that equity funding has a greater impact in more-developed financial markets, contradicting our hypothesis. However,

delving deeper and utilizing instruments to account for potential endogeneity of obtaining equity funding, we find that this variable has a large and statistically significant positive effect only in less-developed financial markets. In more-developed financial environments, the coefficient estimate is positive but smaller, and it is estimated less precisely suggesting greater variance of the impact. As before, our specification tests all point to strong and valid instruments.

Table 6. The interaction of private equity finance and financial development

	Logit		OLS		2SLS high development		2SLS low development	
Variable	Odds sig	SE	Coef. sig	SE	Coef. sig	SE	Coef.	SE
Constant			0.251 ***	0.028	0.493 ***	0.065	0.177 **	0.040
Equity finance	1.009 ***	0.002	0.002 ***	0.000	0.002	0.001	0.007 **	0.001
Equity finance*Fin. Development	1.002 *	0.001	0.000 ***	0.000				
Internal finance_ind	0.968 ***	0.004	-0.005 ***	0.001	0.001	0.001	-0.002	0.001
Gov't ownership	0.996 **	0.001	-0.001 ***	0.000	0.001 *	0.000	-0.001	0.000
Young firm	1.013	0.074	0.002	0.013	-0.038	0.025	0.007	0.017
Log(employees)	1.154 ***	0.023	0.026 ***	0.004	0.037 ***	0.006	0.025 **	0.005
Foreign ownership	0.997	0.108	-0.010	0.017	-0.037	0.034	0.006	0.021
Exporting	1.862 ***	0.190	0.089 ***	0.015	0.106 ***	0.022	0.039 *	0.021
In-house training	2.308 ***	0.195	0.126 ***	0.012	0.143 ***	0.020	0.135 **	0.016
Pseudo-likelihood	-3436.3				Kleibergen-Paap LM	76.73		190.91
(Pseudo) R^2	0.127		0.139		Cragg-Donald F test	122.22		124.59
					Stock-Yogo max IV size	<10%		<10%
					Hansen J (p-value)	0.44 (0.51)		0.003 (0.96)
Observations	6480		6480		2599		3881	

Our third hypothesis states that relational finance has a particularly large effect on innovation of firms particularly subject to asymmetric information such as small, young, and informally organized firms (including sole proprietorships, partnerships, and other organization forms). In comparison with large, established, and publicly traded or privately-held limited liability companies, these types of firms experience greater difficulties in obtaining external funding,

hence they are likely to be more financially constrained. Under these circumstances, they are highly likely to innovate when they do succeed in attracting external finance.

To conserve space, we now present only the 2SLS estimates for the key variables and specification tests that are our primary evidence due to endogeneity concerns. The results in table 7 provide strong evidence for the greater effect of relational finance for smaller and informally organized firms. Both in terms of equity finance and family/friend finance, small and less formally structured firms are more financially constrained and greatly benefit from relational finance for innovation. We find a less consistent difference between old and young firms: family finance matters more for young firms compared with older firms, but equity finance matters for both young and older firms.

Specifications 7 and 8 in each panel estimate the model separately for the subsamples of informally organized firms in low financial development economies, and for small firms in low financial development economies. Both subsamples suggest that the results concerning the effects of family finance on innovation for less-established firms are particularly accentuated in economies where financial development is less advanced. Results estimating the effect of equity finance on these types of firms and environments are aligned but less accentuated. In short, family/friend finance particularly strongly and significantly drives innovation of small and informally-structured firms in less-developed financial markets. For equity finance, we find that the firm characteristics of size and organization form matter relatively more than the financial market development for financing of innovation.

Our specification tests provide mixed support for strength and validity of instruments in the

models estimating the impact of family/friend finance. Family finance appears to be only weakly instrumented in the samples of small firms and young firms, casting some doubt in the interpretation that small firm size drives the need for this type of finance. In contrast, the subsamples of informal firms, and informal firms in less-developed financial markets are well identified, corroborating the claim that informally structured firms tend to strongly rely on funding from family or friends. In estimating the subsample analyses for the impact of equity finance, we do find that specification tests are all supported, in other words, our instruments are strong and statistically valid. The identification issue appears to be concentrated on the first-stage estimation of the effect of our instruments on family/friend finance of small and young firms.

Table 7. Interaction of firm size, age, and organization form with relational finance and financial development

Panel A. Interaction of firm size, age, and organization form with family finance and financial development

	(1) Small firms		(2) Large firms		(3) Informal firms		(4) Formal firms		(5) Young firms		(6) Older firms		(7) Informal &low fin. development		(8) Small & low fin. development	
Variable	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Family finance	0.025***	0.008	0.014***	0.005	0.017***	0.003	0.005	0.008	0.024**	0.011	0.019***	0.004	0.033 ***	0.006	0.051 ***	0.016
Kleibergen-Paap LM	14.94		16.65		71.33		13.1		7.44		25.44		49.85		10.51	
Cragg-Donald F test	7.00		17.70		35.95		2.8		2.93		27.12		18.47		4.40	
Stock-Yogo max IV size	>25%		<15%		<10%		>25%		>25%		<10%		<15%		>25%	
Hansen J (p-value)	0.54	(0.46)	2.82	(0.09)	0.19	(0.66)	0.57	(0.45)	0.34	(0.56)	0.28	(0.60)	0.27	(0.60)	0.07	(0.79)
Observations	2877		3438		3397		3414		1482		4998		2510		1871	

Panel B. Interaction of firm size, age, and organization form with equity finance and financial development

	(1) Small firms		(2) Large firms		(3) Informal firms		(4) Formal firms		(5) Young firms		(6) Older firms		(7) Informal &low fin. development		(8) Small & low fin. development	
Variable	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Equity finance	0.008***	0.001	0.005***	0.001	0.008***	0.001	0.005**	0.002	0.006**	0.002	0.007***	0.001	0.008 ***	0.001	0.008 ***	0.002
Kleibergen-Paap LM	105.64		90.52		144.44		87.92		64.34		127.46		136.68		92.40	
Cragg-Donald F test	69.14		114.87		109.88		44.50		38.63		142.61		92.27		38.32	
Stock-Yogo max IV size	<10%		<10%		<10%		<10%		<10%		<10%		<10%		<10%	
Hansen J (p-value)	0.22	(0.64)	1.44	(0.23)	0.25	(0.62)	0.66	(0.42)	0.20	(0.66)	0.53	(0.47)	0.05	(0.83)	0.37	(0.54)
Observations	2877		3438		3397		3414		1482		4998		2510		1871	

4 Robustness Checks

As the basis of our causality argument lies in our instrument choice, our main concern is that country-industry-level financial obstacles impact firm-level innovation through other mechanisms than firm-level external financing, violating the exclusion restriction. In particular, spillovers from within-industry competitors may be influencing focal firm innovation. If our instrument (average country-industry financial obstacles, excluding the focal firm) negatively impacts within-industry competition, reducing innovation by other firms in the industry for instance, the focal firm may be not innovating as a best response to the reduced innovativeness of competitors. Furthermore, reduction of innovation by industry peers, due to the detrimental external financing conditions, mitigates knowledge spillovers that reduce innovativeness of the focal firm. Under these circumstances, country-industry financial conditions impact the focal firm's innovation via the innovativeness of other firms in the industry, and not solely through external financing.

We address this concern with two additional analyses. First, we measure the mean of country-industry innovation excluding the focal firm as a proxy for the potential spillover from the innovativeness of competitors. Then, we include this variable as an additional control and estimate our baseline regression analysis once more. These results indicate that our main parameter of interest remains robust to the inclusion of this additional proxy for spillovers.

In our next analysis we posit that if exogeneity does not hold because the lack of country-industry financial obstacles may be related to focal firm innovation through the innovativeness of competitors, then we should not expect our baseline regressions to hold in

industries with low average innovativeness. In other words, if we believe that innovativeness of others is the primary mechanism that channels the relationship between the availability of external finance and innovation, then we should not see this relationship in industries where others innovate very little. However, if in fact the relationship between firm-level external financing and innovation is maintained in these less-innovative industries, this supports our claim that the innovativeness of other firms is not significantly driving the results between external financing and innovation.

To test this, we first calculate the mean of country-industry innovation and then characterize industries as more or less innovative industries relative to the overall country-level mean of innovativeness. Then, we estimate our baseline regressions for each subsample. Columns 3 and 4 of Appendix Table 2 indicate that our parameter of interest holds for both more- and less-innovative industries, providing evidence that our instrument is not impacting focal firm innovation through the innovativeness spillover from competitors. Further, intuitive validation of our separation of the sample in this manner is provided by columns 6, 8, and 10 of Appendix Table 2, which indicate that small, young, and informally organized firms are particularly affected by external financing in such less-innovative environments. In addition to concerns over instrument validity, several concerns about generalizability also exist, particularly if results may be driven by the inclusion of one particularly important sub-sample. For instance, Fazzari *et al.* (1988) suggest that the relationship between financial constraints and investment may depend largely on the industry. In order to identify whether one industry is driving the main results in Table 3, we estimate equation 3.3 again, taking each industry out of the estimation individually.

While the non-IV probit specification indicates that the exclusion of retail trade may be driving the results, once the instrumental variable approach is implemented, the impact of retail trade disappears. As the equations without the instrument are likely endogenous, however, we do not believe that retail trade in fact is predominately influencing our results.

Similarly, particular countries may be driving the results, making generalization to the entire set of emerging economies unfounded. To test whether the results are driven by the inclusion of a particular country, we remove the observations of each country individually as well, to see if parameter estimates change as a result. The results of Table 3 remain robust to the sub-samples, indicating that the results are not driven by any one particular country.

5 Conclusions

This paper investigates the relationship between external financing and innovation in environments with varying institutional voids in 19 emerging economy countries and over 6,000 firms. We are particularly interested in whether relational financing differentially impacts the likelihood of innovation in less vs. more well-developed financial markets. We find that external financing significantly influences the likelihood of innovation in environments with institutional voids in both simple logit and linear probability regression, and in instrumental variable models. The main insights from our study highlight the economically and statistically significant relationship between relational financing and innovation depending on the quality financial market institutions. We argue that relational financing is a strategy firms can pursue to promote innovation in the presence of institutional voids. This is particularly salient for smaller and

informally-structured firms.

Whereas earlier research has primarily studied publicly-traded companies from the United States, our study highlights that our understanding of the fundamental drivers of innovation investments would benefit from explicit attention to institutional contexts, as the relationship between funding and innovation investment varies between firms in less and more developed countries, and between privately-held and publicly-traded firms. Further, our results emphasize the importance of efficient and liquid financial markets and institutions that reduce information asymmetries between innovators and potential investors.

Our analysis makes several contributions to the strategic management literature. We bridge together distinct strands of the strategic management and financial economics literatures to theorize and measure how financing choices impact a firm's likelihood of innovation in an emerging-market context. By doing so, we develop a new theoretical framework regarding the funding of innovation in the presence of institutional voids. Even though financing is a crucial resource for firm competitiveness in all kinds of economies, ours is among the first studies that conceptualize financing as a strategic resource in the management literature, and, to our knowledge, the very first study to consider how financial institutions moderate the impact of finance on innovation of firms.

While the institutional voids and transaction costs literatures related to emerging markets largely focus on organizational solutions to institutional voids (business groups, pyramids), and the resource-based perspective in the context of emerging markets focuses largely on managerial ties and networks (Hoskisson 2000, Burt 1997, Granovetter 1985), we integrate a resource-based

and institutional perspectives by conceptualizing financing as a strategic resource that necessitates different types of external relationships in different institutional environments. Thus, this paper realigns focus from the traditional approach which views governance structures as the resolution to emerging market voids and offers a resource-based perspective that financial relationships may be a central component to competitive advantage in the presence of less-developed institutions.

Based on the theory we develop, we show that in the emerging economy context, family and friend financing and equity financing dominate bank financing emphasized in developed settings (Robb and Robinson, 2012). Even though our data confirm the 'pecking-order theory' that firms are most likely to rely on banks for financing their investments, and only source from equity markets and elsewhere as a second or last resort, we argue and demonstrate that funding of innovation investments is different from that of investments in fixed assets (such as machinery or plants). We provide evidence that the capital structure strategies for innovation funding vary across institutional settings, calling into question the ability of management scholars and practitioners to transfer existing models of innovation funding from developed settings to environments with more substantial institutional voids.

We highlight that, in contrast to most of the previous capital structure literature that focuses on large corporations listed on stock exchanges, more than 90 percent of firms in our sample are privately held. Even in countries with well-developed public equity markets like the U.S., fewer than one percent of firms are publicly traded (Asker, Farre-Mensa, and Ljungqvist, 2011). Thus, whereas analyses focused on publicly-traded firms are more readily available, our analysis is

significantly more generalizable. Furthermore, the questions addressed in this study are important because emerging economies accounted for 40% of global GDP in 2013. Therefore we argue, it is essential to gain a more nuanced understanding of the drivers of the innovation process that is central to economic growth and a more general perspective into whether established relationships between external financing and innovation hold in dramatically different institutional contexts. Thus, this paper represents a first step at documenting the impact of funding on a process central to economic growth in an economically important region for management scholars attempting to inform global strategy in Asian countries.

Finally, our results provide insights for business owners and policy makers in overcoming the financial challenges of innovation and building growth-oriented companies in emerging economies. Emerging-economy managers of innovative companies are well-advised to develop extensive personal connections to potential providers of family-and-friend financing and private-equity funding, as this type of funding may be the best suited for innovative activity because of its relational nature. Although debt financing from local banks may also depend on long-standing relationships, it is less administratively intrusive per its very nature (cf. Williamson, 1991), and, therefore, banks are less likely to be able to provide significant funding for the highly uncertain process of innovation. For firm managers in emerging contexts faced with institutional voids, this highlights an alternative strategy to pursue in order to increase the propensity to innovative. For policymaker in emerging economies, the results suggests that providing incentives and legal structures for family-and-friend financing may be another avenue through which innovation by small- and medium-sized firms may be stimulated. As small- and

medium-sized firms are central to economic dynamism, particularly in emerging markets (Biggs and Shah, 2006; OECD, 2006), funding their innovation is key to the development process.

For researchers of innovation, we suggest that a closer analysis of private channels of equity funding, including "business angels" (i.e. local private equity investors) of various types for innovation investments, beyond the special case of venture capital in high technology industries, might be a promising research avenue for strategic management.

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Appendix A. Variable Measures

Outcome variables measure firm level innovation according to the Oslo Accord. The World Bank Enterprise Survey responder was asked if their company had undertaken any of the following initiatives in the last three years:

1. Developed a major new product line
2. Upgraded an existing product line
3. Introduced new technology that has substantially changed the way that the main product line is produced
4. Brought in-house a major production activity that was previously outsourced
5. Outsourced a production activity that was previously in-house
6. Obtained a new licensing agreement
7. Formed a new joint venture with a foreign partner

We create a binary measure of innovation that indicates firms with positive responses to any of these questions.

Country-level financial market development

Country-level financial market development is measured using indicators of the size, efficiency and activity/liquidity of the financial system. All of these measures come from the World Bank Financial Development and Structure Dataset.[6] These indicators are based on the raw data from the International Financial Statistics from the IMF, the equity market indicators on raw data from the Emerging Market Database (Standard & Poor's various years), and the bond market indicators on raw data from the Bank for International Settlements (BIS).

[6] This dataset is publicly available and can be found here: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

Depth and size

To proxy for elements of financial sector depth, we measure liquid liabilities per GDP, and bank deposits per GDP. Liquid liabilities is a broad measure of financial resources, including all banks, bank-like and non-bank financial institutions. It is measured as currency plus demand and interest-bearing liabilities of banks and other financial intermediaries divided by GDP. The second measure of banking sector development, bank deposits per GDP, represents the bank deposits theoretically available to the banking sector for lending. A higher value of both measures indicates a better-endowed financial market. Additionally, for a measure of financial market size, we also use stock market capitalization.

Efficiency

Unlike the size measures, measures of efficiency are constructed from raw bank-level data from the BankScope database and averaged (unweighted) across all banks of a country for a given year. Three measures of efficiency are used, including net interest margin, overhead costs and banking sector concentration. Net interest margin equals the accounting value of a bank's net interest revenue as a share of its total earning assets. Overhead cost equals the accounting value of a bank's overhead costs as a share of its total assets. Higher levels of these measures indicate lower levels of banking efficiency, as banks incur higher costs and there is a larger spread between lending and deposit interest rates. The final measure of efficiency is banking sector concentration, measured as the ratio of the three largest banks' assets to total banking sector assets. A high concentration ratio suggests a less competitive banking market structure.

Activity/liquidity of capital market

Finally, to provide a measure of the activity/liquidity of the capital market, we use stock market total value traded to GDP and the stock market turnover ratio. Stock market total value traded to

GDP equals total shares traded on the stock market exchange divided by GDP, and it indicates the activity of the stock market trading volume as a share of national input and should reflect the degree of liquidity that stock markets provide to the economy. The stock market turnover ratio, in contrast, measures the activity or liquidity of a stock market relative to its size. A small but active stock market will have a low turnover ratio. It is measured as the value of total shares traded divided by market capitalization.

Our final measure of financial market develop is the first factor of a factor analysis of the above seven measures of financial market depth, activity, and liquidity. This factor explains xx% of the total variance of the data and loads highly positively on x and y and strongly negatively on a, b, and c.